(No Model.)

4 Sheets—Sheet 1.

C. K. WELCH.

PNEUMATIC TIRE.

No. 512,594. Patented Jan. 9, 1894.

Fig. 1.

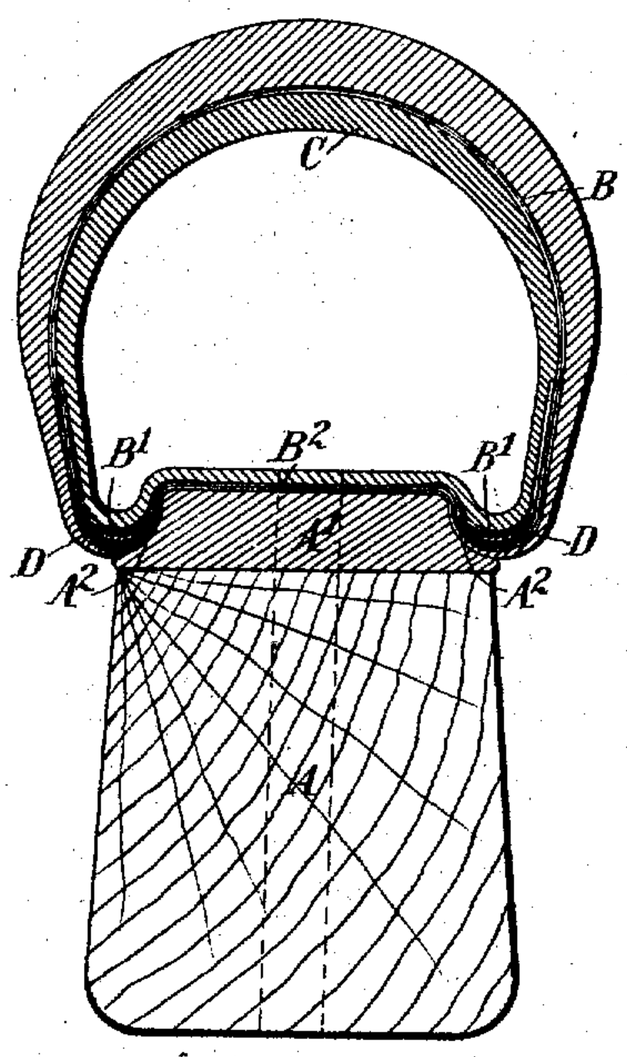


Fig. 2.

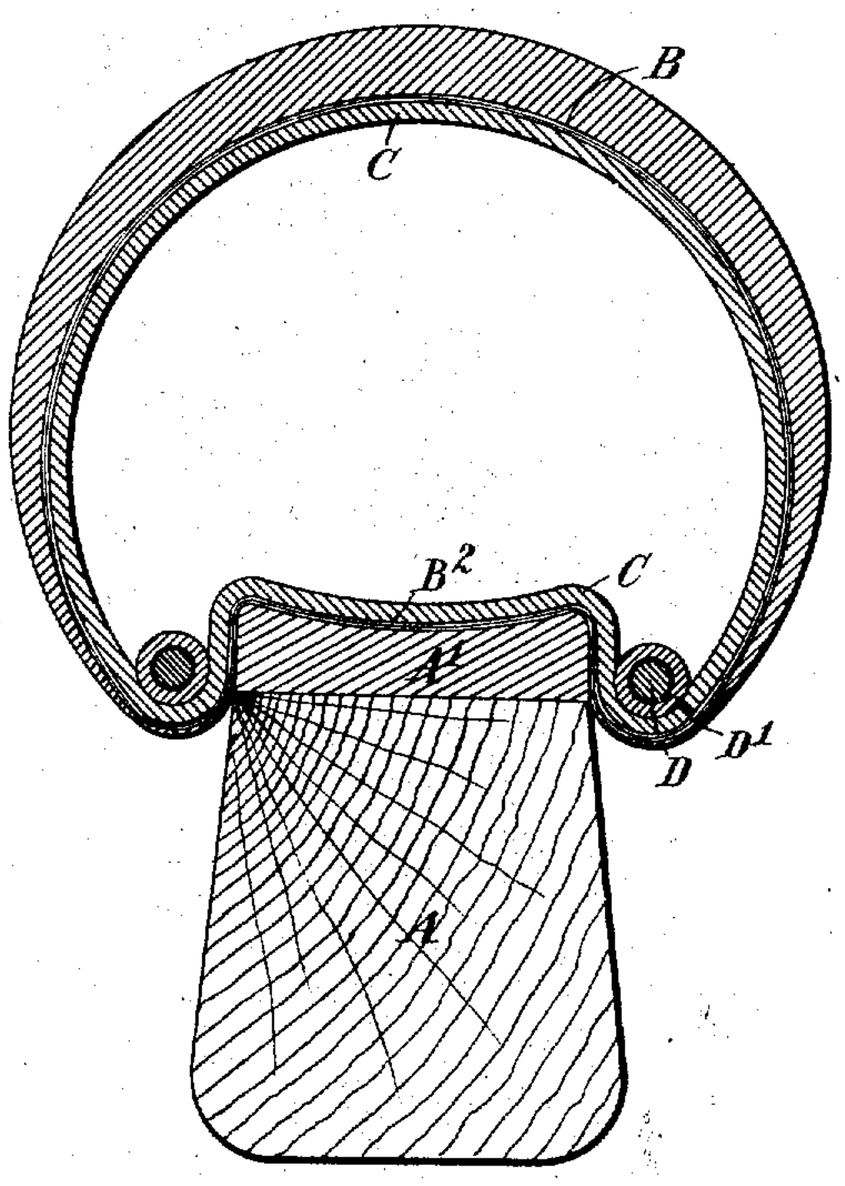


Fig. 3.

