No. 828,514. PATENTED AUG. 14, 1906.

W. W. E. SCHECK.

WIRE FABRIC TUBE FOR WHEEL TIRES.

APPLICATION FILED JAN. 24, 1905.

8 SHEETS—SHEET 1.

Fig. 1.

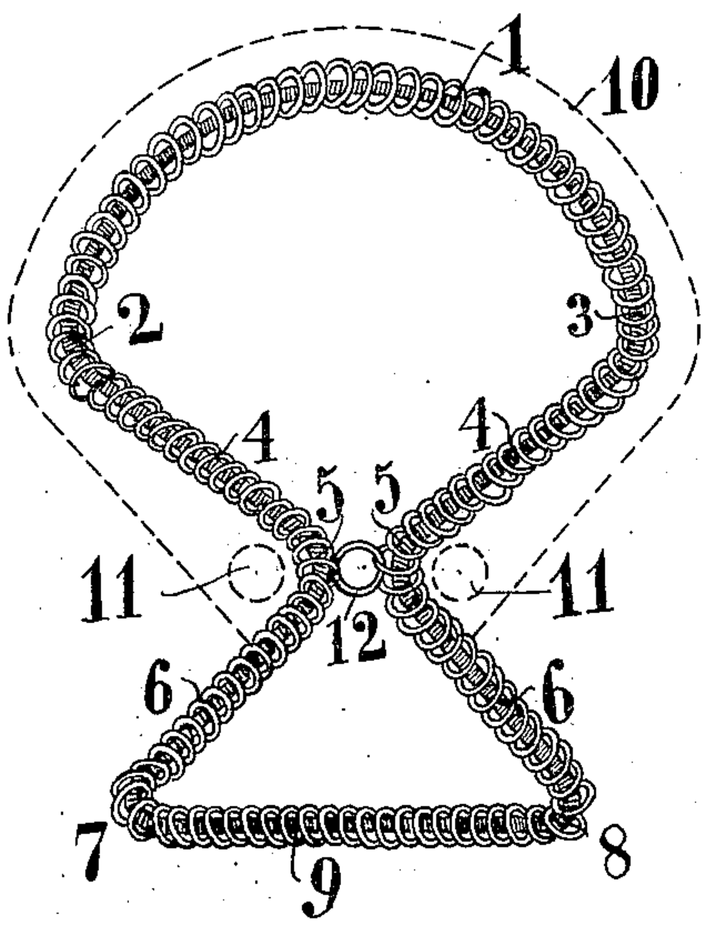


Fig. 2.

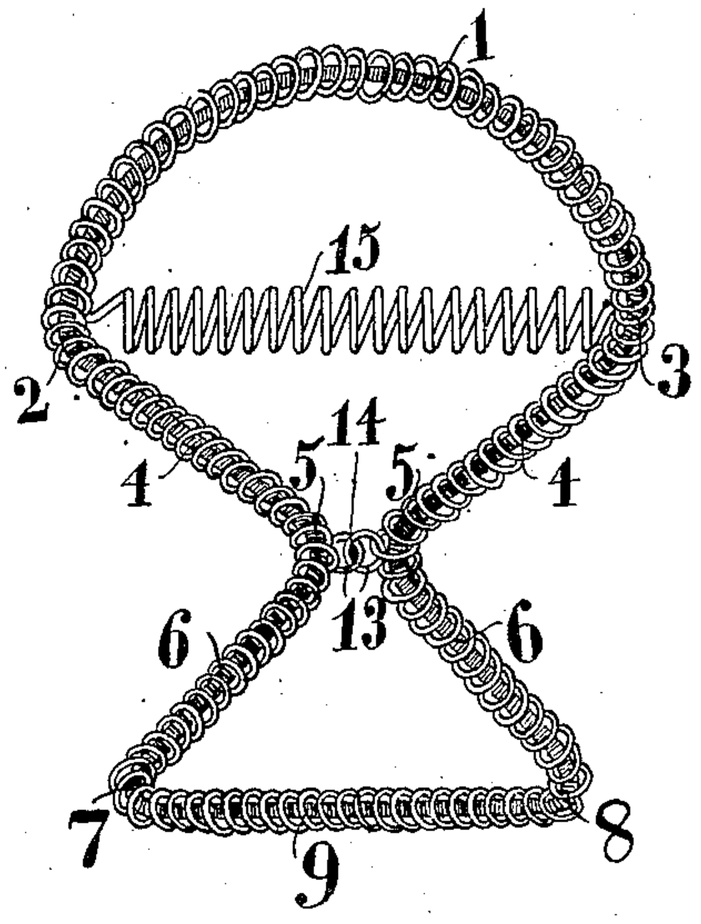


Fig. 3.

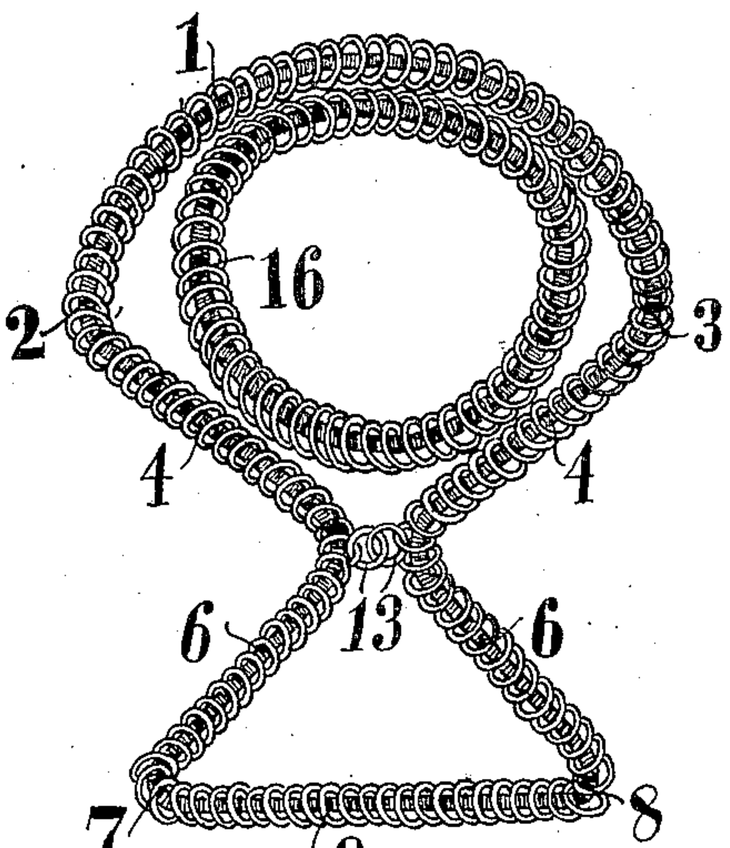
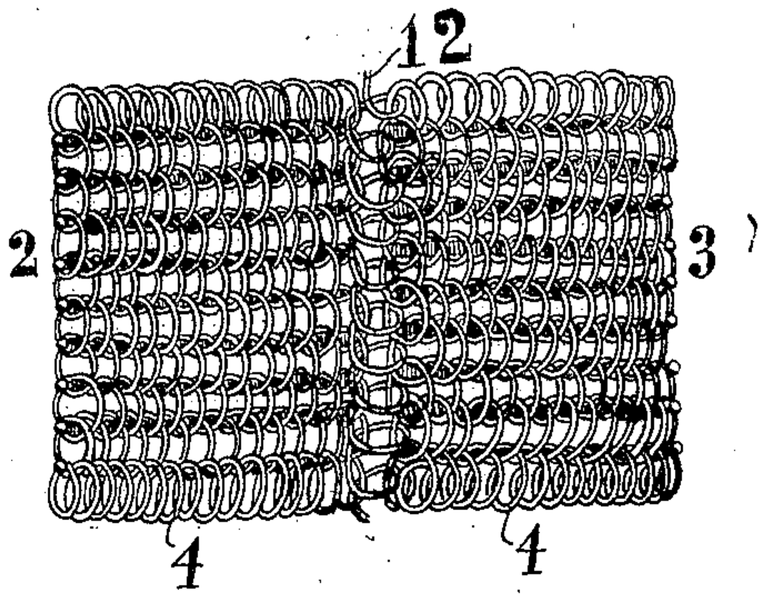


Fig. 1ª.



Attest

F. P. Sutton

E. R. Downey

Inventor

William W. E. Scheck

by William A. Hoge

his Atty.

No. 828,514. PATENTED AUG. 14, 1906.

W. W. E. SCHECK.

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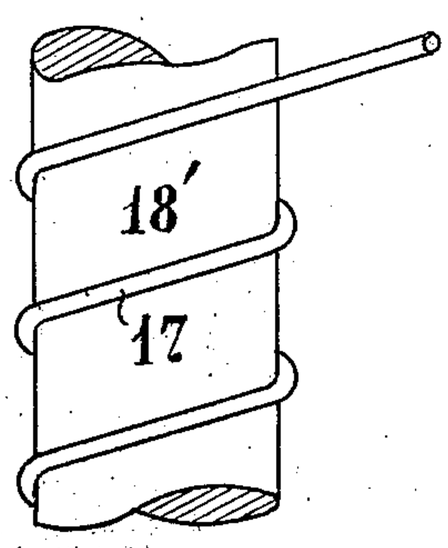
2 SHEETS—SHEET 2.

Fig. 4.



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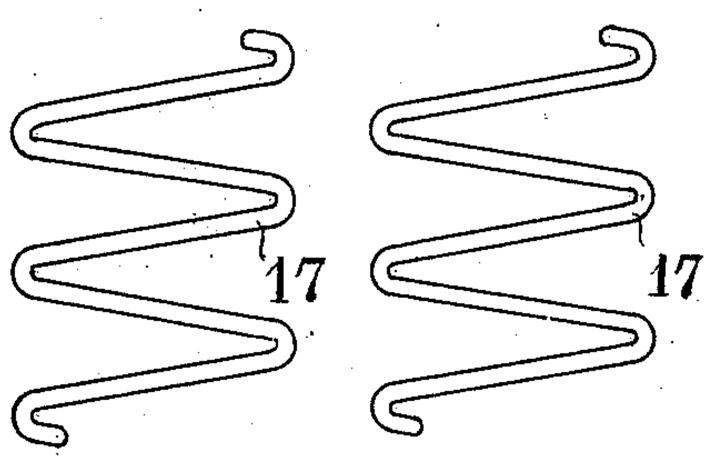

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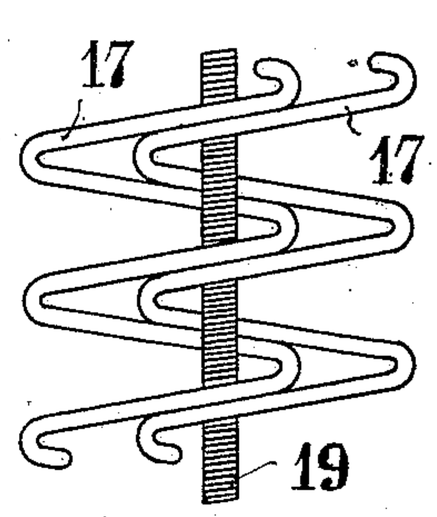

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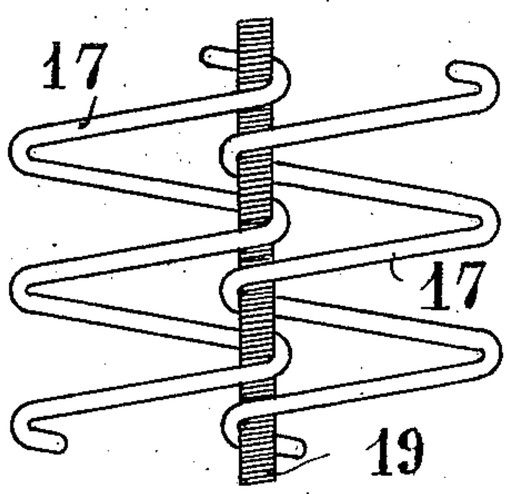

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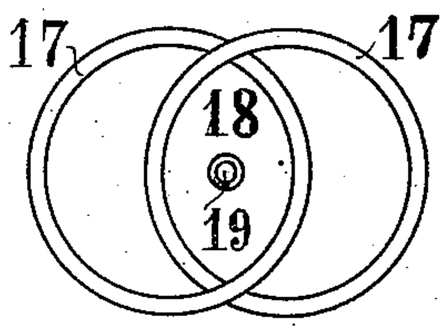

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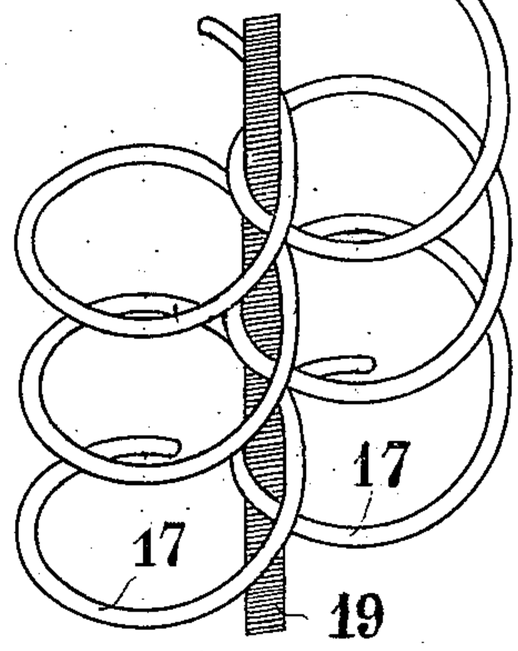

