(No Model.) 2 Sheets--Sheet 1.

E. W. YOUNG.

MANUFACTURE OF PNEUMATIC TIRES.

No. 591,907. Patented Oct. 19, 1897.

Fig. 1.

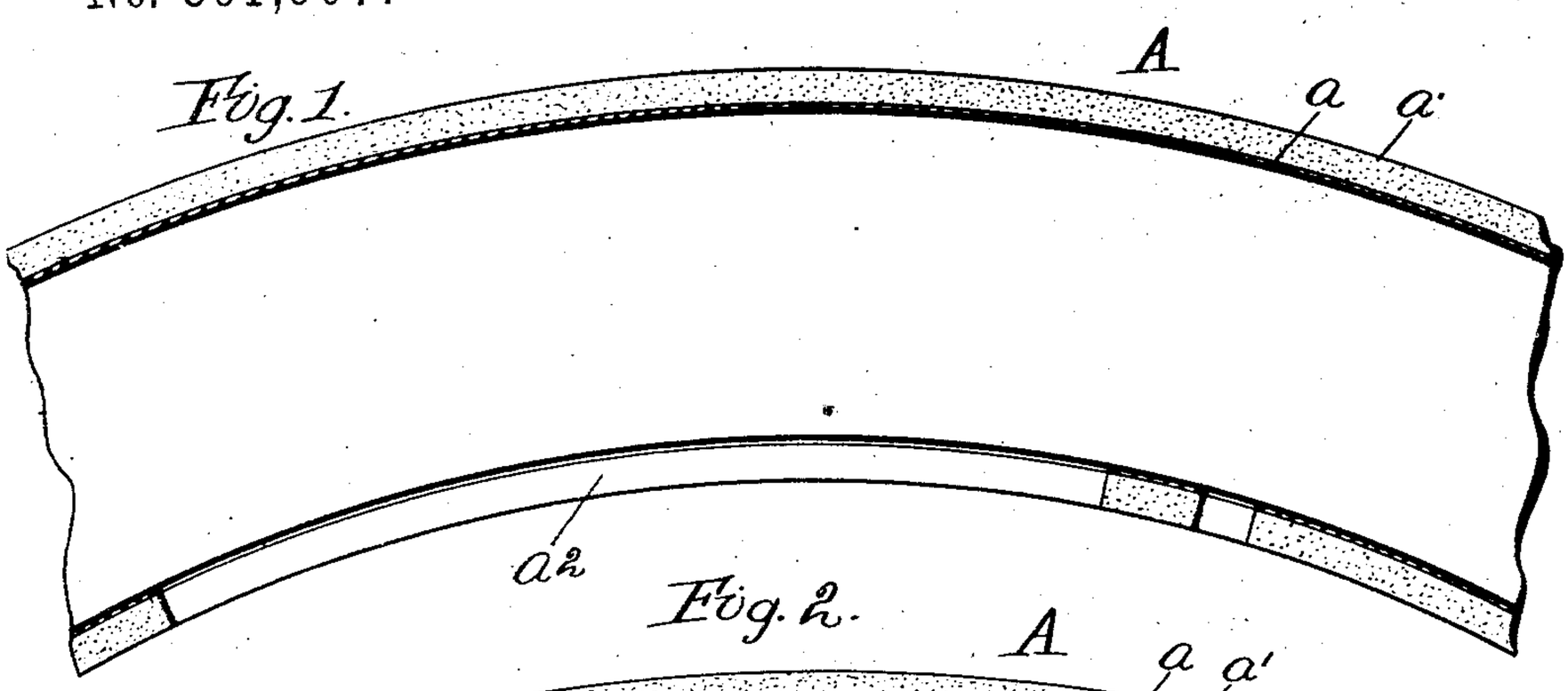

Fig. 2.