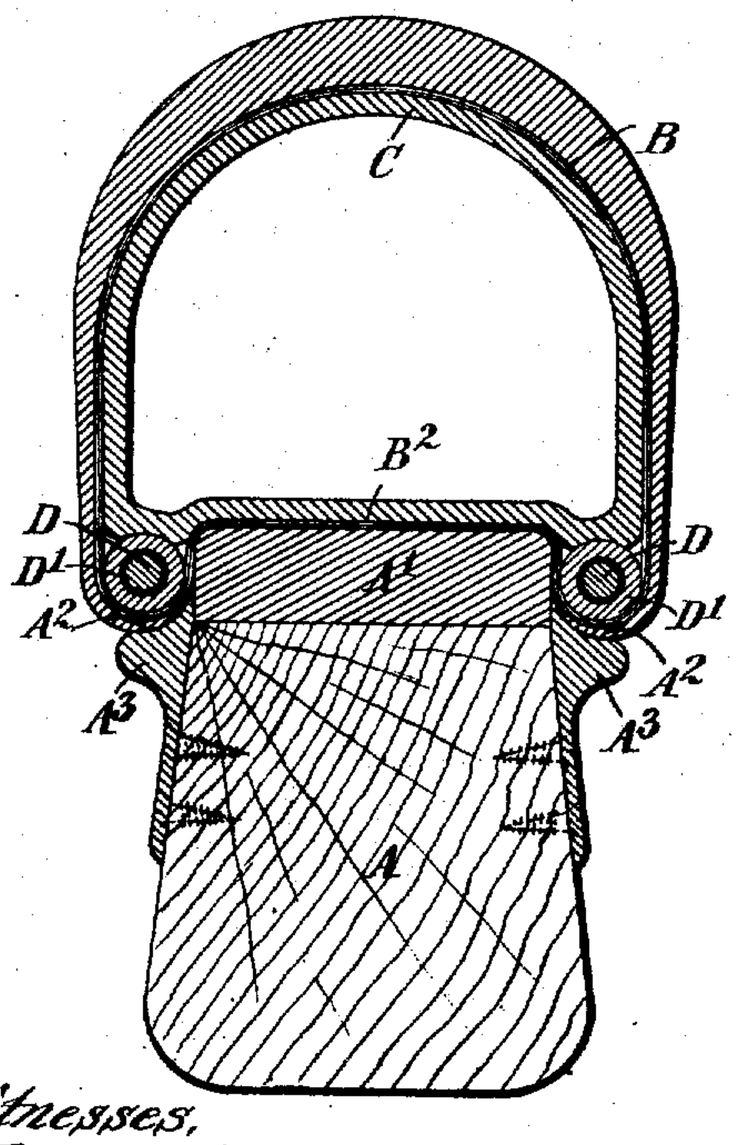
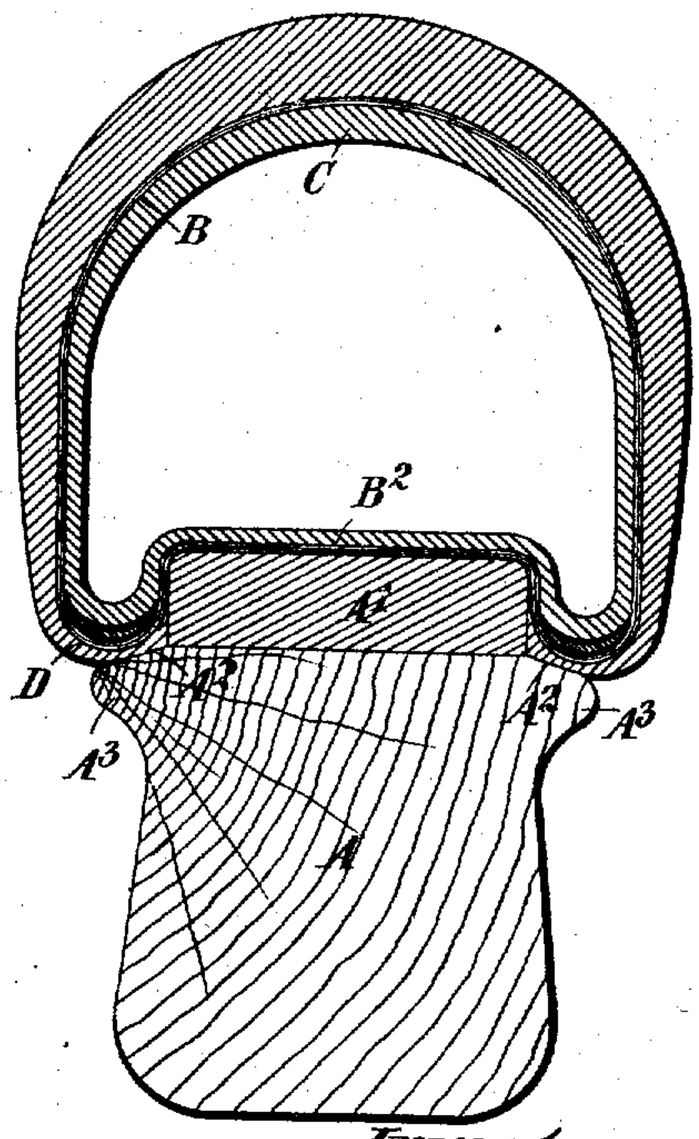


Fig. 4.



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Robt Britt.

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Charles K. Welch.
By Munn & Norris
Attys

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(No Model.) 4 Sheets—Sheet 2.

C. K. WELCH.

PNEUMATIC TIRE.

No. 512,594. Patented Jan. 9, 1894.

Fig. 12.