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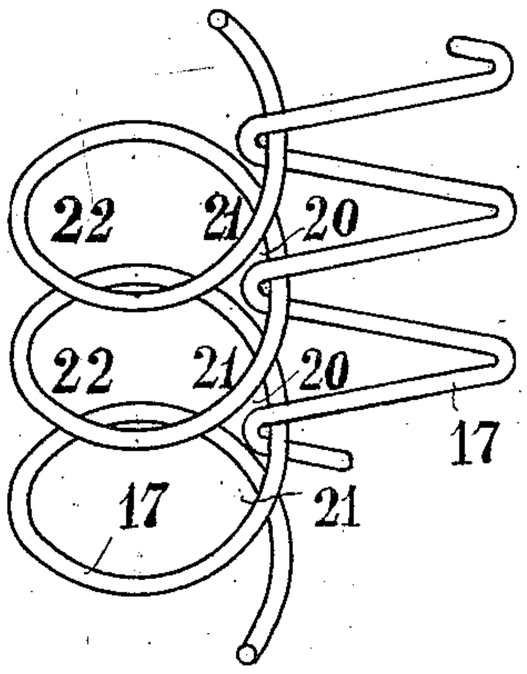
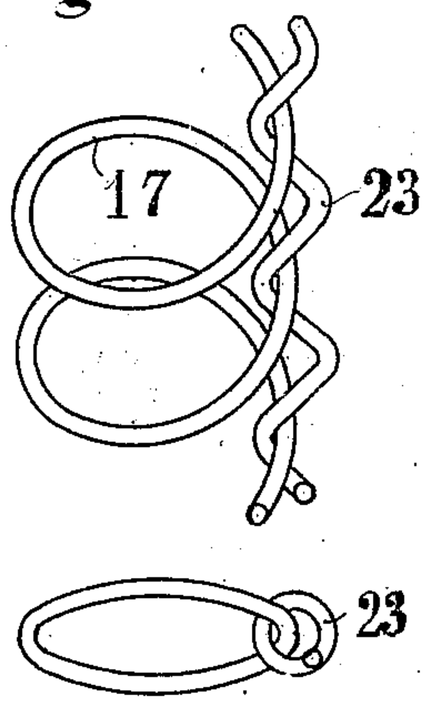
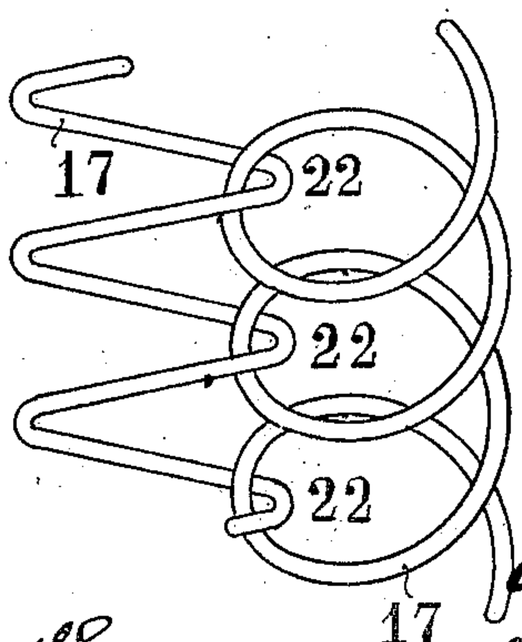
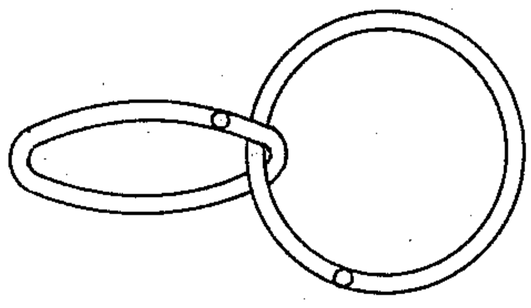


Fig. 11.







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F. P. Fitton
Wm. A. Simmons.

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No. 828,514. PATENTED AUG. 14, 1906.

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8 SHEETS—SHEET 3.

Fig. 12.

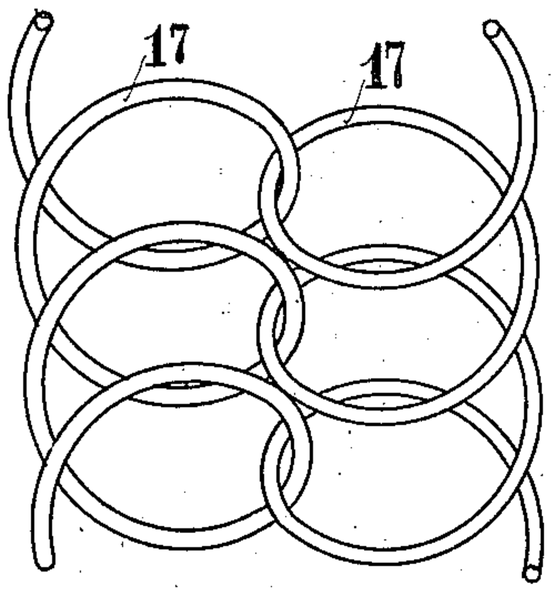
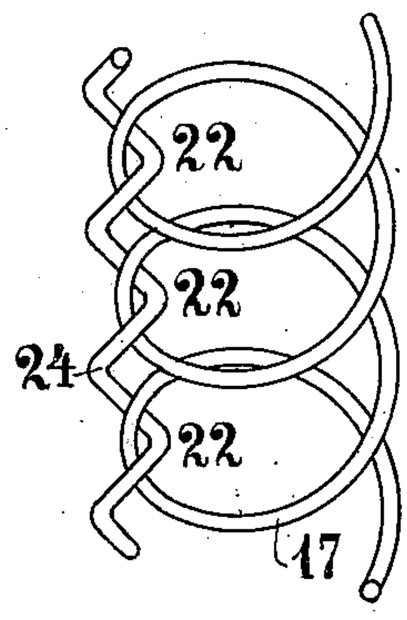


Fig. 13.



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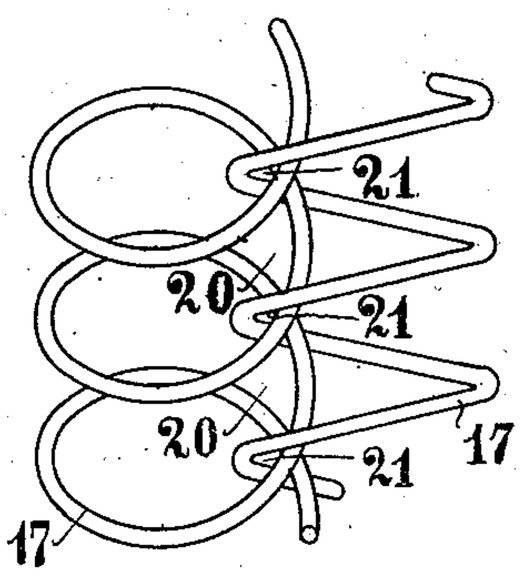

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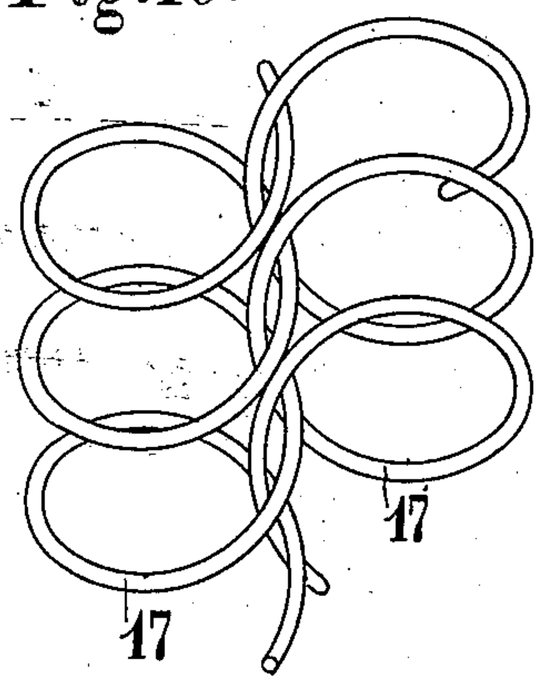

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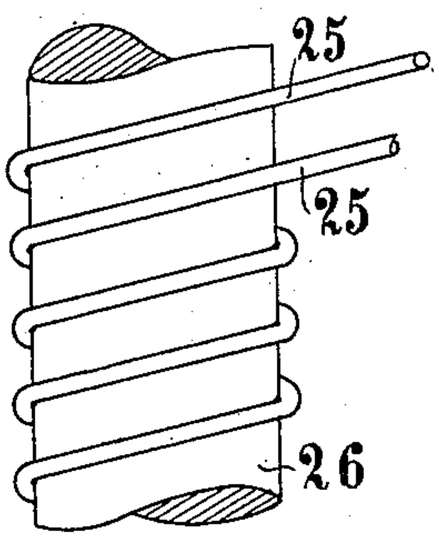
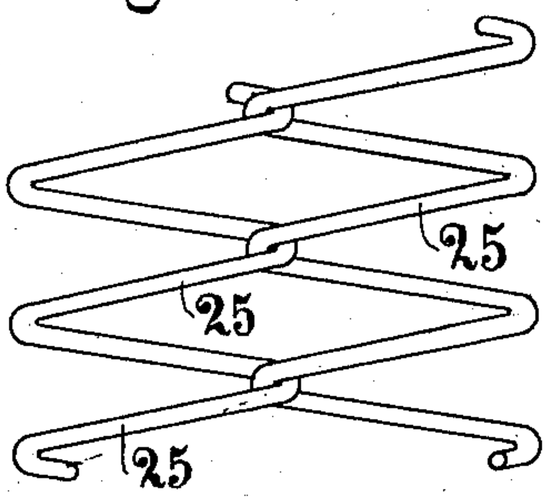


Fig. 17.



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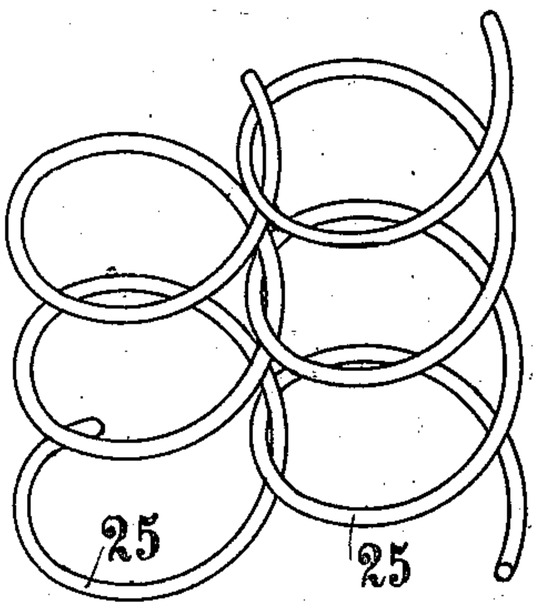

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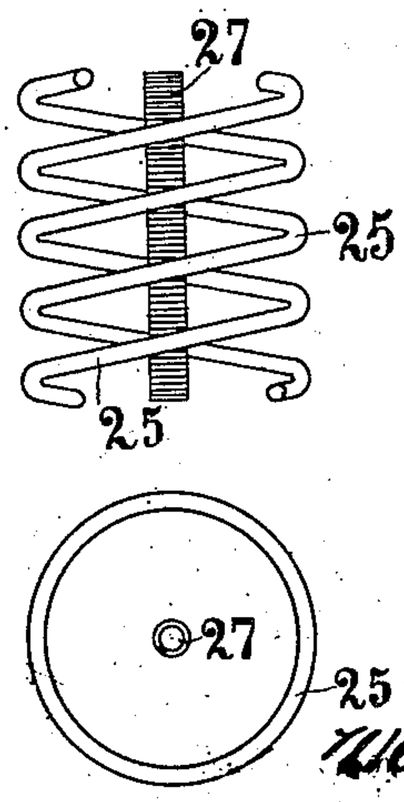
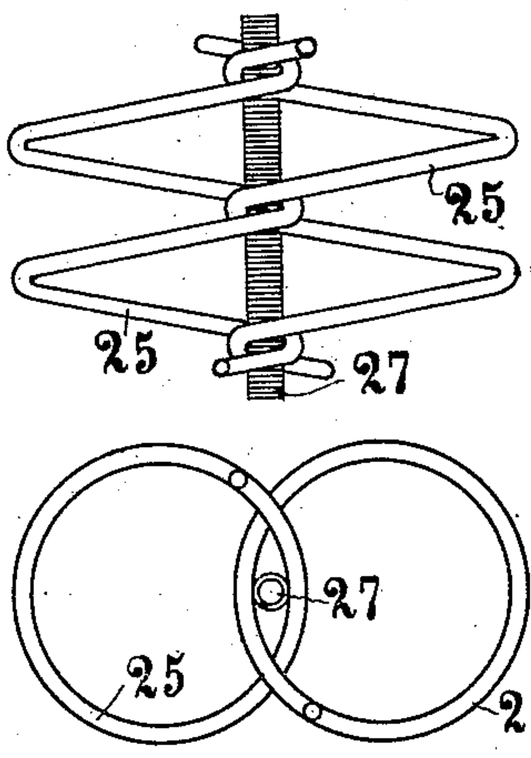


Fig. 20.



