No. 836,569. PATENTED NOV. 20, 1906.

A. DOW.

PNEUMATIC TIRE.

APPLICATION FILED APR. 16, 1906.

3 SHEETS—SHEET 1.

Fig. 1.

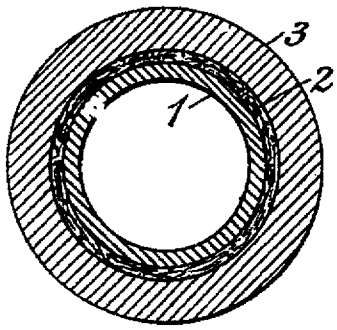


Fig. 2.

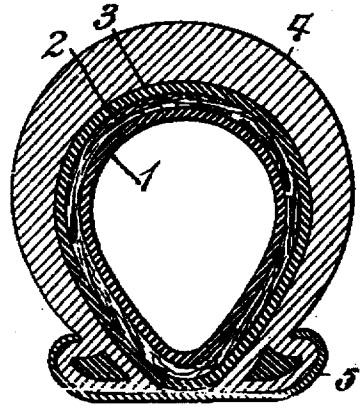


Fig. 3.

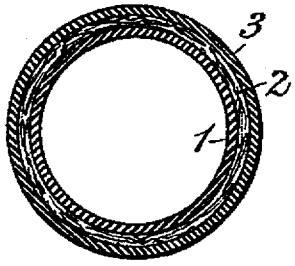


Fig. 4.

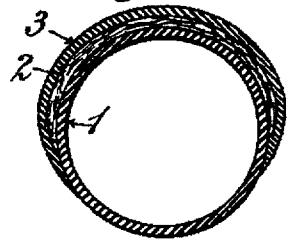


Fig. 5.

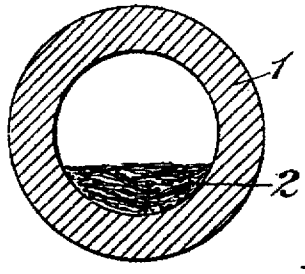


Fig. 7.

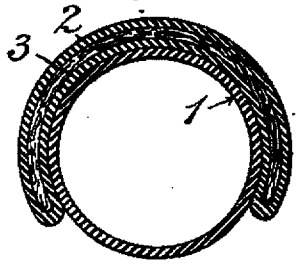
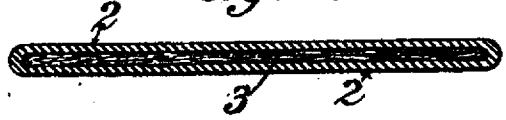


Fig. 6.



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By his Attorneys
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No. 836,569. PATENTED NOV. 20, 1906.

A. DOW.

PNEUMATIC TIRE.

APPLICATION FILED APR. 18, 1906.

3 SHEETS—SHEET 2.

Fig. 9.

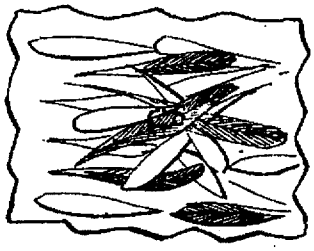


Fig. 8.

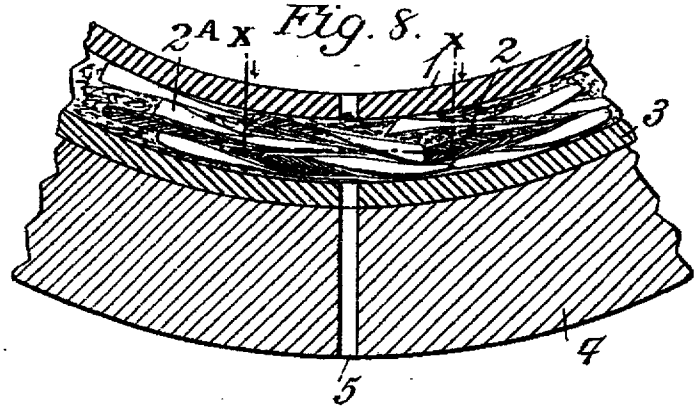
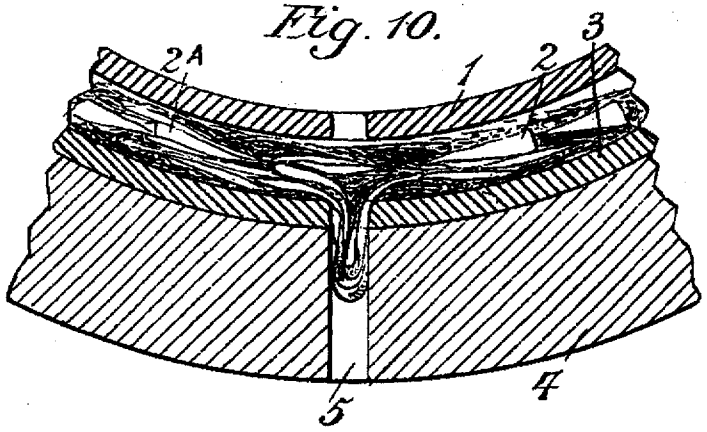


Fig. 10.



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No. 836,569. PATENTED NOV. 20, 1906.

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PNEUMATIC TIRE.

APPLICATION FILED APR. 18, 1906.

3 SHEETS—SHEET 3.

Fig. 11.