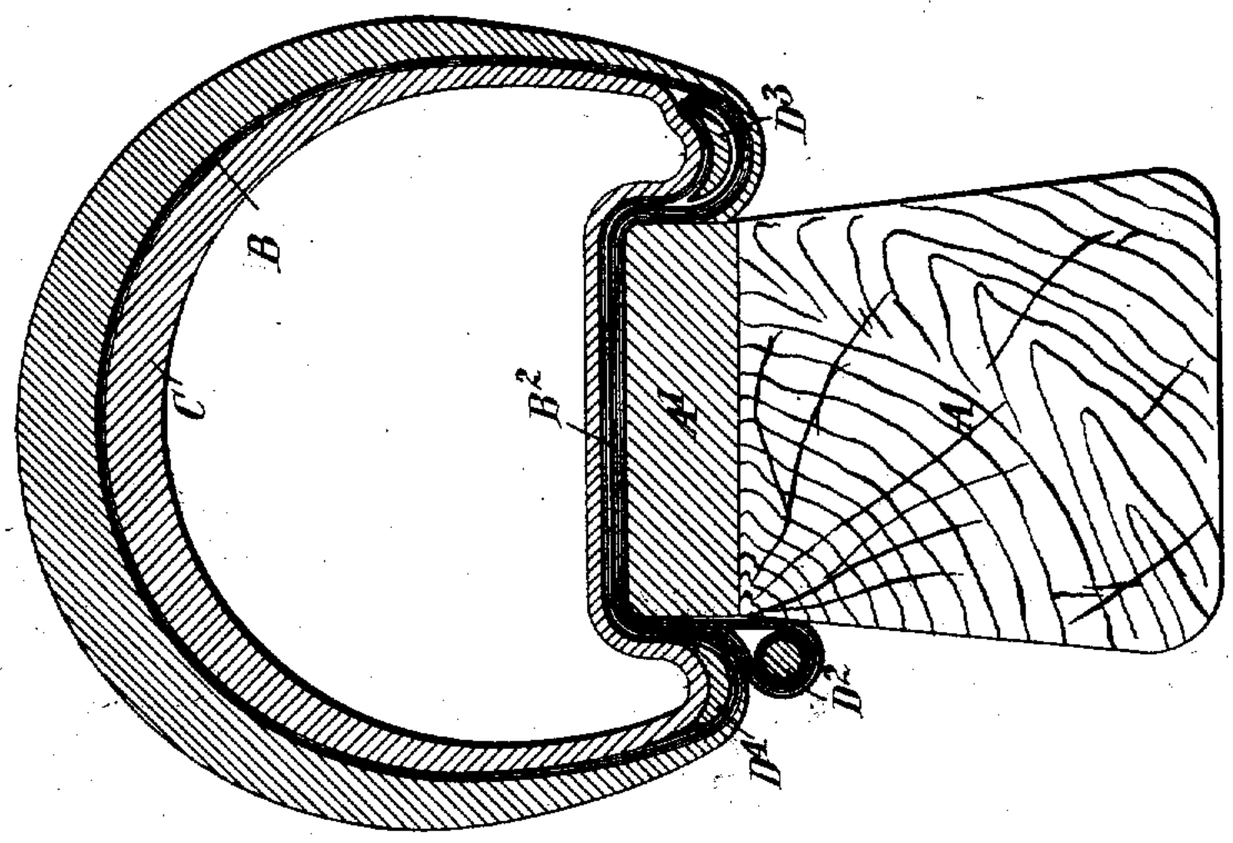


Fig. 6.

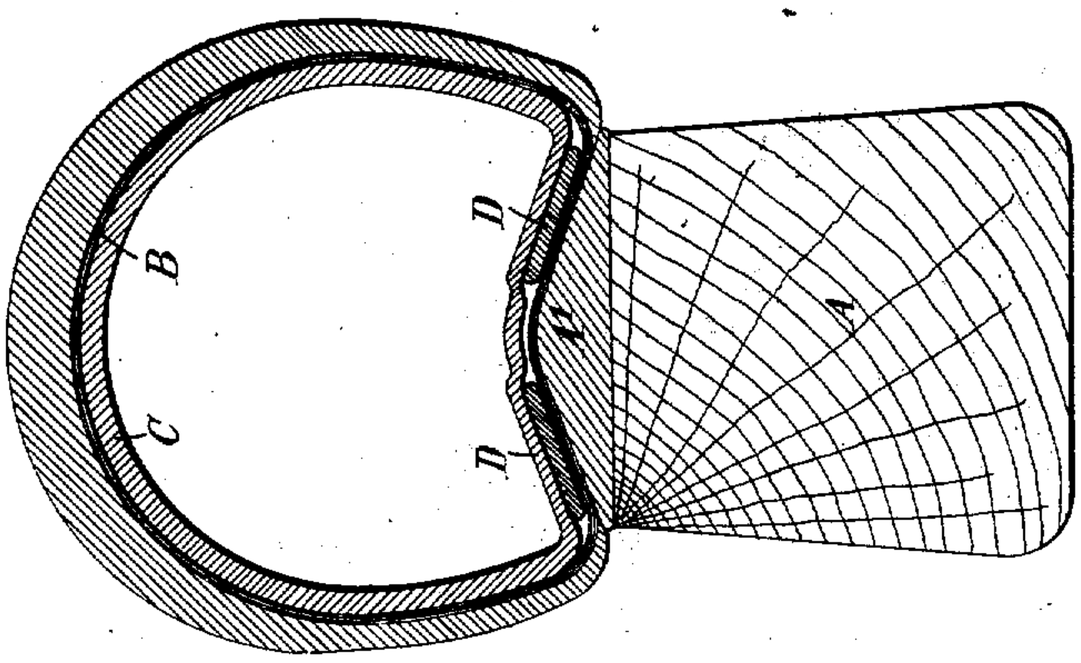


Fig. 11.

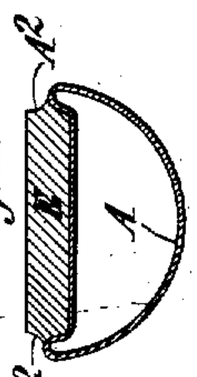


Fig. 5.

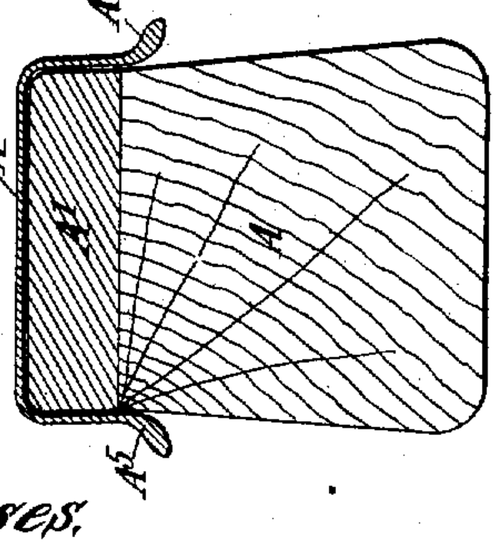


Fig. 7.

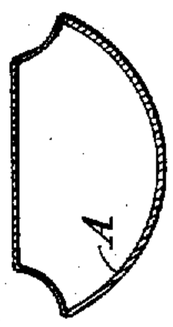


Fig. 8.

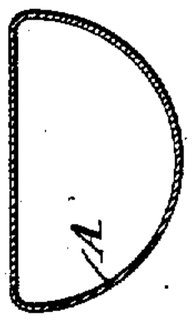


Fig. 9.

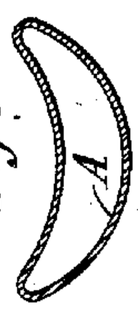
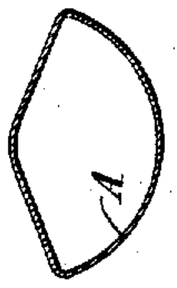


Fig. 10.



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C. K. WELCH.

PNEUMATIC TIRE.

No. 512,594. Patented Jan. 9, 1894.

Fig. 12a.