Attest

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Inventor

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No. 828,514. PATENTED AUG. 14, 1906.

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WIRE FABRIC TUBE FOR WHEEL TIRES.

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8 SHEETS—SHEET 4.

Fig. 21.

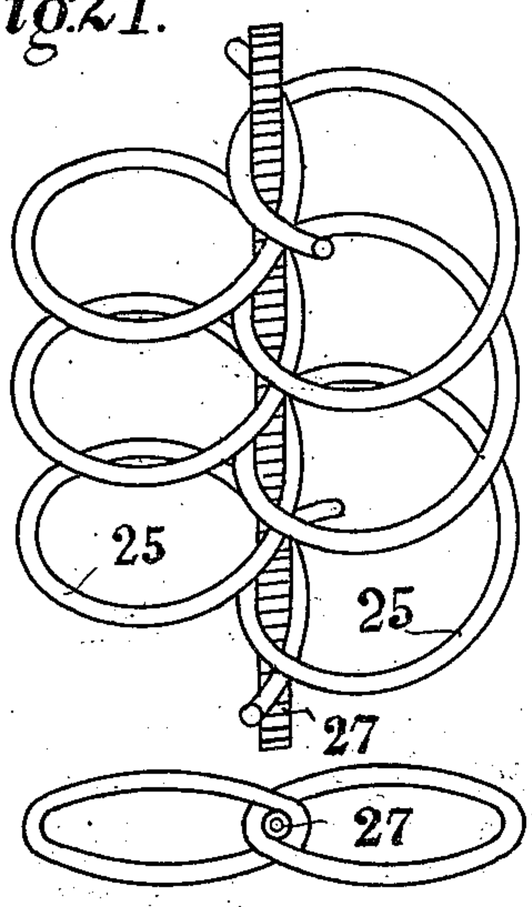


Fig. 24.

Fig. 22.

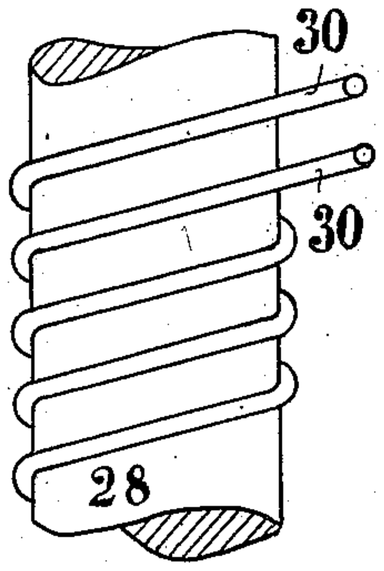
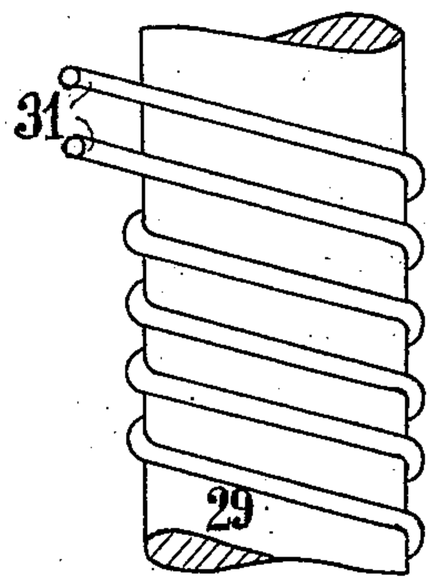


Fig. 25.

Fig. 23.



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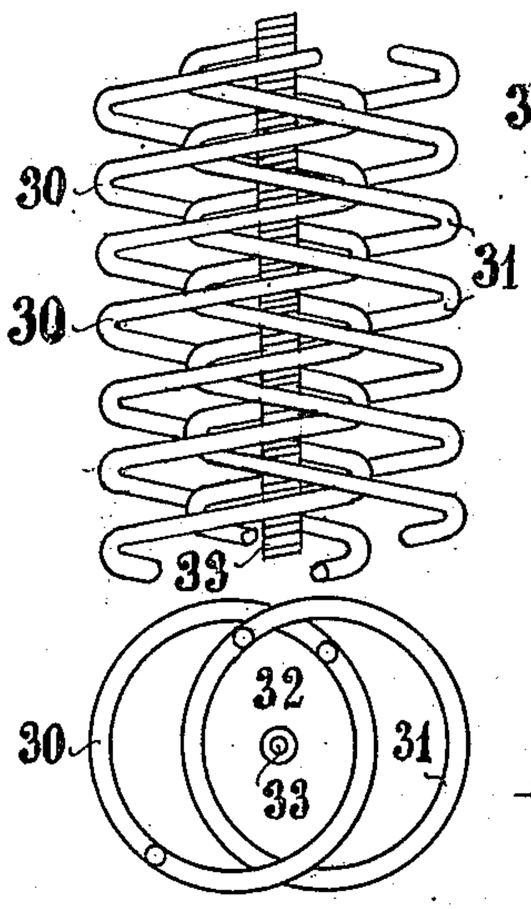

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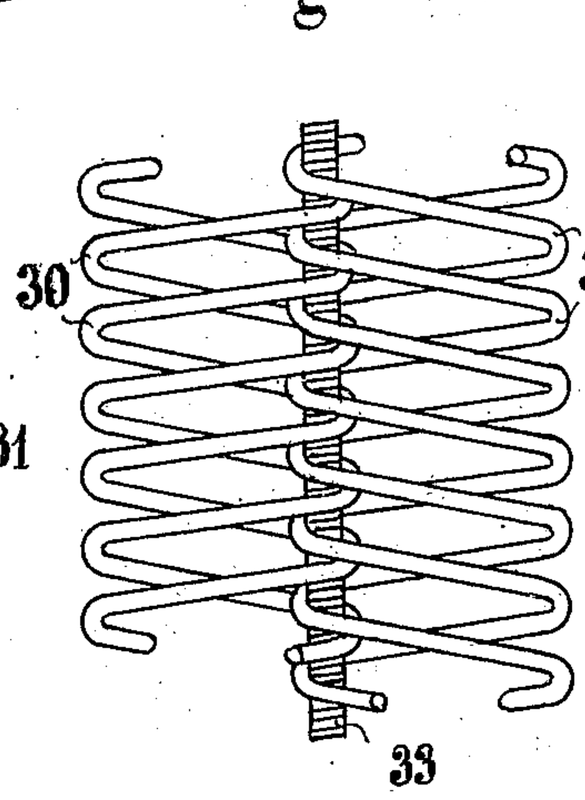

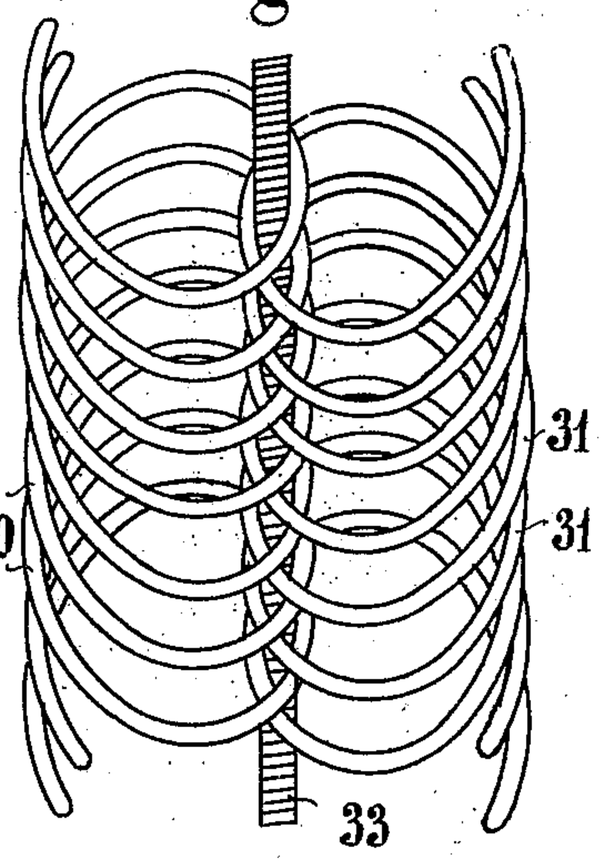

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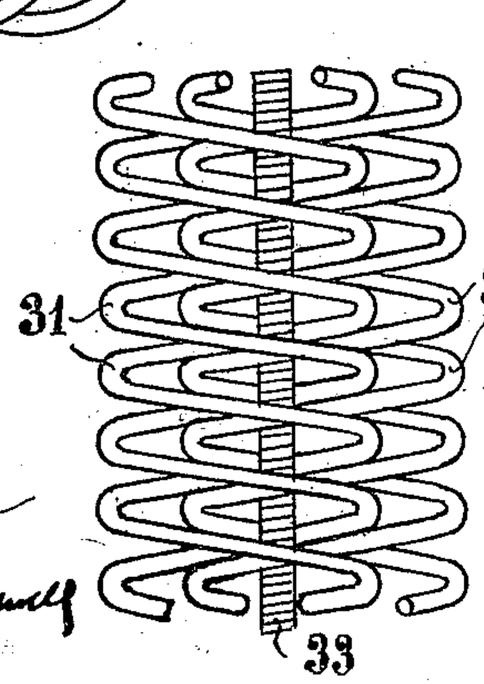

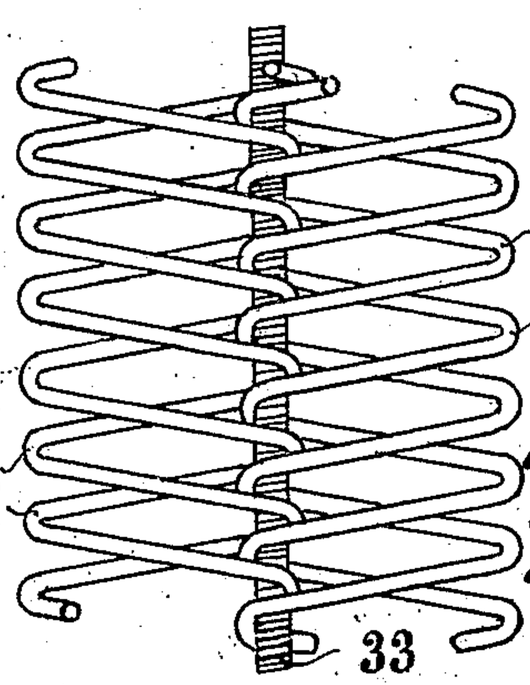

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H. N. Conway

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No. 828,514. PATENTED AUG. 14, 1906.

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8 SHEETS—SHEET 5.

Fig. 29.

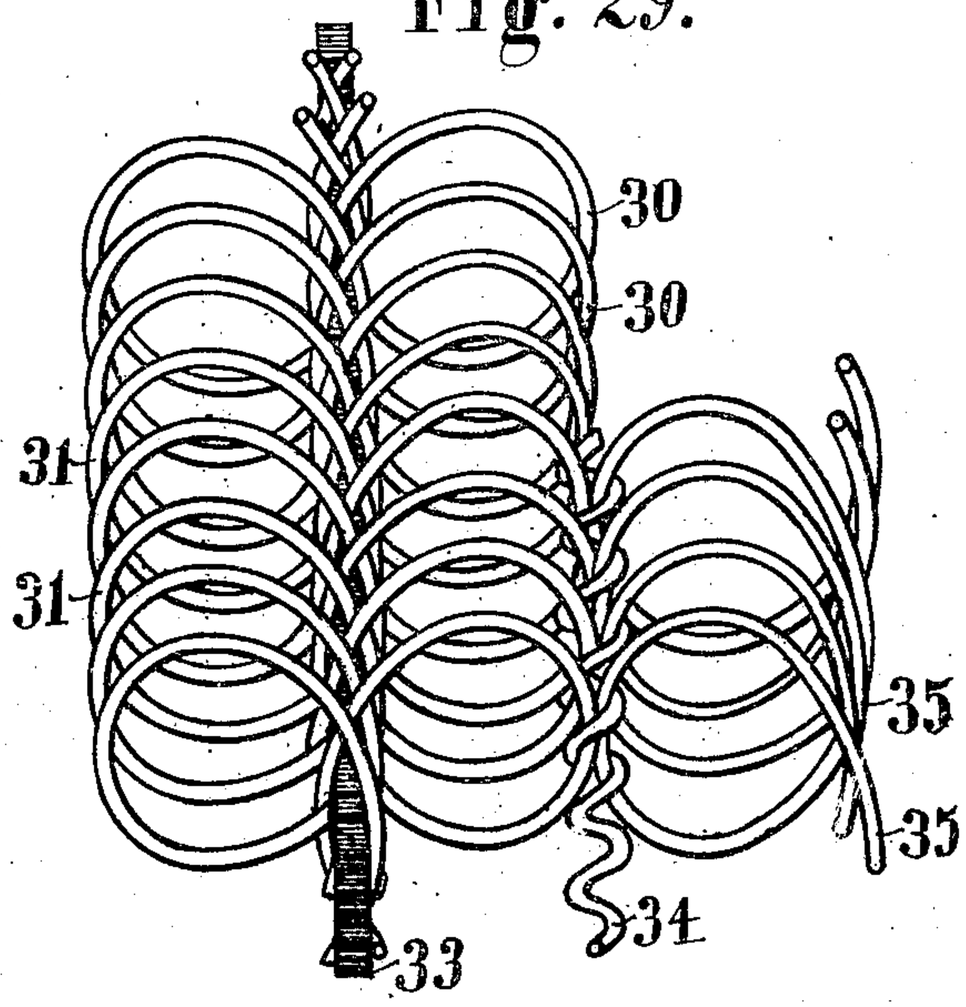
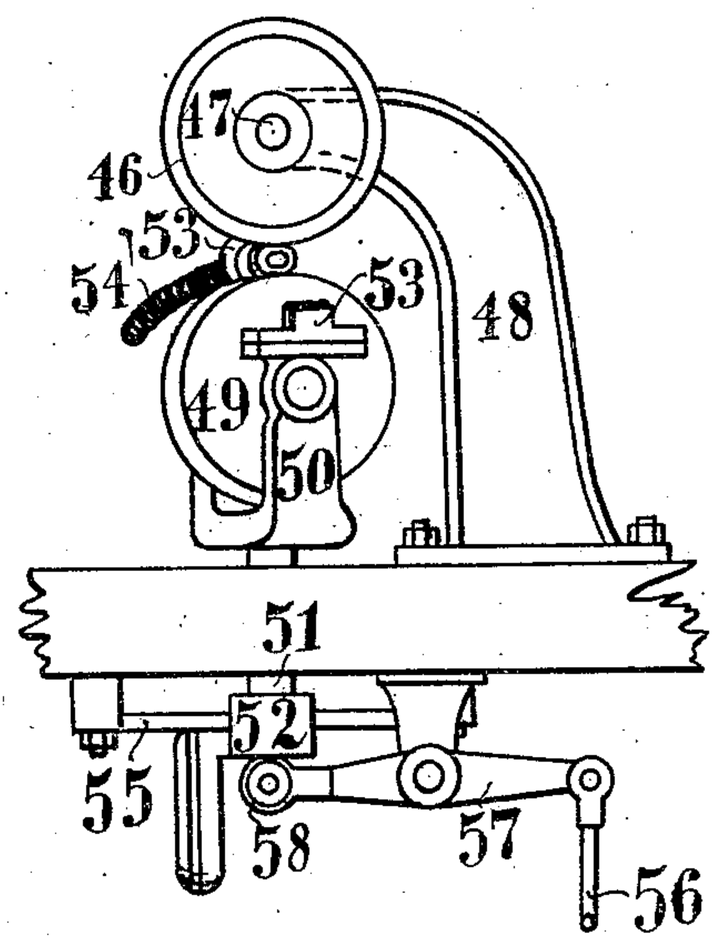