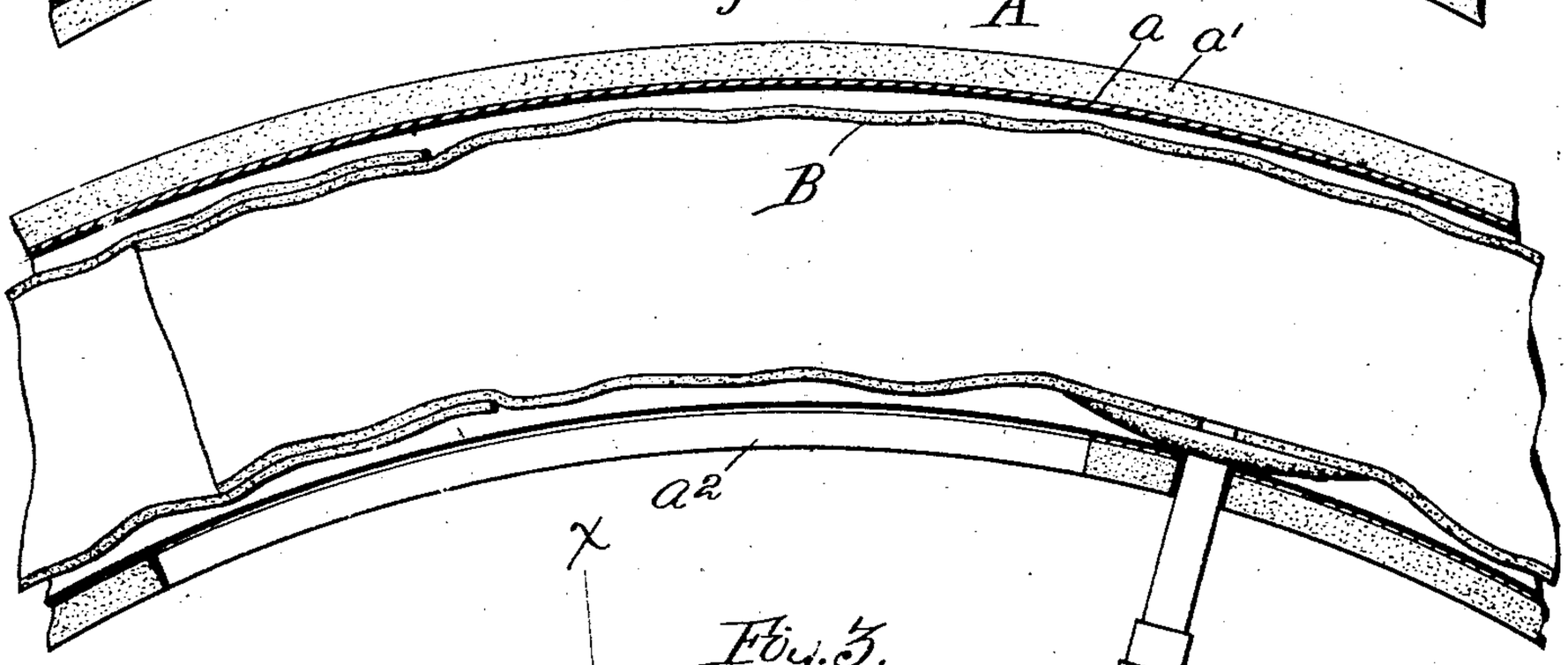

Fig. 3.