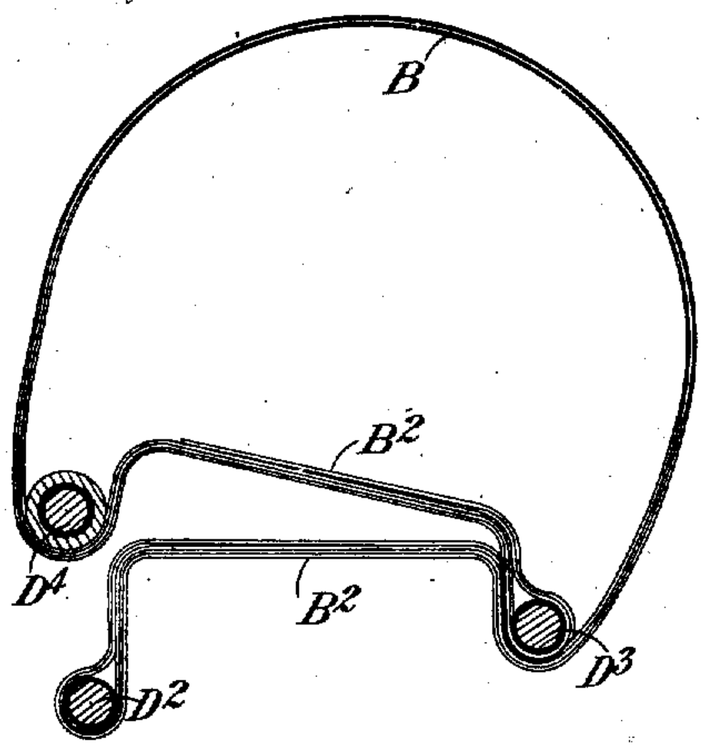


Fig. 12b.

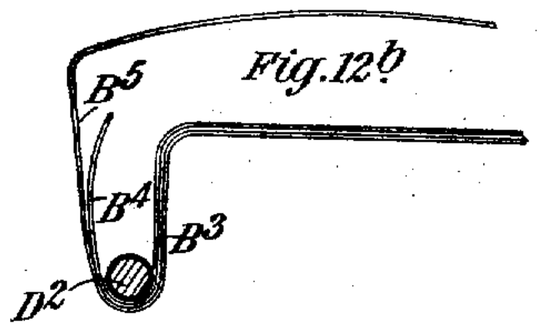


Fig. 13.

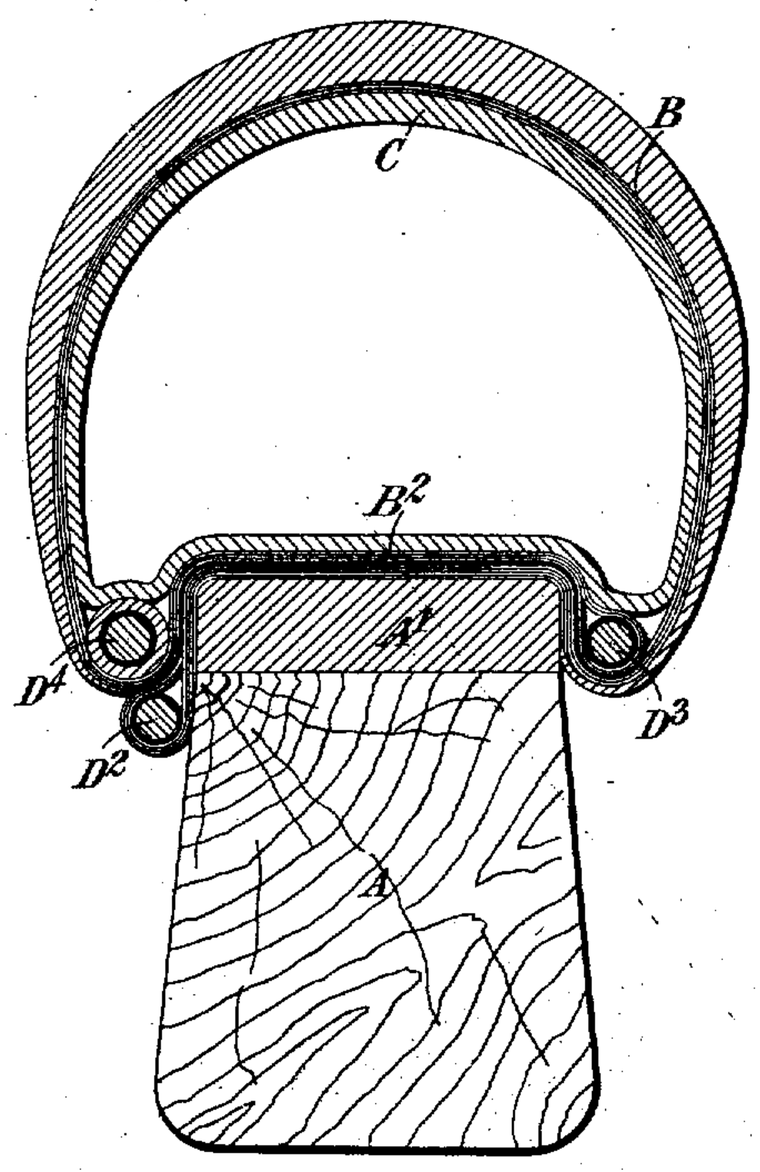


Fig. 14.