Fig. 30.



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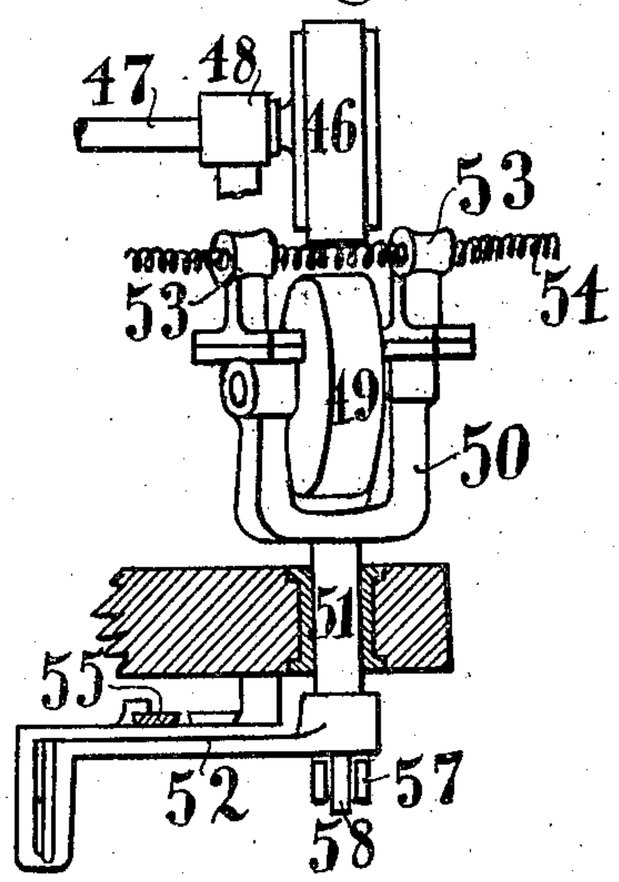


Fig. 32.

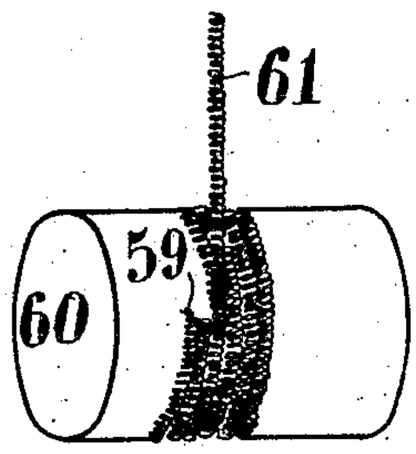


Fig. 33.

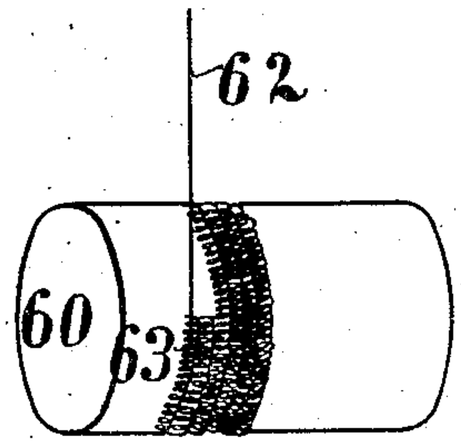
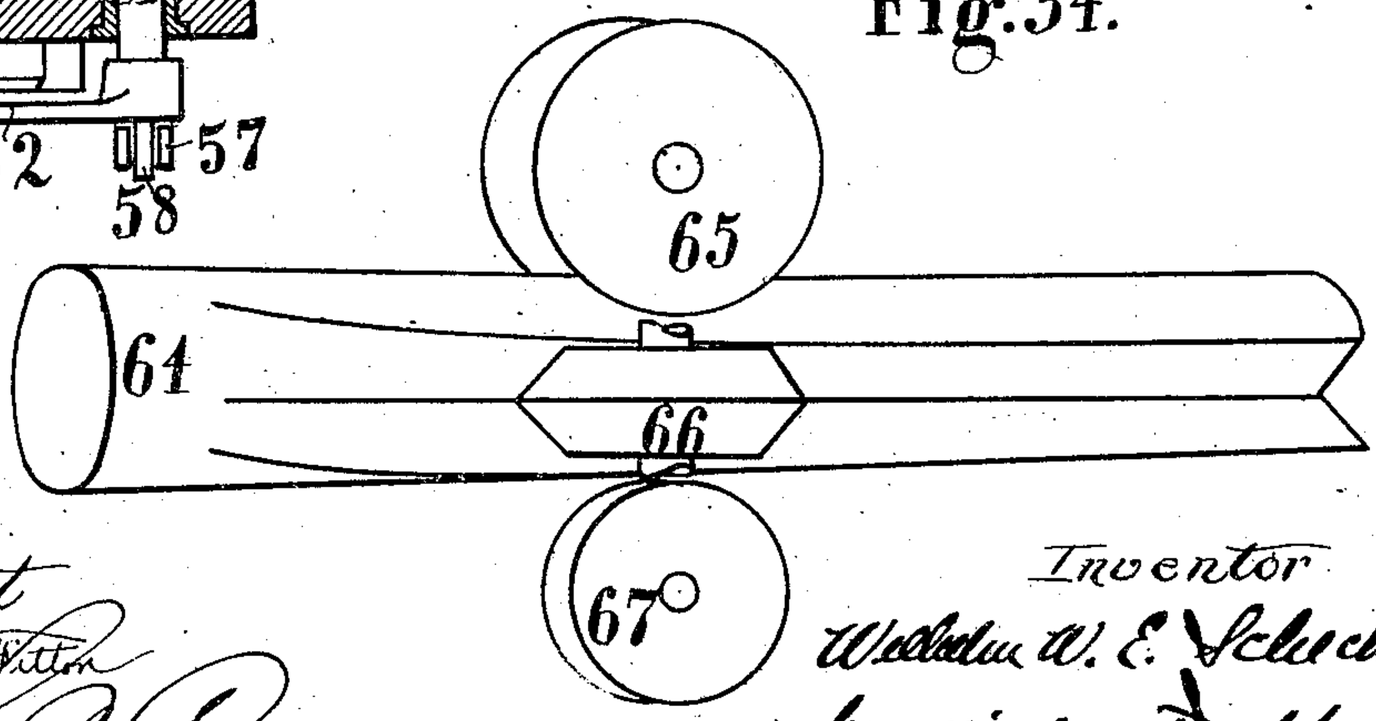


Fig. 34.



Attest
F. R. Fitton
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Inventor
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No. 828,514. PATENTED AUG. 14, 1906.

W. W. E. SCHECK.

WIRE FABRIC TUBE FOR WHEEL TIRES.

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8 SHEETS—SHEET 6.

Fig. 35.

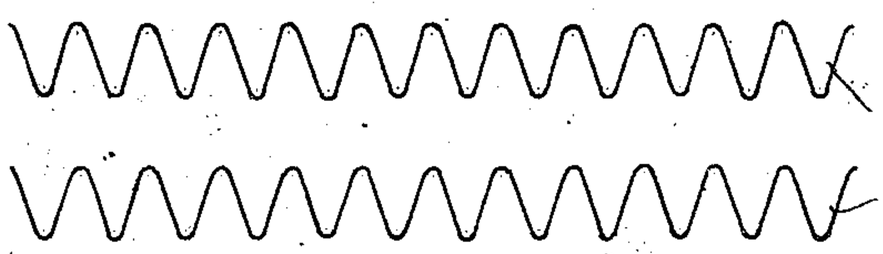


Fig. 36.

Fig. 37.

Fig. 38.

Fig. 39.

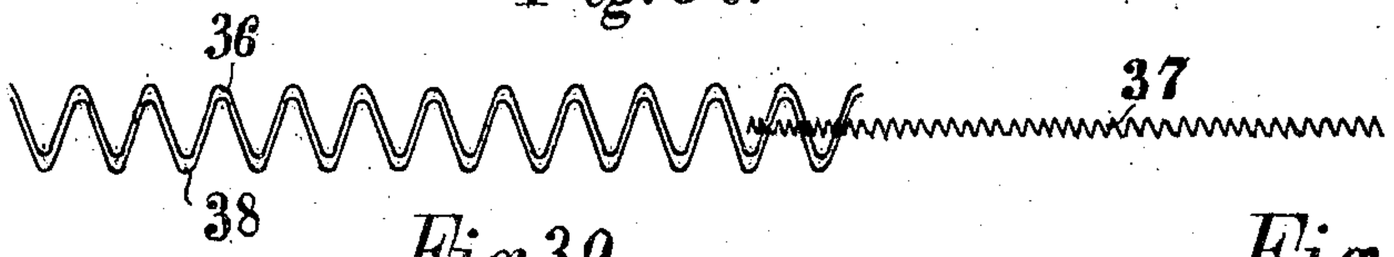


Fig. 40.

Fig. 41

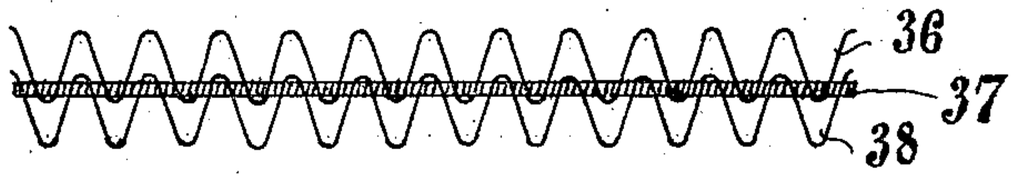


Fig. 42.

Fig. 43.