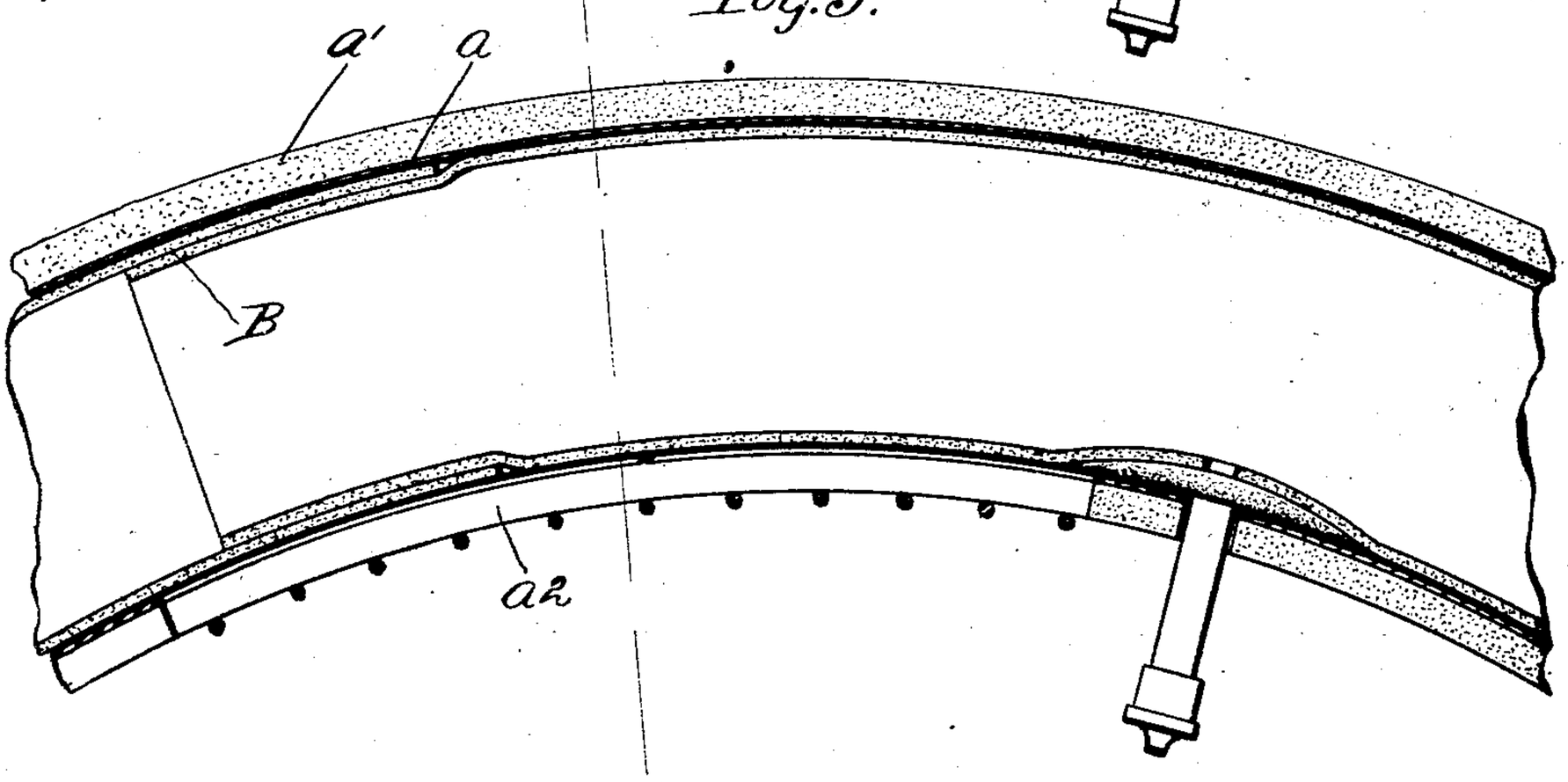

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Fig. 1.