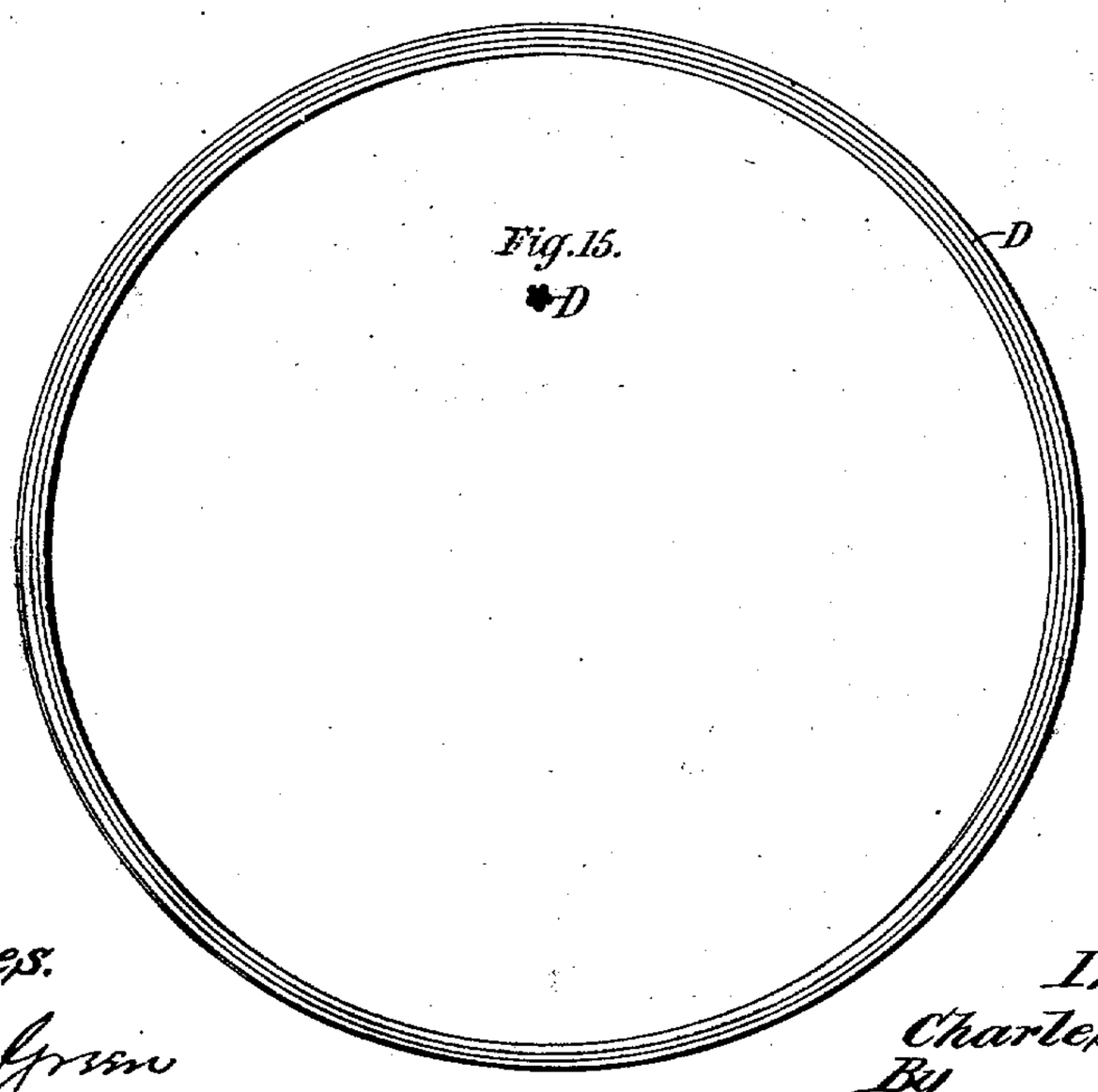
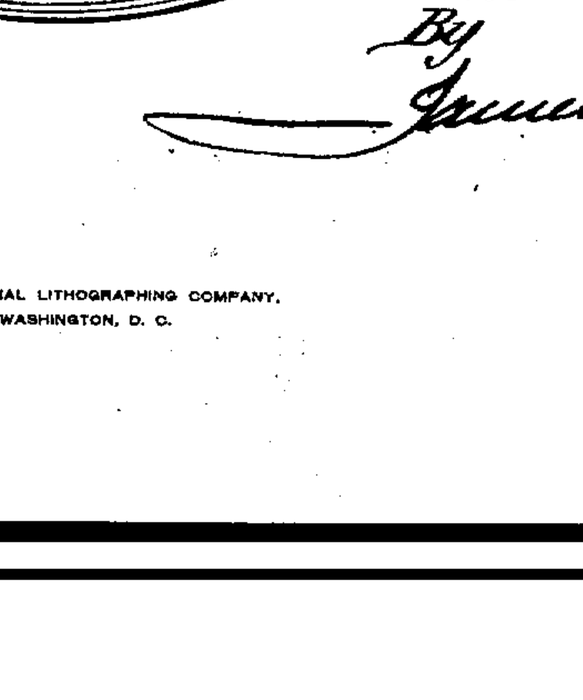


Fig. 15.



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(No Model.) 4 Sheets—Sheet 4.

C. K. WELCH.

PNEUMATIC TIRE.

No. 512,594. Patented Jan. 9, 1894.

Fig.16.

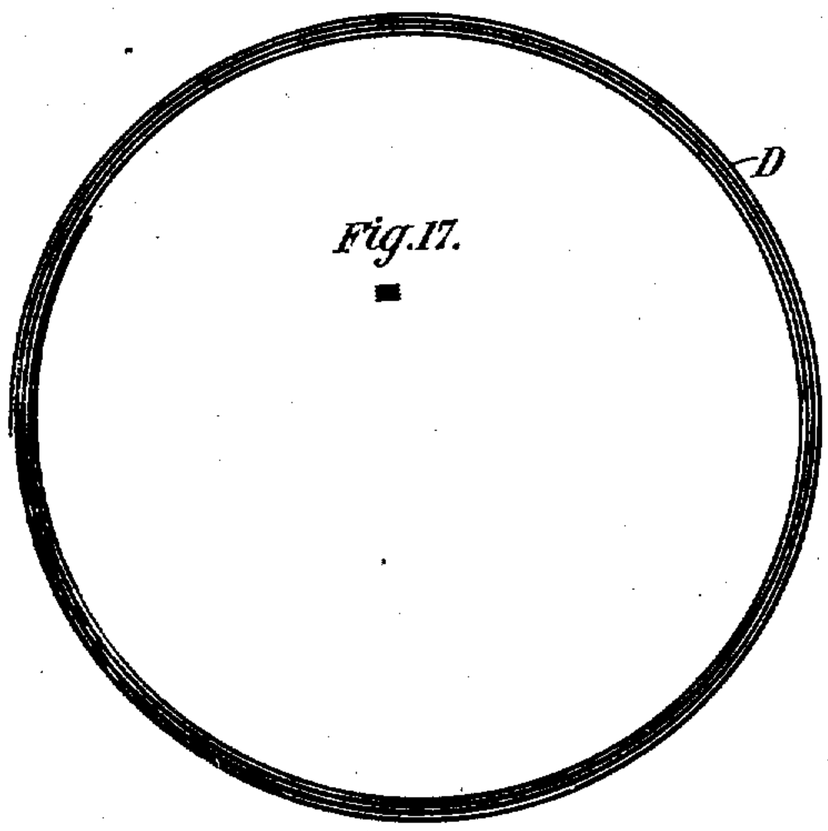


Fig.17.

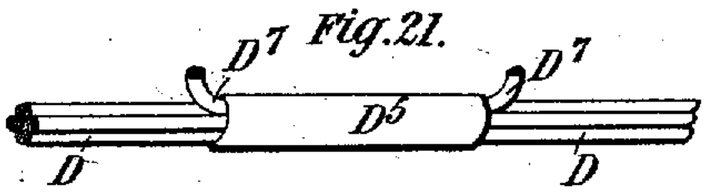


Fig.18.