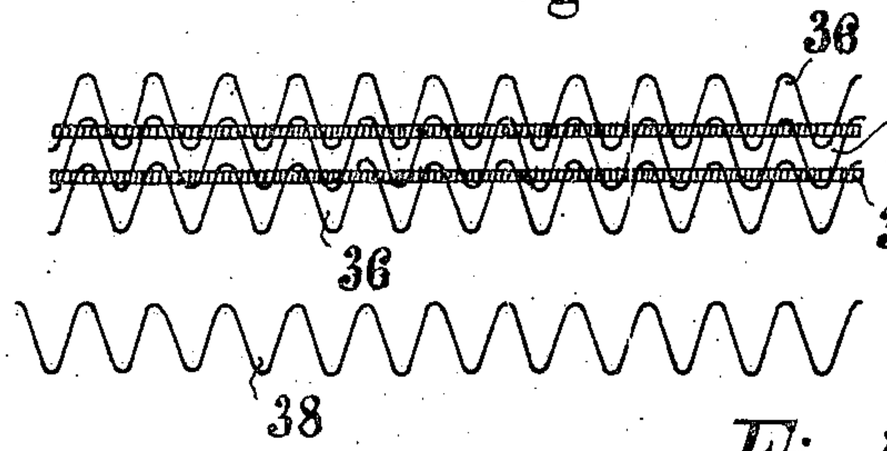
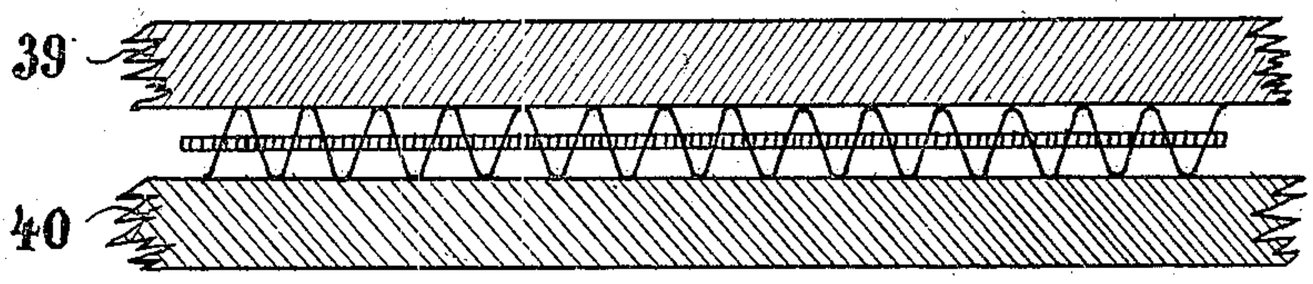
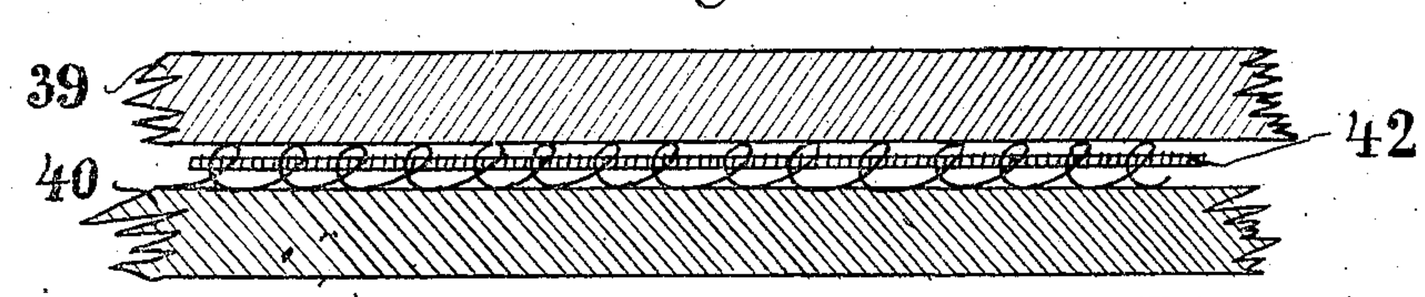


Fig 44





Attest

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No. 828,514. PATENTED AUG. 14, 1906.

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WIRE FABRIC TUBE FOR WHEEL TIRES.

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8 SHEETS—SHEET 7.

Fig. 45.

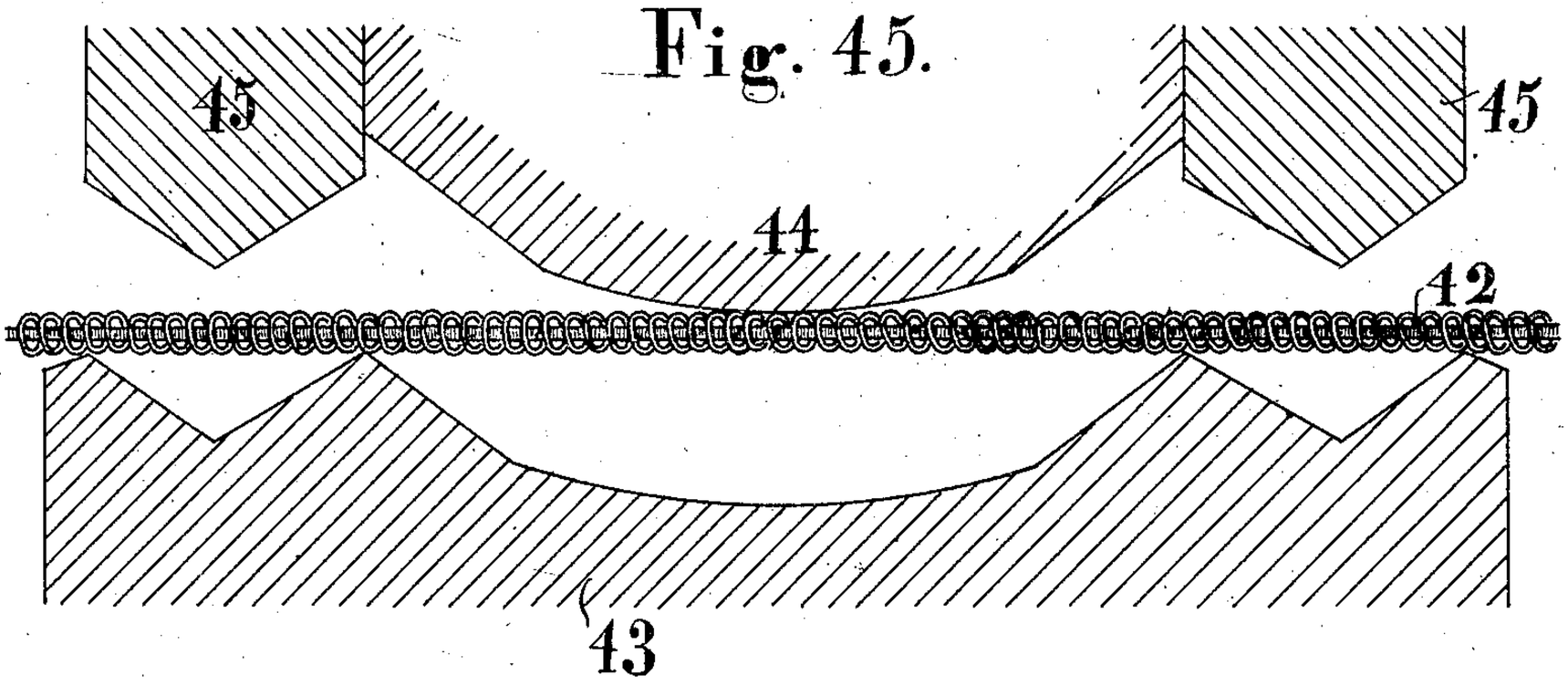


Fig. 46.

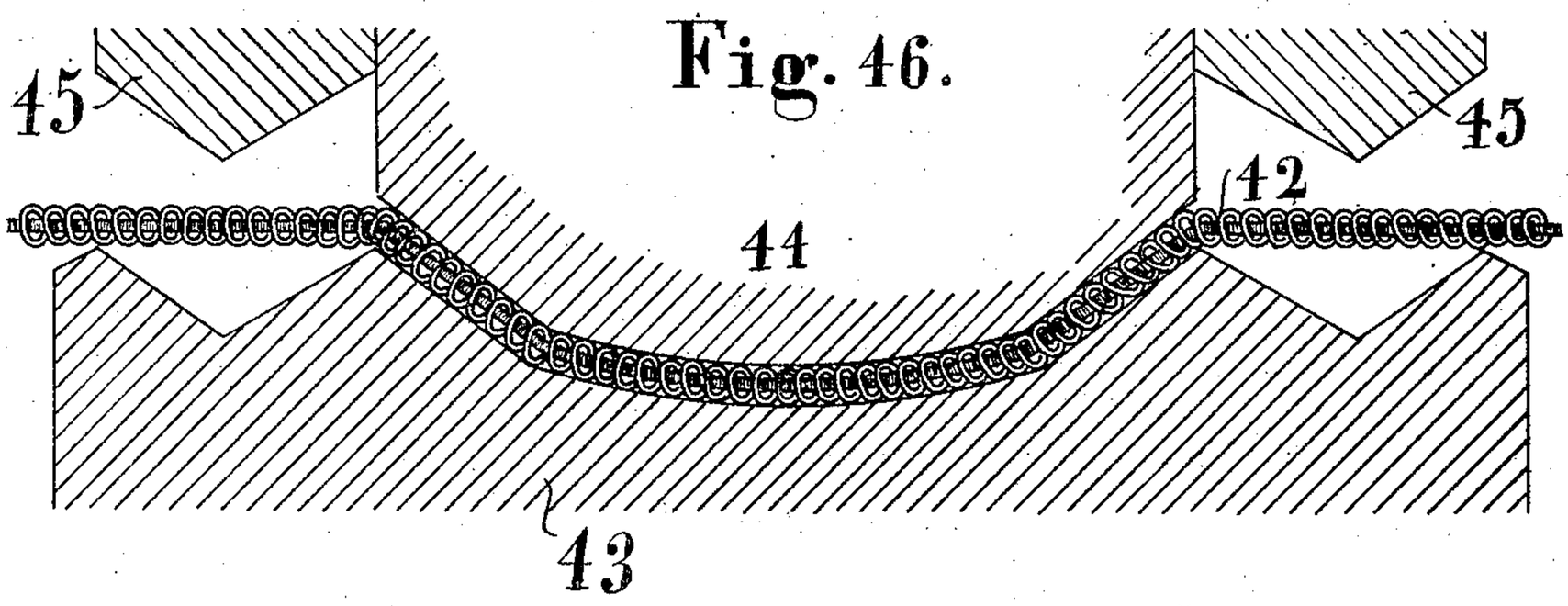


Fig. 47.

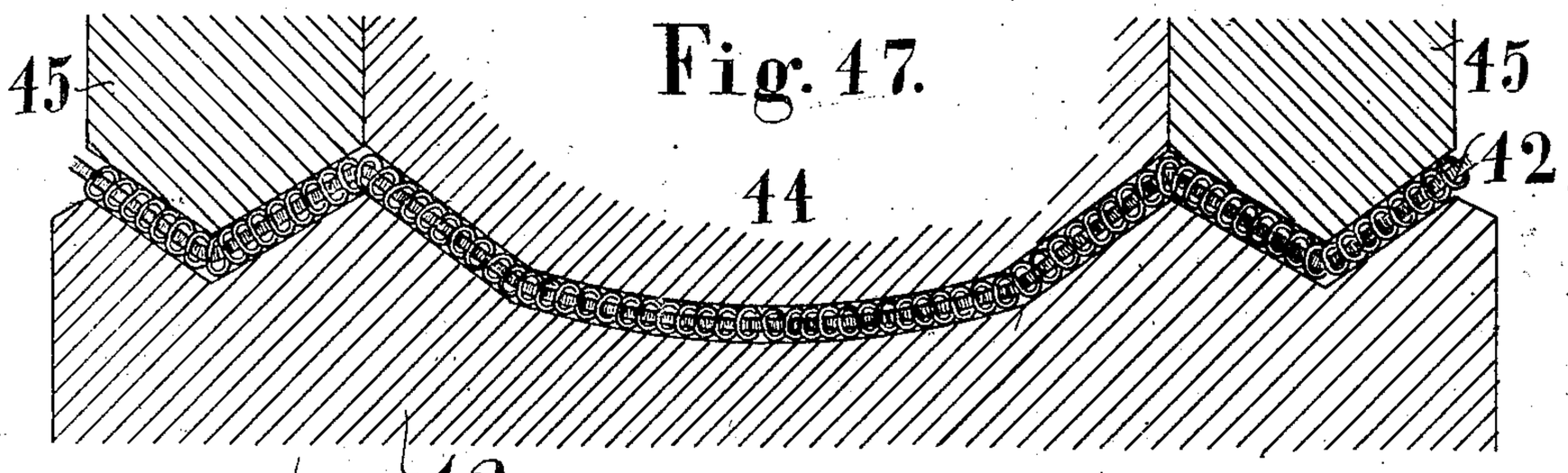
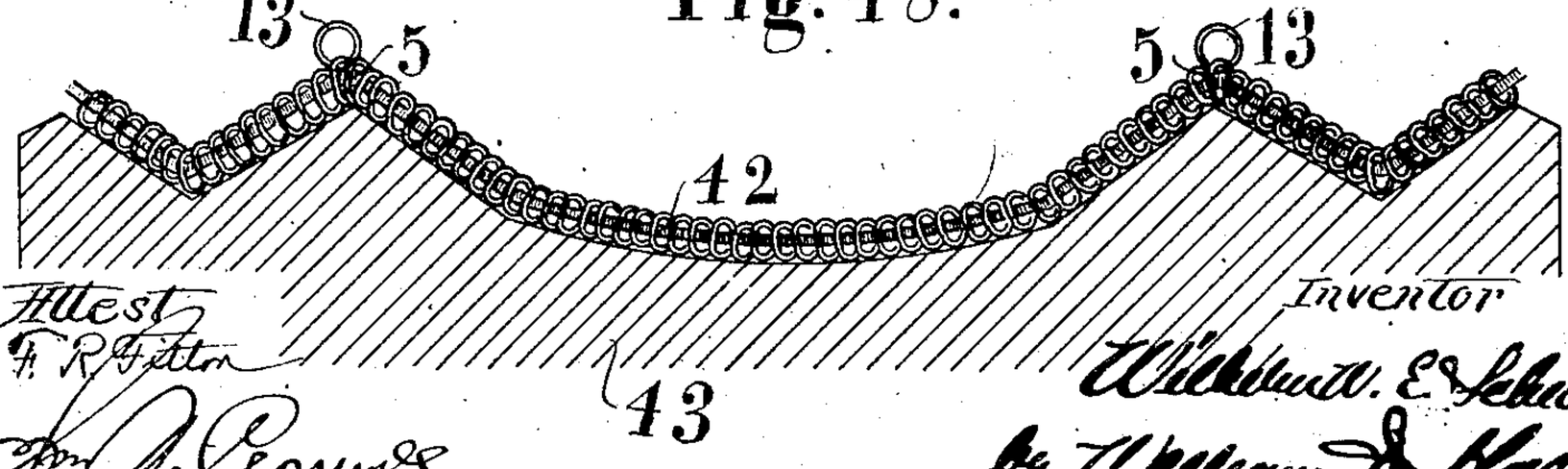


Fig. 48.