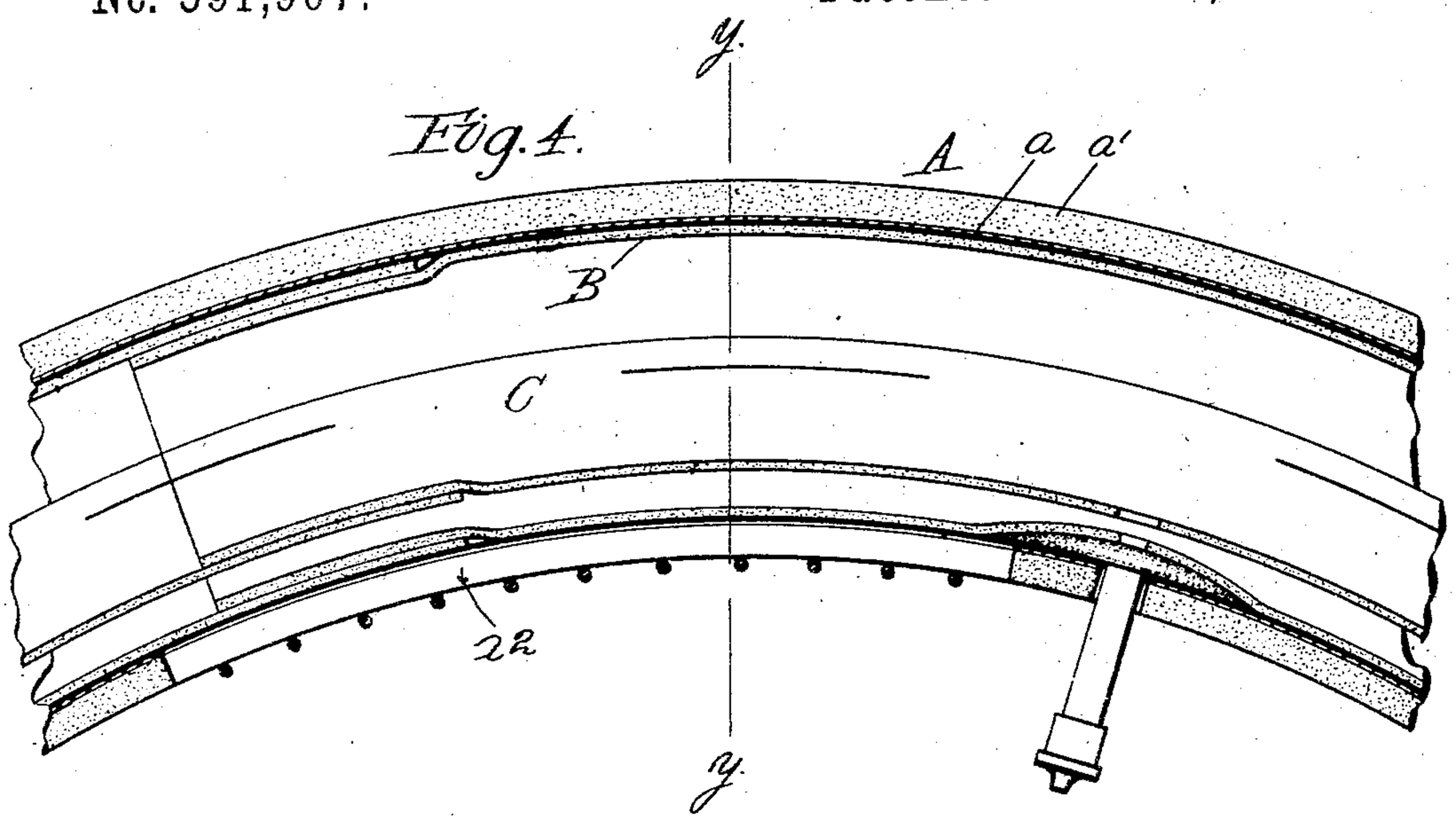


Fig. 5.