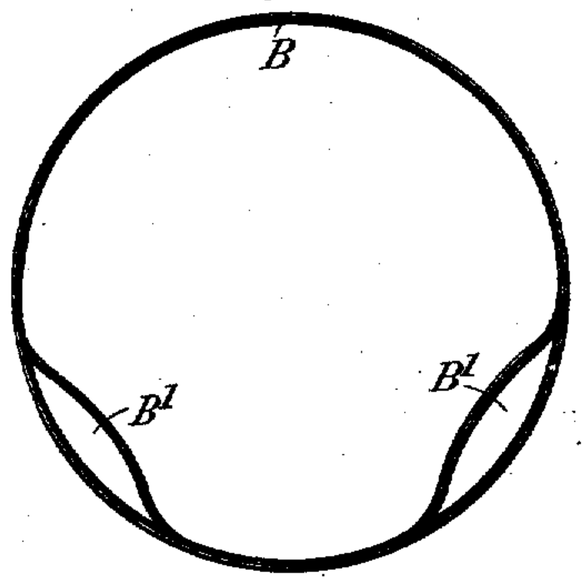


Fig.19.

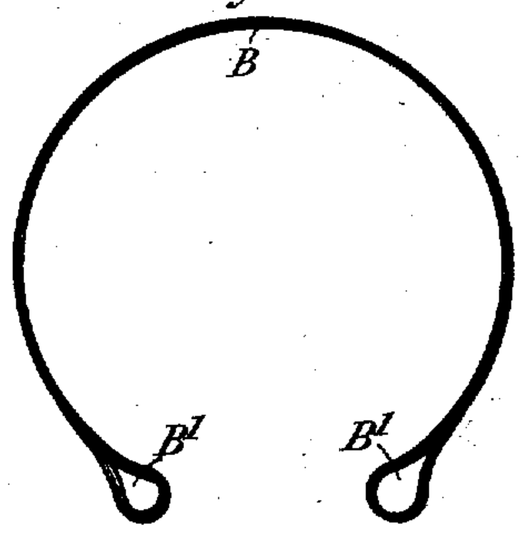


Fig.20.

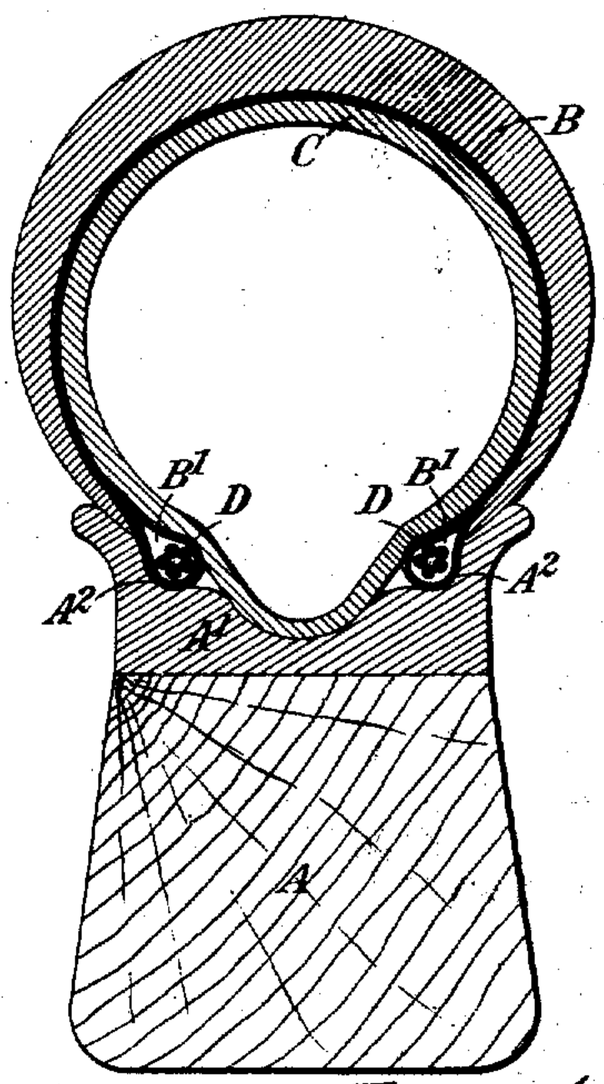


Fig.21.

Fig.22.

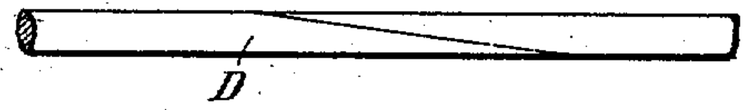


Fig.23.

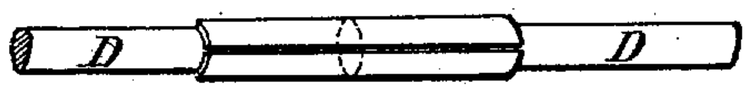


Fig.24.

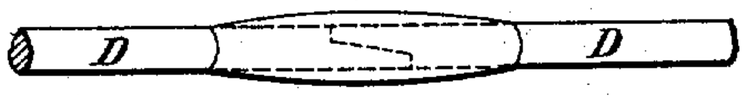


Fig.25.

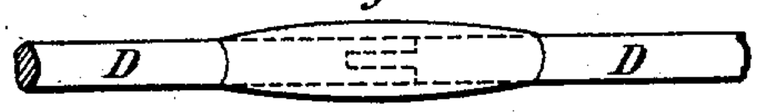
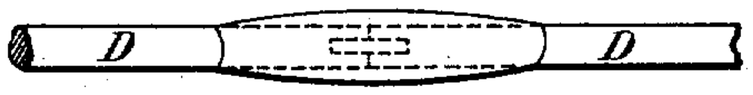


Fig.26.



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UNITED STATES PATENT OFFICE.

CHARLES KINGSTON WELCH, OF COVENTRY, ENGLAND, ASSIGNOR TO THE PNEUMATIC TYRE AND BOOTH'S CYCLE AGENCY, LIMITED, OF DUBLIN, IRELAND.

PNEUMATIC TIRE.

SPECIFICATION forming part of Letters Patent No. 512,594, dated January 9, 1894.

Application filed January 21, 1893. Serial No. 459,206. (No model.) Patented in England June 23, 1892, No. 11,772; in France January 23, 1893, No. 227,353, and in Belgium January 24, 1893, No. 103,135.

To all whom it may concern:

Be it known that I, CHARLES KINGSTON WELCH, engineer, a subject of the Queen of Great Britain, and a resident of Coventry, England, have invented certain new and useful Improvements in and Relating to Pneumatic or Air-Inflated Tires, (for which I have obtained Letters Patent in Great Britain, No. 11,772, dated June 23, 1892; in France, No. 227,353, dated January 23, 1893, and in Belgium, No. 103,135, dated January 24, 1893,) of which the following is a specification, reference being had to the accompanying drawings.