Witnesses:
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John A. Cowling

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No. 828,514. PATENTED AUG. 14, 1906.

W. W. E. SCHECK.

WIRE FABRIC TUBE FOR WHEEL TIRES.

APPLICATION FILED JAN. 24, 1905.

8 SHEETS—SHEET 8.

Fig. 49.

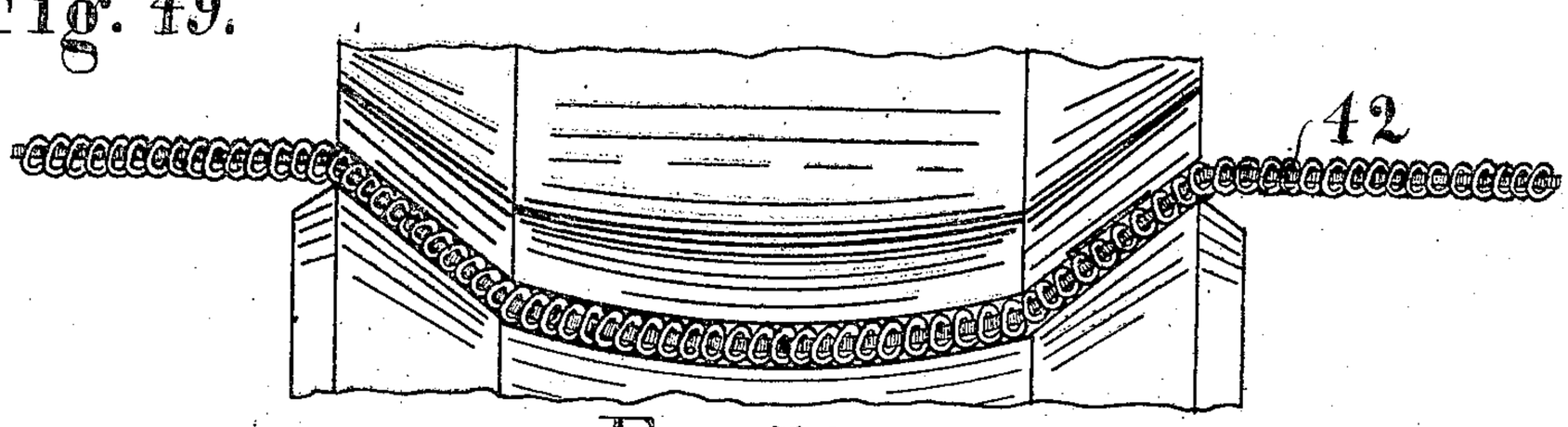


Fig. 50.

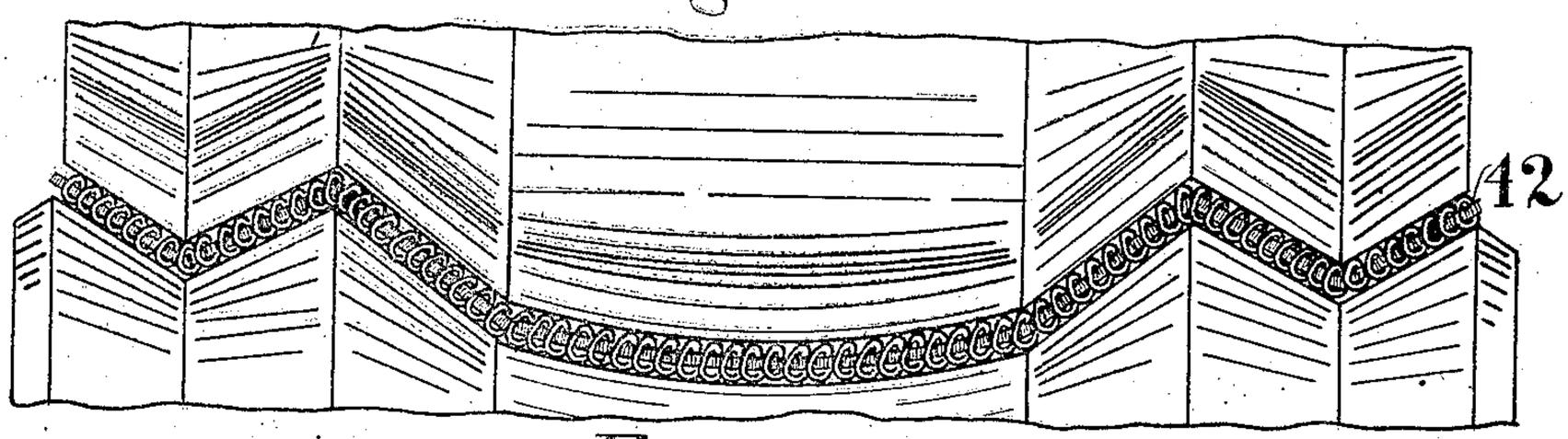


Fig. 51.

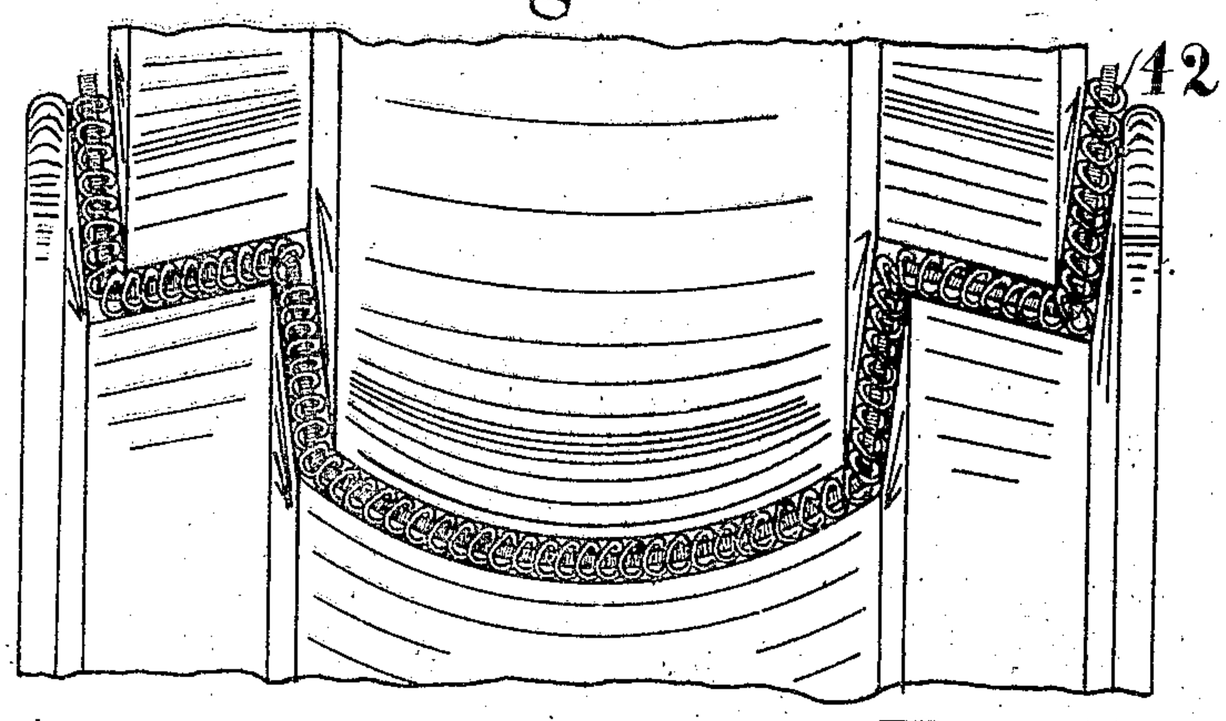
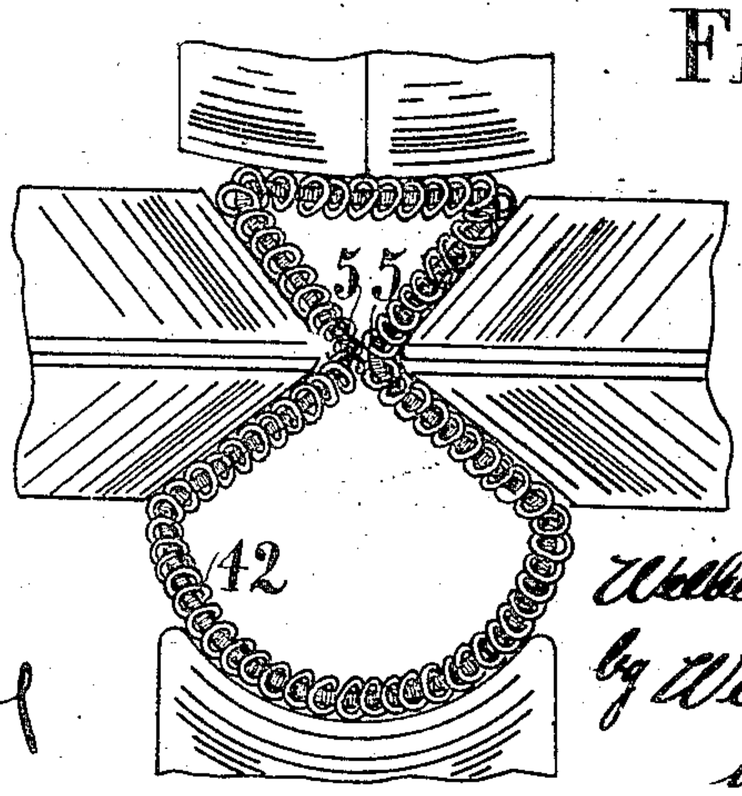


Fig. 52.



Witnesses:
F. R. Fitton
H. P. Connell

Inventor:
William W. E. Scheck
by Williamson Hall
his Atty.

UNITED STATES PATENT OFFICE.

WILHELM WHEATON EDUARD SCHECK, OF HELSA, NEAR CASSEL, GERMANY.

WIRE-FABRIC TUBE FOR WHEEL-TIRES.

No. 828,514. Specification of Letters Patent. Patented Aug. 14, 1906.

Application filed January 24, 1905. Serial No. 242,567.

To all whom it may concern:

Be it known that I, WILHELM WHEATON EDUARD SCHECK, a subject of the German Emperor, residing at Helsa, near Cassel, in the Kingdom of Prussia, Province of Hesse-Nassau, Germany, have invented certain new and useful Improvements in Wire-Fabric Tubes for Wheel-Tires, of which the following is a specification, reference being had therein to the accompanying drawings.

As is well known, the air-tubes within pneumatic tires, which are made of india-rubber or the like and contain compressed air, are expensive and subjected to a rapid wear and tear. Many attempts have been made to replace these air-tubes by other parts of greater resistance, such as leaf-springs or the like, but in vain, since these springs cannot be made sufficiently elastic in view of the required strength.

My invention relates to a new tube of peculiar cross-section which is made of wire fabric and is intended to replace the air-tube, after it has been properly bent to a ring whose ends are conveniently connected, and my invention also relates to the manufacture of such wire-fabric tubes in suitable lengths. This wire-fabric tube when bent and formed to an endless ring is to receive an outer jacket which may completely cover the tube and consist of india-rubber, or the jacket may be made along the tread portion and the adjoining portions of india-rubber and for the remainder of impregnated linen or cloth or the like. Such a wheel-tire for cycles, automobiles, autotrucks, &c., affords the advantages that it is not only sufficiently strong and elastic, but also the compressed air is unnecessary, so that all the trouble connected with the repeated inflation of the pneumatic tires is avoided.

I will now proceed to describe the new wire-fabric tube for wheel-tires and the manufacture of the same, reference being had to the accompanying drawings, in which—

Figure 1 is an end view of a wire-fabric tube, fully illustrating its cross-section. Fig. 1ª is a horizontal section through a part of the same. Fig. 2 is an end view of a similar wire-fabric tube reinforced by a convenient number of cross spiral springs in the upper part. Fig. 3 is an end view of a wire-fabric tube similar to that shown in Fig. 1, which in its upper part is reinforced by a second wire-fabric tube of circular cross-section. Figs. 4 to 29, inclusive, illustrate, on a magnified scale, various kinds of wire fabric suitable for the tube and the manner of producing the same. Fig. 30 is an elevation of a device for putting a spiral spring into rotation and will be referred to later on. Fig. 31 is a side view of the same, the table being shown in section. Fig. 32 illustrates the manner in which a wire-fabric tube of a circular cross-section can be produced by twisting a spiral spring of small diameter into the adjoining turns of a pair of interwoven flattened wire coils spirally wound around a core-rod. Fig. 33 illustrates the manner in which a wire-fabric tube of a circular cross-section can be produced by introducing a wire through the interjecting turns of a pair of interwoven flattened wire coils spirally wound around a core-rod. Fig. 34 illustrates the manner in which such a wire-fabric tube of circular cross-section can be turned into a tube of the peculiar cross-section shown at Fig. 1, Figs. 35 to 44, inclusive, illustrate the manner in which a strip of wire fabric for the tube can be formed and flattened and will be referred to later on. Figs. 45 to 48 illustrate the manner in which the strip of flattened wire fabric can be bent by pressing previous to the formation of the wire-fabric tube. Figs. 49 to 52 illustrate the manner in which the strip of flattened wire fabric can be formed to a tube by rolling.