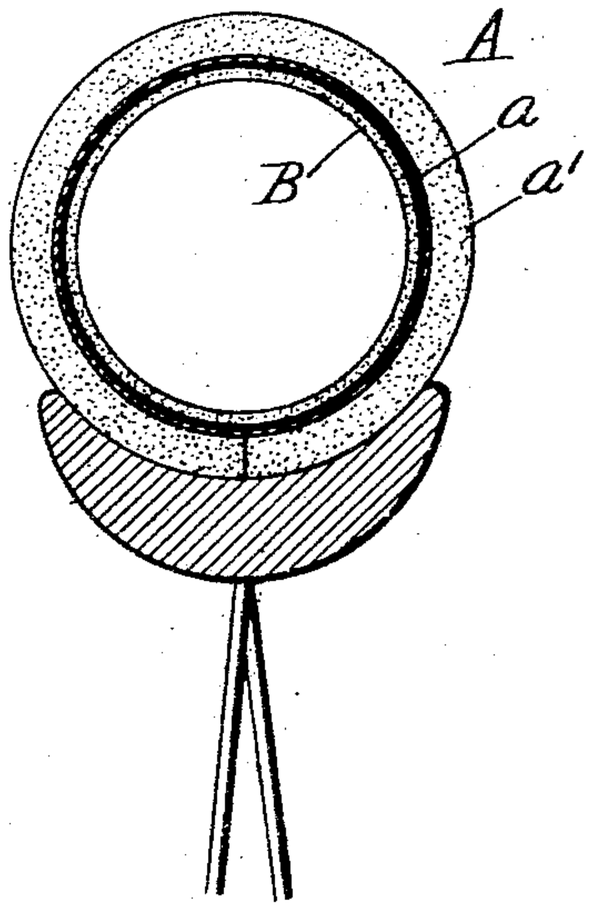
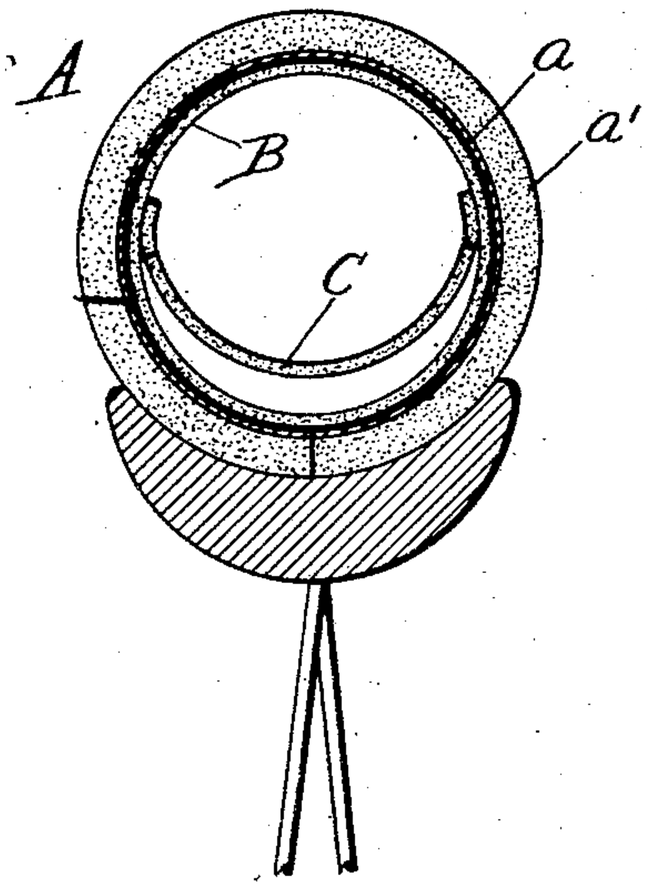


Fig. 6.



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UNITED STATES PATENT OFFICE.

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MANUFACTURE OF PNEUMATIC TIRES.

SPECIFICATION forming part of Letters Patent No. 591,907, dated October 19, 1897.

Application filed June 28, 1897. Serial No. 642,689. (No model.)

To all whom it may concern:

Be it known that I, ERNEST W. YOUNG, a citizen of the United States, residing at Austin, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in the Manufacture of Pneumatic Tires, of which the following is a specification.

My invention relates to the manufacture of a construction of pneumatic tire involving an annular tubular casing and a relatively thin inner tube cemented to the inner surface of the casing.

Letters Patent of the United States No. 566,113, granted to me August 18, 1896, and issued to Morgan & Wright, as assignee, describe separately vulcanizing the inner tube and the casing; introducing the inner tube within the casing; introducing liquid cement between the inner surface of the casing and the outer surface of the inner tube, and then inflating the inner tube so as to press its outer surface against the inner surface of the casing and thereby cause such opposing cemented surfaces to unite. In manufacturing such pneumatic tires, it has been found difficult to evenly spread the cement and provide a suitably thin layer of cement of uniform thickness between the inner tube and casing, and frequently a wrinkle or gather or the like in the inner tube will form a pocket in which an undue quantity of cement will collect and remain. It is also found that where the cement is thus introduced between the tube and casing the flow of surplus cement to the opening in the casing, preparatory to inflating the inner tube, is retarded, sometimes to an extent to leave an objectionable quantity of cement in the tire. As a result of these objectionable features, an undesirable percentage of imperfect tires has been incurred and corresponding loss involved.