Heretofore pneumatic tires have been secured to the grooved rims of cycle and other wheels by incorporating with or attaching to the said tires wires or bands the ends of which were connected together directly or indirectly to form rings of smaller diameter than the diameter of the wheel at the edges or highest points of the rim. In some cases these annular bands were made by brazing together the ends of wires and working them over into the grooved rim where they were held in position by the internal air pressure, while in others the ends of the wires after being laid in the grooved rim were joined by hooks, loops, nuts or other devices made to engage with each other directly or with lugs set in the rim between the edges of the same. All of these tires, however, exhibit a common principle of construction. They are normally loose on the rims and detachable therefrom, but the action of the internal air pressure tends to force the sides or edges of the tire up the sides of the grooved rim, which movement is checked and limited to the line or position within the groove which the diameter of the inextensible bands permits such bands to assume.

In some forms of wheel the employment of a grooved rim is objectionable, as for example in carriage wheels, and the object of my present invention is to utilize the principle of construction of the tires above described in adapting pneumatic or inflated tires to such wheels. In lieu therefore of using a grooved rim and securing the endless bands to those portions of a tire that lie within the rim, I adopt the converse of this and use an ordinary felly and associate with the tire bands of less diameter than the highest part of the felly, placing one on each side of such highest point. The tire, to secure the desired results is, in such cases, tubular, or some non-extensible connection is made between portions containing the bands and which constitutes that portion which lies over the felly, whereby, when the tire is inflated the tendency which it exhibits of leaving the wheel will be resisted by the wires which, by reason of their smaller diameter, cannot come together nor pass over the felly, and limit the movement of the sides or edges of the tire toward the periphery of the wheel to lines determined by their diameter with reference to that of the wheel. In this way I provide for the attachment of a pneumatic tire to ordinary wheels, even those which are already provided with the usual metal tires.

The manner in which my invention is or may be carried into effect is illustrated in the accompanying drawings, in which—

Figures 1 to 6 are transverse sections showing different methods of securing the covers of pneumatic tires to rims of vehicles according to my invention. Figs. 7 to 11 are transverse sections of wheel rims which are suited for the purposes of my invention. Figs. 12 and 13 are transverse sections showing a tire secured to the rim of a wheel by means of three binding wires or cores. Fig. 12^a is a section of the canvas envelope removed from the wheel rim and Fig. 12^b is a detail view showing how the binding wires or cores are secured in the edge of the canvas envelope. Figs. 14 to 17 are views showing various forms of binding wires or cores which I employ in attaching said envelopes to rims. Figs. 18 and 19 are views showing my improved form of non-elastic jacket or envelope which is placed round the air tube of a pneumatic tire. Fig. 20 is a transverse section, showing a tire applied to an ordinary cab wheel, and Figs. 21 to 26 are detail views showing various methods of joining the binding wires or cores.

Similar letters of reference denote similar parts in all the drawings.

A is the rim or felly of the wheel to which the tire is fitted.

B is the non-elastic or inextensible jacket or envelope surrounding the air tube C; and D, D, are the binding wires or cores which secure the tire to the rim.

In Fig. 1 the rim or felly of a heavy wheel such as a cab wheel is shown fitted with a metal or other tire A′. A^2, A^2, are chamfers forming seatings for the cores D by which the pneumatic tire is secured in place. The cores D are in this instance rings of crescent section of a circumference a little smaller than the greatest circumference of the wheel rim. The said cores are placed loose inside the tubular jacket B and are tightened on to their seats when the air tube is inflated in a manner easily understood. The tubular jacket B is sometimes formed with pockets B′ for the reception of the binding cores as will be hereinafter more fully explained.

In Fig. 2 a pneumatic tire is shown fitted to a heavy wheel furnished with a metal or other tire A′ which has only a shallow channel to its outer periphery. The cores are placed loose inside the air tube C and bed against the sides of the felly or rim. In Figs. 3 and 4 the rim or felly A is furnished with projection A^3 which may either be placed at intervals round the rim or may take the form of complete rings forming seatings A^2 for the binding wires or cores. The tire is thereby prevented from slipping round so as to become eccentric to the rim of the wheel. The said cores are shown in Fig. 3 as being in two parts, one portion D′ completely surrounding and inclosing the other part D which may be a solid cylindrical core such as a wire for instance. When the tire is being inflated and the part B^2 of the jacket is being tightened across the rim the outer part D′ of the binding core rolls round the inner part D thereby obviating the friction which would otherwise occur between the jacket B and the binding core. Such a binding core as that described I prefer to call an "annular roller."

In Fig. 4 the binding cores are shown of a crescent section.

Fig. 5 shows a device which I sometimes use instead of forming or securing projections on the sides of the rim as shown in Figs. 3 and 4. A^4 are metal clips of suitable width which are placed at intervals round the rim. The ends A^5, A^5, of the said clips form seatings for the binding cores in the same manner as the projections A^3. Shown in Fig. 3.

In Fig. 6 the rim or felly A is fitted with a convex metal or other tire A′. The binding cores in this case take the form of conical hoops of rectangular section which when the tire is inflated tend to ride up to the highest portion of the periphery and thus hold the tire on very firmly.

In all these cases the binding cores may be made of wire which may or may not be covered with a layer of india-rubber, gutta-percha, or the like or varnished, or plated or otherwise made smooth and protected on the outside. Annular rollers made in the fashion hereinabove described may also be used. The said cores are either loose inside the tubular envelope or they may be placed loosely in pockets formed in the sides of the woven jacket hereinafter described.

In Figs. 7 to 11, I have shown various forms of light hollow rims suitable for velocipede wheels on which tires can be fitted as hereinabove described. For instance Fig. 7 shows a rim on which a pneumatic tire may be fitted as shown in Fig. 1. Figs. 8 and 9 in like manner show rims on which the tire may be secured as hereinabove described with reference to Fig. 2. Fig. 10 is a rim with a convex or doubly conical periphery the binding cores to be used with this form of rim being conical hoops as above described with reference to Fig. 6. In Fig. 11 a light wheel rim is shown which is already fitted with a flat india-rubber or other tire E the outer circumference of which is larger than the outer circumference of the rim A thus forming seatings A^2, A^2, for the binding cores which secure the pneumatic tire in place as described with reference to Fig. 1.

From the nature of the requirements of tires made as above described, it will be understood that the tire must be either tubular and contain the annular bands, or some similar provision must be made for causing the bands to ride up the sides of the felly as the result of the inflation of the tire. This may be accomplished by the use of any means that will constitute a bridge over the felly between the portions of the tire in contact with the wires.