Similar characters of reference refer to similar parts throughout the several views.

The wire-fabric tube according to my invention is given a cross-section essentially of the shape shown at Fig. 1. The upper portion 1, bent to a circle and extending to the corners 2 and 3, is destined for the tread portion of the tire. The two adjoining portions 4 4 are substantially plain and oppositely inclined, so as to meet each other at the corners 5 5. The two next following portions 6 6 are equally substantially plain and spread out downwardly and adjoin at the two corners 7 8 the bottom portion 9, which is substantially plain and is the rim portion. The rim of the wheel on which this tube is to be applied is made preferably of a dovetailed cross-section, so as to embrace the two bottom corners 7 and 8 of the tube. The wire-fabric tube may be formed by bending either from a strip or from a tube of circular cross-section in the manners to be hereinafter described. This

straight tube of the section shown at Fig. 1 is bent to a circle by means of any convenient known tool or machine-tool, and its two ends are united in any suitable manner. As this invention relates to the straight tubes only and to their manufacture, I need not describe more particularly the manner of uniting the two ends of the circularly-bent tube. The tread portion 1 and the two adjoining portions 4 4 of the so-finished wire-fabric tube are preferably covered with an outer jacket 10, of india-rubber, as indicated by the dotted line in Fig. 1. The edges of this outer jacket 10 may be made to rest on the two lower inclined portions 6 6. Where so preferred, the two edges of this jacket 10 may be reinforced by embedded spiral springs 11 11. The two lower portions 6 6, either alone or in combination with the rim portion 9, may be externally lined with a convenient impregnated linen, sail-cloth, or the like. As already stated above, the two edges of the dovetailed wheel-rim should be adapted to grip the corners 7 and 8 of the tubular tire in any known manner. Where so preferred, the whole circumference of the tube shown at Fig. 1 may be completely covered with india-rubber.

It will be seen that the tubular tire of wire fabric is several times bent—*i. e.*, at 2, 5, 7, 8, 5, and 3—whereby the elasticity of the tire is considerably increased. From an examination of Fig. 1 it will be evident that on the tire bending under a load its tread portion 1 will be flattened, so that the two corners 2 and 3 will move away from each other, while the rim portion 9 will remain unaltered, since it bears on the rim-face and is secured on the two corners 7 and 8. To prevent the two internal corners 5 5 from moving away or otherwise shifting beyond certain narrow limits, they are preferably connected. This may be effected by means of a spiral spring 12, twisted into the adjoining turns of the wire fabric on the two corners 5 5, as shown, or by means of two interjecting spiral springs 13 13, engaging in each other, (see Fig. 3,) or the two spiral springs 13 13 may be screwed separately into the turns of the wire fabric on the two corners 5 5, then pushed into each other, and connected by the insertion of a wire 14 or a narrow spiral spring in a manner which will be explained later on. The use of this wire 14 or narrow spiral spring presents the advantage that the movability of the two corners 5 5 is reduced. Where so preferred, of course, the rim portion 9 may equally be curved in a similar manner as the tread portion 1, in which case the wheel-rim will of course require to be shaped accordingly. The bent tread portion 1 will by reason of its elasticity resume its original shape on leaving the soil. In order to increase the elasticity of the tire, a convenient number of cross spiral springs 15 (see Fig. 2) may be disposed at suitable distances from each other for connecting the two corners 2 and 3. The so-reinforced tubular tire may be suitable for heavy vehicles, such as automobiles or the like, as it will have to withstand a greater strain. In case the rim portion 9 is curved in a similar manner as the tread portion of course similar cross spiral springs may be employed for connecting the two corners 7 and 8. In place of the cross spiral springs 15 also a wire-fabric tube 16 (see Fig. 3) may be employed for reinforcing the upper portion 1 4 4 and, if so preferred, also the lower portion 6 9 6. This internal tube 16 may be reinforced by cross spiral springs similar to 15 in Fig. 2.

The wire-fabric tube according to my invention essentially consists of interjecting flattened spiral springs, either in parallel rows, as shown at Fig. 1ª, or in a spiral.

I will now proceed to describe several kinds of wire fabric which are suitable for the tube. A plurality of spiral springs 17 17 (see Fig. 5) are wound separately in one and the same direction (right hand in Fig. 4) on a suitable core-rod 18′. When two such spiral springs 17 17 are put together laterally and parallel to each other, (see Fig. 6,) they will engage in each other and leave a longitudinal space 18, (see the end view below in Fig. 6,) in which either a wire or a narrow spiral spring 19 can be inserted. On again moving aside the two spiral springs 17 17 they will be stopped by the wire or narrow spiral spring 19, as is clearly shown at Fig. 7. After in a known manner the ends of the two spiral springs 17 17 have been inclined with the aid of a hammer the two springs 17 17, when covered with two plates on opposite sides, can be passed between a pair of rolls, whereby they are flattened so that their turns will assume the shape shown in elevation at Fig. 8, while their end views will be ovals, (similar to the lower part of Fig. 9 on the left.) Thus a well-known flattened pair of wire coils is formed. If, on the contrary, a single spiral spring 17 is alone flattened in the manner indicated, it will present in the elevation various loops or corners 20 21 22. (See Fig. 9.) Now if another spiral spring 17 in its unflattened state is twisted consecutively with the loops 20 20 on the right side, as is clearly shown in elevation and end view at Fig. 9, and afterward flattened in the same direction as the first spring 17 the two flattened springs 17 17 will look in elevation as in Fig. 18—*i. e.*, exactly the same as two spiral springs simultaneously formed on a common core-rod (see Fig. 16) and afterward flattened. This means that no gain of time or trouble would be made by this manner of producing flattened spiral springs 17 17. The matter becomes, however, different when the second spiral spring coiled in the same direction and pitch is given a smaller diameter, such as 23 in Fig. 10, which latter

clearly shows how distinct this fabric looks. In this case it would be impossible to form the two spiral springs on the same core-rod, so that the production of this pair of coils means no waste of time and labor. On the other hand, if a second spiral spring 17 of same diameter is consecutively twisted with the loops 22 22 on the left side of the first flattened spiral spring 17 (see Fig. 11) and afterward flattened in a direction opposite to that of the first spring the two flattened springs will present the appearance of Fig. 12, which is different from Fig. 18. If the second spiral spring, coiled in the same direction and pitch, were of a smaller diameter, such as 24 in Fig. 13, and screwed into the loops or corners 22 22 of the first spring 17, the appearance of the two springs would be again different and also distinct from Fig. 10. If, further, a second spiral spring 17 coiled in the same direction, pitch, and diameter is screwed into the other loops 21 21 on the right of the first flattened spring 17 (see Fig. 14) and afterward flattened in a direction opposite to that of the first spring 17, the two springs will look as Fig. 15 and present on both sides open spaces between their turns when looked at from either side. These open spaces may be so ample as to permit the insertion from the side of a flattened spiral spring 17, (such as in Fig. 9 on the left,) its right turns engaging in the said spaces, so that a wire or narrow spiral spring similar to 19 in Fig. 6 can be inserted between the turns of the third spring 17 and those of the left spring 17 in Fig. 15, so that these two springs are connected in a similar manner as shown at Fig. 8. It would not be possible to insert a fourth flattened spring 17 from the right in the spaces between the turns of the right coil in Fig. 15, since the turns of the two springs 17 17, flattened in opposite directions, would cross each other. It would be necessary to insert a flattened spiral spring coiled in the opposite direction—that is, a left-hand spiral spring—as will be clear on examining Fig. 15. If the right spring 17 had been flattened in the same direction as the left spring 17, of course it would be possible to insert a fourth flattened spring 17 coiled in the same direction from the right in the spaces between the turns of the right spring.

When two right-hand spiral springs 25 25 are simultaneously formed on a common core-rod 26 in Fig. 16 and withdrawn, they cannot be detached, as they engage each other, (see Fig. 17,) unless either of them is unscrewed from the other. When the two spiral springs 25 25 are moved to the sides and flattened in one direction, they will present the appearance in Fig. 18. If on withdrawing the two spiral springs from the core-rod 26 a wire or narrow spiral spring 27 has been introduced, Fig. 19, the two springs 25 25 on being moved aside will come in contact with the narrow coil 27, Fig. 20, so that on being flattened in the same direction as in Fig. 18 they will present the appearance in Fig. 21. It will be observed that two spiral springs coiled in the same direction will when flattened in one and the same direction look on both external sides differently, (see Figs. 8, 18, and 21, where, so to say, the right side seems to be closed;) but when flattened in opposite directions their external sides will look alike. (See Figs. 12 and 15.)

When on two core-rods 28 and 29, Figs. 22 and 23, two pairs of right-hand and left-hand spiral springs 30 30 and 31 31 have been formed and withdrawn, the two double coils can be inserted from the sides, so that their turns engage in the spaces of the other coil and leave a space 32 (see the end view in the lower part of Fig. 24) into which a wire or narrow spiral spring 33 can be inserted. On moving aside the two double coils they will be checked by the narrow spiral springs 33, Fig. 25, and on being simultaneously flattened in one direction they will present the appearance in Fig. 26. It matters much from what sides the two double coils are inserted in each other. In Fig. 24 the right-hand coil was on the left and the left-hand coil on the right. If, now, the right-hand coil is placed on the right and the left-hand coil on the left, as in Figs. 27 and 28, and both coils are flattened in the same direction, (whether in the one or in the other,) they will present the appearance in Fig. 29. On examining Figs. 26 and 29 it will be apparent that a spiral spring 34 of half the pitch of the springs 30 or 31 and of a small diameter will more readily engage in the loops of either coil 30 or 31 in Fig. 29 than in Fig. 26. It is also apparent that this spring 34 will connect two coils more readily if they are coiled in opposite directions, such as the coils 30 30 and 35 35 in Fig. 29, as in this case their adjoining turns will be substantially in the same parallel planes. Moreover, the two oppositely-threaded coils can be readily inserted in each other, the turns of the one coil engaging in the spaces of the other coil, so that a wire or narrow spiral spring can be introduced for connecting the two coils, as is clearly shown at Fig. 26.

The wire fabric used for the tube according to my invention may be varied in many respects, and I do not limit myself to any special kind of the wire fabric. In general the wire fabric consists of parallel interwoven flattened coils each comprising either one or two or three or more spiral springs, these parallel coils being disposed either at right angles to the longitudinal axis of the tube, or nearly so. The essential point for all kinds of wire fabric that may be used for the tire-tube is that the several parallel coils are at liberty to shift in the longitudinal direction of the tube within

the limits determined by their interjecting turns. This is necessary to enable the finished wire-fabric tubular tire to adapt itself to the soil periodically during the revolution of the wheel while being bent and flattened under the action of the load. As is well known, in the portion of a pneumatic tire in contact with the soil its tread portion 1 in Fig. 1 will be compressed in the middle and extended at both ends of the contact-line in the longitudinal direction, so that every section of the tread portion is alternately extended and compressed uninterruptedly during the run of the vehicle. Also the adjoining portions 4 4 and 6 6 of the tubular tire will have to undergo similar uninterrupted dislocations in both directions.

In order to better illustrate the manufacture of the wire-fabric tube and the manner in which the several kinds of wire fabric may be selected and varied, I will now first describe the manufacture of a plain strip of wire fabric and the process of turning this strip into a tube.

A convenient machine comprising the following parts and capable of performing the following operations is used, while its construction is immaterial. Preferably two wire-coiling devices for producing from thin wire (of .8 millimeter diameter, for instance) right and left hand spiral springs (of eight millimeters diameter, for instance) and a third wire coiling device for producing from very thin wire (of .4 millimeter diameter, for instance) spiral springs (of 1.3 millimeters diameter, for instance) the turns of which touch each other are disposed parallel to each other, also devices for cutting the three spiral springs into equal lengths corresponding to the circumference of the cross-section of the tube in Fig. 1. All these devices are so arranged that, first, a wide right-hand spiral spring 36, Figs. 35 and 36, in the course of its production is cut and allowed to roll down a chute to a place nearly in the center line of the narrow spiral spring 37 in course of formation. Then a wide left-hand spiral spring 38 in the course of its production is cut and allowed to roll down the chute (see Fig. 35) and to engage in the spaces of the right-hand spiral spring 36 (see Figs. 37 and 38) in a similar manner as the two double coils in Fig. 27. Thereupon the narrow spiral spring 37 during its production is permitted to proceed and engage in the longitudinal space of the two coils 36 and 38, Fig. 38, and on its end reaching the ends of the two coils it is cut. Next the left-hand coil 38 is in any known manner moved into the position of the right-hand coil 36 and therein secured, while the right-hand coil 36 is in any known manner (for example, with the aid of small weights hanging on threads led over guiding-rollers) moved aside, or, in other words, it is fed forward, until it is checked by the narrow coil 37 (see Figs. 39 and 40) and leaves room for a fresh coil. Afterward a second right-hand coil 36 is cut and allowed to roll down the chute and engage in the spaces of the left coil 38. Then a fresh narrow coil 37 is permitted to engage in the longitudinal space of these two coils until it is cut. Next the second right-hand coil 36 is moved into the position of the left-hand coil 38 and therein secured, while the first coils 36 37 38, forming the beginning of the fabric, are permitted to move on and leave room for a fresh coil. (See Figs. 41 and 42.) Thereupon a second left-hand coil 38 is cut and allowed to roll down the chute and engage in the spaces of the second right-hand coil 36, and next a fresh narrow coil 37 is permitted to engage in the longitudinal space of these two coils until it is cut. These operations are repeated in the described order until the fabric has attained a length approximately equal to that of the finished wheel tubular tire. The fabric so formed is placed between two plates 39 and 40, Fig. 43, of wood or any other suitable material, the only condition being that their surfaces in contact with the fabric should be sufficiently rough for gripping the turns of the fabric to prevent them from shifting. Then by means of a suitable pressing device the top plate 39 is forced downward and at the same time moved to a side, so as to flatten the fabric. (See Figs. 43 and 44.) The flattened fabric 42 so formed is placed on a bottom die 43, which may have the cross-section shown in Fig. 45. Then a central stamp 44, about of the cross-section shown, is forced downward to press the internal portion of the flattened fabric 42 into the bent shape shown at Fig. 46. Next two lateral stamps 45 and 45 are equally forced downward to press the external portions of the fabric 42 into the shape shown at Fig. 47. When assuming the internal corners 5 5 of the finished tube to be connected by means of two spiral springs 13 13 and a narrow spiral spring 14, as shown at Fig. 2, then two spiral springs 13 13 of a convenient small diameter, but of the same pitch as the wide coils 36 38, are put into rotation in a manner to be described hereinafter, so that they twist themselves with the loops in the corners 5 5 of the fabric 42, Fig. 48, their ends consecutively engaging in the several turns of the respective coils in the fabric. The so flattened and bent fabric 42 is then passed through conveniently-disposed rolls, of which the last ones may be arranged in a manner shown at Fig. 52, so as to gradually form the fabric to a tube of the section shown at Figs. 1 to 3. A narrow spiral spring 14 (see Fig. 2) is then inserted in the longitudinal space of the two interjecting coils 13 13, after which the tube is finished and ready for the manufacture of the circular tire-tube. Where so preferred, of course, rolls may be em-