The object of my invention is to overcome all of such objectionable features; to produce more perfect tires; and also to produce them more rapidly and economically. To the attainment of these and other useful ends, I separately form and vulcanize the casing and the inner tube; then coat the surface of the casing with suitable liquid cement, and then permit the latter to dry. I then introduce the air-tube within the casing, and subject the coating of cement which is on the inner surface of the casing to the action of a solvent to an extent to soften up and again render the cement suitably sticky, after which I inflate the inner tube so as to cause its outer surface to properly adhere to the inner surface of the casing.

In the accompanying drawings, Figure 1 is a section taken longitudinally through a portion of the casing having its inner surface coated with cement. Fig. 2 is a like view, illustrating the inner tube within the casing, the ends of the inner tube being telescoped and the said tube being uninflated. Fig. 3 is a like view showing the inner tube inflated and cemented to the casing. Fig. 4 is a like view showing the tube provided with internally-arranged patching fabric. Fig. 5 is a section on line $x\,x$ in Fig. 3. Fig. 6 is a section on line $y\,y$ in Fig. 4.

The endless, tubular tire-casing A can be made and vulcanized in accordance with any known or suitable method, and can be composed of any material or materials suitable for pneumatic-tire casings, it being preferable, however, to construct it with one or more inner layers of fabric, as at a, and an outer layer a' of rubber or rubber compound.

The inner tube B, which is of suitable impervious material, is preferably made of rubber, and in such case is vulcanized separate from the casing.

A suitable slit or opening, as at a^2, is made in the casing, and before introducing the inner tube a suitable quantity of liquid cement, such as the rubber cement employed by rubber manufacturers for cementing rubber articles, is introduced into the casing through the opening in the latter, and caused to spread over the entire inner surface of the casing. This liquid cement can be introduced by a suitable injector, but as a simple, rapid, and convenient way a quantity of the liquid cement—for example, about a pint—can be simply poured into the casing, and by then circumferentially turning the casing while in a vertical plane and during such operation manually kneading or exerting a rubbing and pressing action upon a portion of the casing supported by a bed or table, the liquid

cement which has been introduced within through the opening in the casing will be caused to rapidly work along the entire length of annular bore or passage in the casing, and, while thus passing along such bore or passage, the cement will be distributed over the wall thereof. After this most of the surplus cement can at once be emptied from the casing through the opening in the latter and by then hanging up the casing for a short time all further surplus cement will find its way to the said opening, through which it can be readily discharged. As a further step, the cement in the casing is permitted to dry, or harden to an extent to lose the stickiness, which would interfere with the drawing of an inner tube within the casing. For example, a casing thus treated with cement, and left over night, will be in condition to permit an inner tube to be drawn in without sticking, and without rubbing off or injuring the thin coating of cement on the inner surface of the casing. As a further step, the inner tube is drawn into the casing, and the cement on the inner surface of the casing is then subjected to the action of a solvent—such as gasolene, benzene, or the like—to an extent to again render it sticky, after which the inner tube can be inflated, so as to cause its outer surface to adhere to the inner cemented surface of the casing and thereby provide the latter with a smooth, tubular lining.

Preferably, the ends of the inner tube are closed or telescoped preparatory to introducing the solvent between the tube and casing, in which way the tube can be completed and tested by a temporary inflation while the cement is dry, for the purpose of ascertaining the integrity of the joint at or between its ends. The ends of the tube could be separately closed and lapped within the casing, but I prefer to telescope such ends, whereby a continuous tube is provided, and in such case it is desirable to temporarily inflate the inner tube, so as to test the joint formed by telescoping the ends of the tube before the cement has been softened by a solvent. The solvent, for example, in quantity about equal to the quantity of cement previously introduced, as hereinbefore stated, can be easily introduced through the slit or opening in the casing, and by then suitably manipulating the casing—for example, in the way hereinbefore mentioned in connection with the cement—the solvent can be caused to pass over the entire layer of cement, after which all surplus solvent can be readily emptied out of the casing through the opening in the latter.