In Figs. 12 to 13 is shown an example of such means of securing a pneumatic tire to a wheel rim by means of three binding wires or cores. The woven jacket in this case is not tubular but consists of an arched band having binding cores D^2, D^3, firmly secured to each edge thereof, the third core D^4 which is preferably an annular roller as shown in Fig. 13 is placed loose inside the jacket or air tube. The envelope is preferably made with three thicknesses of canvas B^3, B^4, B^5, as shown more clearly in Figs. 12^a and 12^b. In order to avoid making a thick joint at the parts where the cores D^2, D^3, are inclosed, the folded edges of the three layers of canvas are successively reduced in width and made narrower. Thus the layer B^3 does not lap round the cores and the lap of the layer B^4 is narrower than the lap of the layer B^5 as shown in Fig. 12^b. The envelope is so placed round the air tube with reference to the wheel rim that it forms two thicknesses on the periphery thereof as shown at B^2, B^2, Fig. 12^a. The air tube is thereby thoroughly protected from injury by the tire A′ of the wheel. The cores which I use for securing tires on to wheels are of any suitable descrip-

tion, and in all cases are made into complete rings by brazing or otherwise before being put on the wheel. Besides the annular roller hereinbefore described I use cores made as shown in Figs. 14 to 17 in which Figs. 14 and 16 are side views and Figs. 15 and 17 sectional views respectively of cores formed by winding a spiral either of cylindrical wire as shown in Figs. 14 and 15 or flat strip as shown in Figs. 16 and 17. The ends of the wire or strip are joined together by welding, soldering or in any other suitable manner and the whole of the core may be soldered together and covered with any suitable material such as rubber, canvas or the like. I preferably cover the said cores with gutta-percha.

The canvas jacket or envelope which I place round the air tube of a pneumatic tire is very often a woven tube and I make the same with pockets B′ at the sides as shown in Fig. 18. These pockets serve to contain the binding wires or cores which secure the tire in place on the wheel. When an arched envelope is used I make similar pockets E′ at the edges of the canvas strip as shown in Fig. 19. These pockets are not formed by securing separate strips of canvas to the tubes or by folding in the edges of the strip as heretofore, but are woven at the same time as the tube or canvas strip.

When I use a tubular woven envelope as in Fig. 18 I very often make transverse or longitudinal slots in the under or that part nearest the hub of the wheel so that the air tube can be easily withdrawn through the said slots when it is deflated.

I prefer to weave the cover or tubular envelope in a curved form so as to approximately fit the circumference of the wheel even before it is applied thereto. I do this by arranging that the warp threads shall be longer in one part of the cover than in another. For instance, in the case of an arched cover the warp threads are longer in the central part of the cover than they are at the edges of the same. I sometimes weave the said envelope or jacket round the endless binding wires or cores.

In Fig. 20 a pneumatic tire made with an arched canvas jacket is shown fitted to a wooden felly. The said felly is provided with an iron rim A′ having a deep central channel and side channels A^2, A^2, in which the binding wires or cores D are seated. The cores in this figure are of the kind hereinabove described with reference to Fig. 14.

In Figs. 21 to 26 I have shown various methods of joining the wires or binding cores so as to make them into rings or annuli. This is done before the woven jacket or air tube is made into a complete endless tube. In Fig. 21 a method of joining the ends of the wire which form the spiral core shown in Figs. 16 and 17 is illustrated. D′ is a sleeve which is slipped over the lapped ends of the wire. The said ends are then turned up as shown at D^6, D^7. The whole joint may be then made solid with soft solder if desired. The construction of the other joints is clearly shown in the drawings, the wires being brazed or soldered or otherwise united where necessary.

All the tires herein described are put on and off the rims when the air tube is deflated by pulling the cores on one side of the wheel eccentric to the rim in a manner well known in the trade. The tubes and valves through which the tire is inflated and deflated are of the ordinary pattern. This method of securing a pneumatic tire to rims of wheels which may be used without an elastic tire such as those shown in the accompanying drawings is very advantageous as in the case of puncture the pneumatic tire is very easily taken off, and, if beyond repair at the time, put aside and the vehicle ridden or driven home.

What I claim is—

1. The combination, with a wheel rim or felly, of an inexpansible envelope, and inextensible cores of smaller circumference than the largest circumference of the rim of the wheel placed in said envelope on opposite sides of the rim or felly or the part of greatest diameter of the same and capable of lateral movement toward the sides of the rim or felly when the tire is inflated, the envelope being simultaneously caused to tighten on the circumference of the rim, substantially as described.

2. The combination with a wheel rim or felly, of a hollow flexible inexpansible envelope, and inextensible cores smaller in circumference than the largest circumference of the wheel rim placed on opposite sides of the rim or felly and loose inside said envelope and not attached thereto but capable of lateral movement therein for securing the envelope to the rim, substantially as described.

3. The combination with a wheel rim or felly, of an envelope of textile fabric, an inflatable air tube inclosed within the said envelope, and inextensible cores smaller in circumference than the largest circumference of the wheel, placed on opposite sides of the rim or felly and loosely inside the said envelope and not attached thereto, but capable of lateral movement for securing the said envelope and air tube upon the rim, substantially as set forth.

4. The combination with a wheel rim or felly, of an inexpansible envelope, inextensible cores smaller in circumference than the largest circumference of the wheel, placed on opposite sides of the rim or felly and loosely inside the said envelope and not attached thereto but capable of lateral movement therein, for securing the said envelope upon the rim, and projections provided on said rim forming seatings for the reception of the said binding cores when the envelope is inflated, substantially as set forth.

5. The combination with a wheel rim or felly, of a jacket of textile fabric, an inflatable air tube inclosed within the said jacket,

and annular rollers forming inextensible cores smaller in circumference than the largest circumference of the wheel placed loosely inside the said jacket for securing the said jacket and air tube upon the rim, substantially as set forth.

6. The combination with a wheel rim or felly, of a jacket of textile fabric, an inflatable air tube inclosed within the said jacket, and spiral wire cores placed loosely inside the said jacket, for securing the said jacket and air tube to the rim, substantially as set forth.

7. The combination with a wheel rim or felly, of a jacket of textile fabric, an inflatable air tube inclosed within said jacket and spiral wire cores covered or protected to prevent rusting, placed loosely inside said jacket for securing the said jacket and air tube to the rim, substantially as set forth.

8. The combination with a wheel rim or felly, of a jacket of textile fabric, an inflatable air tube inclosed within said jacket, and three inextensible cores for securing the said jacket and air tube to the rim, one of the said cores being secured in each edge of the said jacket and the third of the said cores being placed loosely inside the said jacket and not attached thereto, substantially as set forth.

In witness whereof I have hereunto set my hand this 10th day of January, 1893.

CHARLES KINGSTON WELCH.

Witnesses:
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