ployed for gradually bending and forming the flattened wire fabric 42 to a tube in a manner which is so clearly illustrated in Figs. 49 to 52 as to require no further explanation. It need scarcely be remarked that only parts of the rolls are shown for the purpose of economizing in the space of the drawings. In all cases the butting joint of the tube formed from a strip of flattened wire fabric is placed in the center of the rim portion 9 in Fig. 1, so that it will have no influence whatever upon the elasticity of the finished tire-tube.

For the sake of clearness I have shown in Figs. 35 to 44 single coils 36 and 38; but it is evident that these coils may also be double (see Figs. 22 and 23) or treble or multiple, while the manufacture of the fabric remains substantially the same.

For reasons stated above the wire fabric 42 is preferably formed of alternating right and left hand coils, since they are all flattened in one and the same direction. However, I reserve to myself the right to alter the order in which the wide coils are interjected.

Some of the coils in the wire fabric—such as 12 in Figs. 1 and 1ª; 13 13 in Figs. 2, 3, 48; 17 in Figs. 9, 11, and 14; 24 in Fig. 13; 23 in Fig. 10, and 34 in Fig. 29—require to be put into rotation to enable them to twist themselves with the loops of the respective coils. This may be effected with the aid of a device shown at Figs. 30 and 31. A disk 46 is fastened on the end of a shaft 47, which is mounted to turn in a convenient support 48 and driven in either direction in any known manner. Beneath the disk 46 another disk 49 is mounted to turn in a swiveling support 50, the vertical pivot 51 of which is longitudinally movable and turnable and carries an adjustable lever 52, similar in construction to steering-levers in steam-engines. On the two branches of the support 50 two adjustable coil-guides 53 53 are disposed, which may be replaced by other ones for guiding a coil 54 of any diameter. The two guides 53 53 are to prevent the coil 54 from shifting to the side, while it by reason of its contact with the two disks 46 and 49 is put into rotation. According to the pitch of the coil 54 the lower disk 49, with its support 50, is adjusted in such a position by means of the lever 52 and a notched bow 55 that the turns of the coil 54 on the upper and lower sides are in the planes of the two disks 46 and 49, respectively. The two guides 53 53, on the contrary, are so adjusted that they are in the longitudinal axis of the coil 54. By means of a treadle, (not shown,) the draw-bar 56, and a two-armed lever 57 a roller 58 can be pressed from below against the lower end of the pivot 51, so as to raise the support 50 with the disk 49 and to bring the coil 54 into contact with the constantly-running disk 46. Then the coil 54 will not only be put into rotation, but also be fed forward in its longitudinal direction. Of course any other known device may be employed for the same purpose.

The described device is suitable for coils of not too great a length. For longer coils it will be necessary to employ a suitable machine—for example, of that kind used in the manufacture of wire ropes. The coil may in this case be wound on a drum, which is mounted to turn in a turnable frame at right angles to the axis of the latter, and a convenient gearing is arranged for driving both the drum and the turnable frame at the correct rates of speed.

In case the two internal corners 5 5 of the wire-fabric tube of Fig. 1 are to be connected by a single spiral spring 12 of course the flattened and bent wire fabric 42 (shown in Fig. 48) is left without the two interjecting coils 13 13 and at once formed to a tube in the manner shown at Fig. 52, after which a spiral spring 12 of the same pitch as the distance between two neighboring turns in the wire fabric is introduced and put into rotation with the aid of the device in Figs. 30 and 31 or otherwise, so that its end consecutively engages in the several loops until it arrives at the end of the tube.

There are known spiral-wire corset steels and busks comprising two parallel interwoven flattened wire coils. Some of these steels and busks have the appearance of Fig. 26 and Fig. 29 on the left, another of them is shown at Fig. 18, and others of them have the appearance of Fig. 29 after the left coil 31 31 and the connecting spiral spring 33 have been withdrawn or a similar shape. There are so many various kinds of such pairs of interwoven coils that it is impossible to describe all of them. Suffice it to say that they are manufactured by special machinery. I also reserve to myself the right of manufacturing the strips of wire fabric in the manner that such pairs of interwoven and flattened coils are fed one after the other down a chute of a machine and connected with the finished part of the fabric by means of coils of a smaller diameter, which are put into rotation, so that they twist themselves with the loops of the adjoining turns in a manner clearly shown at Fig. 29, where the connecting-wire is denoted by 34. The wire-fabric tube of the section shown at Fig. 1 may also be formed from a tube of circular cross-section. The latter tube may be manufactured in either of the two following manners:

A pair of interwoven and flattened wire coils 59 in Fig. 32 of either of the kinds mentioned above is fastened with its one end in any known manner on a core-rod 60 and wound thereon in a spiral line, so that the adjoining turns of this coil touch each other, as is shown at Fig. 29. It is here to be remarked that in Fig. 32 and also in Fig. 33 only a few spirals of the pair of interwoven

wire coils are shown, while in reality the spiral is continued until the core-rod 60 is completely covered on a length corresponding to the circumference of the finished wheel-tire tube. Then a spiral spring 61 of a small diameter is introduced into the loops of the two first spiral turns on the rod 60 in the manner shown at Fig. 32 and put into rotation either with the aid of the device shown at Figs. 30 and 31 or by means of some suitable machine, when this spiral spring 61 will twist itself consecutively with the loops of the spirally-wound pair of wire coils until its end arrives at the other end of the spiral on the rod 60, when the tube will be finished or a pair of interwoven and flattened wire coils 63 in Fig. 33 is so wound in a spiral around the core-rod 60 that the turns of the coils in the pair engage in the spaces of the adjoining turn on the core-rod 60 and a spiral space is formed between these interjecting turns. Then an elastic wire 62, Fig. 33, is introduced into the external row of loops at the beginning of the spiral 63 in the manner shown and fed forward in any known manner, when the end of the wire 62 will proceed in the said spiral space, and thus connect the turns of the spiral 63. On the end of this wire 62 arriving at the end of the spiral 63 the tube will be finished. Instead of the wire 62 also a narrow spiral spring or a narrow pair of interwoven wire coils may be used.

It is easy to change the tube of circular cross-section so formed into a tube of the section shown at Fig. 1 by means of a suitably-shaped mold 64 and four rolls 65, 66, 67, and 66 (on the rear) in Fig. 34, which requires no further explanation only that the wire fabric is moved longitudinally on the mold 64 by the rolls.

It will be obvious that in selecting either of the kinds of flattened wire coils illustrated in Figs. 8, 10, 12, 13, 15, 18, 21, 26, and 29 or other kinds for the wire fabric the elasticity and the strength of the desired tire-tube and other circumstances should be taken into consideration. In case the tube is to be formed from a strip of flattened wire fabric in a manner illustrated in Figs. 35 to 44 it will be in general necessary that all the coils of the fabric should be flattened in one and the same direction. In accordance with this circumstance it will be best to employ alternating right and left hand coils and to select the kinds of the coils accordingly. In case the strip of wire fabric is to be formed of parallel pairs of interwoven flattened wire coils and connected by coils of a small diameter (such as 34 in Fig. 29) it is of course immaterial whether all of the pairs of coils are flattened in the same direction or alternately in opposite directions. It then depends upon these circumstances what kinds of pairs of interwoven coils are to be selected, and it should be borne in mind that the turns to be twisted with connecting spiral springs (34 in Fig. 29) should be in the same parallel planes, also the direction of these connecting spiral springs will have to depend upon the kind of fabric to be produced. On examining Figs. 26 and 29 it will be evident that the connecting narrow spiral springs do not prevent the two coils from moving inwardly, so that the total width of this system is reduced. This is desirable for the tube according to my invention, as thereby the latter is enabled to adapt itself to the soil periodically during the run of the vehicle, as explained above. It will also be clear to any one versed in the art to which this invention appertains how he should select the kinds of the coils for the wire fabric.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. As a new article of manufacture, a wire-fabric tube having in cross-section an approximately semicircular tread portion, two converging straight portions forming continuations of the ends of the tread portion, two diverging straight portions forming continuations of the ends of the converging portions, and a straight rim portion, substantially as described.

2. As a new article of manufacture, a wire-fabric tube to be used in tires, comprising a substantially semicircular tread portion, two converging straight portions forming continuations of the ends of the tread portion, two diverging straight portions forming continuations of the ends of the converging portions, means for connecting the sides of the tube to each other at the junction of the converging portions with the diverging portions and a straight rim portion, substantially as described.

3. As a new article of manufacture, a wire-fabric tube to be used in tires, comprising a substantially semicircular tread portion, two converging straight portions forming continuations of the ends of the tread portion, two diverging straight portions forming continuations of the ends of the converging portions, means for connecting the opposite sides of the tube to each other at the junction of the converging portions with the diverging portions and a straight rim portion, substantially as described.

4. As a new article of manufacture, a wire-fabric tube designed to be used for a tire, comprising a tread portion, two converging straight portions forming continuations of the ends of the tread portion, two diverging straight portions forming continuations of the converging portions, and means interlocking with the opposite sides of the fabric at the point of juncture of the converging portions, with the diverging portions, substantially as described.

5. As a new article of manufacture, a wire-fabric tube to be used in tires, comprising a

substantially semicircular tread portion, two converging straight portions forming continuations of the ends of the tread portion, two diverging straight portions forming continuations of the ends of the converging portions, means including a coil for connecting the opposite sides of the tube to each other at the junction of the converging portions with the diverging portions and a straight rim portion, substantially as described.

6. As a new article of manufacture, a wire-fabric tube to be used in tires, comprising a substantially semicircular tread portion, two converging straight portions forming continuations of the ends of the tread portion, two diverging straight portions forming continuations of the ends of the converging portions, two coils interengaged with each other and the fabric of the opposite sides of the tube for connecting the said sides to each other at the junction of the converging portions with the diverging portions and a straight rim portion, substantially as described.

7. A wire-fabric tube to be used in a wheel-tire having in dross-section an approximately semicircular tread portion, two converging straight portions adjoining the ends of the tread portion, means for joining the adjacent end of the latter, diverging portions forming continuations of said adjacent ends and a straight rim portion, substantially as described.

8. A wire fabric to be used in a wheel-tire having in cross-section an approximately semicircular tread portion, two converging straight portions adjoining the ends of the tread portion, two diverging straight portions adjoining the adjacent ends of the converging portions and a straight rim portion adjoining the ends of the diverging portions, the adjacent ridges of the tube being connected by interwoven spiral springs and the tread portion of the tube being reinforced by a plurality of cross-spiral springs.

9. As a new article of manufacture, a wire-fabric tube designed to be used for a tire, comprising a tread portion, two converging straight portions forming continuations of the ends of the tread portion, two diverging straight portions forming continuations of the converging portions, means for connecting the sides of the tube to each other at the junction of the converging portions with the diverging portions, and yielding bracing means arranged in the space of the tube formed by the tread portion and the converging portions, substantially as described.

10. As a new article of manufacture, a wire-fabric tube designed to be used for a tire, comprising a tread portion, two converging straight portions forming continuations of the ends of the tread portion, two diverging straight portions forming continuations of the converging portions, means for connecting the sides of the tube to each other at the junction of the converging portions with the diverging portions, and reinforcing-springs located in the space of the tube formed by the tread portion and the converging portions, substantially as described.

11. As a new article of manufacture, a wire-fabric tube designed to be used for a tire, comprising a tread portion, two converging straight portions forming continuations of the ends of the tread portion, two diverging straight portions forming continuations of the converging portions, means for connecting the sides of the tube to each other at the junction of the converging portions with the diverging portions, and transversely-arranged springs connected at their ends to the sides of the tire, substantially at the ends of the tread portion, substantially as described.

In testimony whereof I have affixed my signature in presence of two witnesses.

WILHELM WHEATON EDUARD SCHECK.

Witnesses:
OTTO KURFFNER.
HENRY MARKS.