The short slit or opening in the casing which has been made for the introduction of the air-tube, and other matters hereinbefore referred to, can be finally closed in any desired way—for example, by lacing or lacing and cementation, or by any suitable mechanical means, and it can also be concealed by any suitable strip or layer cemented upon the casing.

The inner tube can, if desired, be provided with any known or suitable arrangement of patching fabric involving one or more layers. For example, it can be provided with a web or layer C, attached to the inner side of the inner tube and arranged whereby it can be picked up and cemented to the side of the inner tube nearest the tread of the tire, for the purpose of closing punctures.

The tire thus made can also be opened at any point for purposes of repair without destroying the inner tube. For example, after cutting through the casing at the base of the tire, the portion of the inner tube adjacent to the opening thus made can be pulled away from the inner surface of the casing, and where the tire has been in use for a long time, the application of a solvent, such as gasolene or the like, will facilitate such separation of the inner tube from the inner wall of the casing. After a repair has been thus made, the portion of the inner tube which has been separated from the casing can be again cemented to the latter, and the slit in the casing can be laced up or otherwise suitably closed.

With reference to the feature of economy, it may be noted that in manufacturing these tires one operator can work continuously on coating the inner wall of the casing with cement; another can work continuously on introducing tubes; another on telescoping the ends of the tubes; another on introducing the solvent; and another on closing up the casings, in which way a large number of tires can be produced with great rapidity and economy, as will be readily understood by those acquainted with the various problems involved in the manufacturing industries.

It will also be noted that after telescoping the ends of the inner tube, the latter can be temporarily inflated to test the integrity of the joint before introducing the solvent.

Broadly considered, I can in place of coating the inner side of the casing with cement, as hereinbefore described, coat the outer surface of the inner tube with cement and permit such coating of cement to dry, preparatory to introducing the inner tube within the casing, or in place of thus coating with cement one of the two surfaces which will be opposed the one to the other and which are formed by the outer surface of the inner tube and the inner surface of the casing, I can separately coat both of such surfaces with cement and after the cement is dry, introduce the inner tube within the casing and then introduce the solvent. I prefer, however, as a matter of further improvement to coat the inner side of the casing only with cement, as hereinbefore first described.

What I claim as my invention is—

1. The process of manufacturing pneumatic tires consisting in separately forming and vulcanizing an annular tubular pneumatic-tire casing and an inner air-tube therefor; coating with cement one or both of the two areas of surface which will be opposed the

one to the other, and respectively formed by the inner tube and inner surface of the casing when the inner tube is in place within the latter; drying such cement preparatory to placing the inner tube within the casing; drawing the inner tube within the casing; subjecting the surface thus coated with cement to the action of a solvent to again render it adhesive; and inflating the inner tube to effect a cemented union between the inner tube and casing, substantially as set forth.

2. The process of manufacturing pneumatic tires, consisting essentially in separately forming and vulcanizing an annular, tubular pneumatic-tire casing and an inner air-tube therefor; coating the inner surface of the casing with cement and drying the latter preparatory to the introduction of the inner air-tube; introducing the inner air-tube within the casing thus prepared; subjecting the cement upon the inner surface of the casing containing the inner air-tube to the action of a solvent so as to again render it adhesive; and inflating the inner air-tube so as to bring together the outer surface of the inner air-tube and the inner cement-coated surface of the casing while the cement is in an adhesive condition and cause such opposing surfaces of the casing and the inner air-tube to unite, substantially as described.

3. The process of manufacturing pneumatic tires, consisting essentially in coating with cement the inner lining of fabric of an endless, tubular pneumatic-tire casing composed of layers of fabric and rubber; drying such cement preparatory to introducing an inner air-tube; introducing an inner air-tube within the casing thus prepared; telescoping the ends of the air-tube; passing between the air-tube and inner cement-coated wall of the casing a solvent acting to again render the cement on such inner wall adhesive; and inflating the air-tube while such cement is adhesive so as to unite the outer surface of the air-tube with the inner surface of the casing, substantially as set forth.

ERNEST W. YOUNG.

Witnesses:
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ARTHUR F. DURAND.