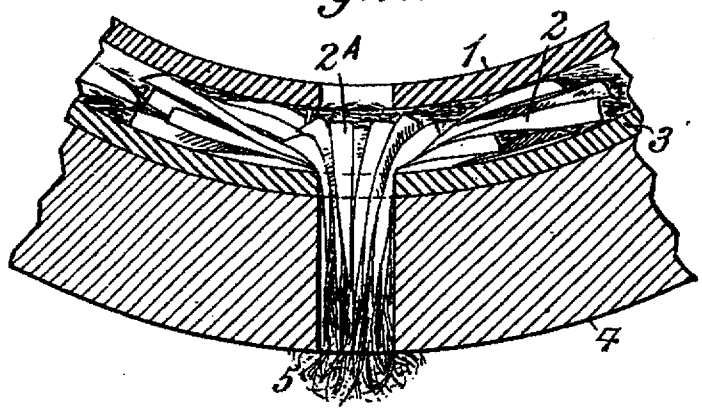


Fig. 12.

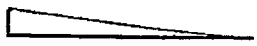


Fig. 13.

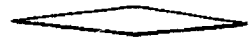
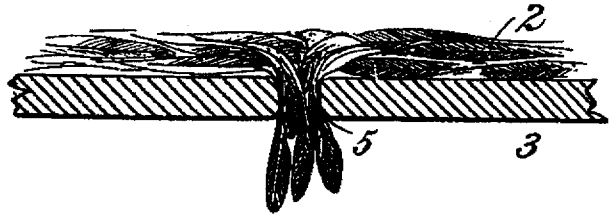


Fig. 14.

Fig. 15.

Fig. 16.



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UNITED STATES PATENT OFFICE.

ALEXANDER DOW, OF NEW YORK, N. Y.

PNEUMATIC TIRE.

No. 836,569. Specification of Letters Patent. Patented Nov. 20, 1906.

Application filed April 18, 1906. Serial No. 312,338.

To all whom it may concern:

Be it known that I, ALEXANDER DOW, a citizen of the United States of America, and a resident of New York city, county and State of New York, have invented certain new and useful Improvements in Pneumatic Tires, of which the following is a specification.

My invention relates to an improvement in pneumatic tires, and has particular reference to means for sealing and healing punctures which may occur in the same.

Broadly speaking, the subject-matter of my invention pertains to that class of tire-healing apparatus wherein a healing compound in association with solid matter not homogeneous therewith is carried by the pneumatic tire in position to be affected by the pneumatic pressure when a puncture occurs, so as to drive the compound into the puncture and by so doing to both close and seal the aperture. I am aware that this art has been developed along the lines referred to and that it is not broadly new in the art either to employ a healing compound or a healing compound associated with material carried by the compound, and I realize that in order to make clear the full meaning of my invention it will be necessary for me to differentiate my present invention from others of the same class which may appear at first to contain substantially the same elements.

My invention consists in the employment of a conveying or carrying medium consisting of a fluid, preferably having a flowing quality and one that does not readily evaporate. I mix with this fluid a long tough fiber—such, for instance, as feathers, long-fibered cotton, long-fibered asbestos, or other material, such as long-fibered grasses, the requisite of such material being that it should be relatively long and tough.

I also point out as an important feature of my invention that the fiber or foreign material used should preferably be of a tapering form—such, for instance, as feathers, referred to, which when presented to a hole small end first will tend to jam in its passage into the hole. I would be understood also as intending to use in this connection any form of wedge-shaped article which may be of natural structure or artificially manufactured for the purpose suitable to be carried and capable of being carried by the fluid above referred to. As heretofore stated, I mix such materials with a flowing material and employ the same as a means under pneumatic pressure to stop the hole in a pneumatic tire. The manner in which I may employ the same is various. I may mention, however, that the compound may be contained within the tire and permitted to flow therein and by the operation of the tire be thrown against the inner walls in such a manner as to completely cover the same and be in a position to be operated upon by the pneumatic pressure in the event of a puncture occurring. Again, I may interpose the compound above referred to between the walls of the tire or between the walls of the inner tube of a tire, or I may make the inner tube of a tire double on part of its periphery and interpose the healing material carrying such foreign matter in a chamber covering part of its periphery. I desire to call particular attention to the use of feathers in this connection. I believe that I have discovered a quality in feathers which makes them particularly adaptable for this purpose, first, because of the long tapering quality of the feather, which causes it when presented to a hole to jam therein, and also by reason of its shape to overlie a hole and when one feather is laid upon another by reason of the pneumatic pressure over the hole to seal the same. All of this is aided by reason of the peculiar textile quality of the feather, which produces a fabric through which the fluid cannot pass. In this connection the fluid in turn prevents the escape of the air through it.

The operation of my device is substantially as follows: When a puncture occurs, the pneumatic pressure operates upon the fluid carrying the feathers or other foreign matter to convey the same to the puncture, which is immediately filled by the feathers or other foreign matter in one of several ways, either by forcing the same through the hole, beginning with the tapered end of the feather, which, it will be manifest, will cause the fibers or branches of the feather to jam into the hole and prevent its further passage, or the feather may overlie the hole and be followed by other feathers overlying the same, so where long fibers are employed—such as long-fibered cotton, asbestos, or grasses, or whatever it may be—if the fibers are not immediately forced into the hole they will overlie the same. Experience has shown me that

sometimes a few feathers will be forced into the hole, but that in the majority of cases and under normal conditions the fibers will overlie the hole and form a mat which will effectually seal the aperture and prevent the further escape of air. I have referred to feathers in this connection for the reason that I have found them to be peculiarly adapted for this purpose. I attribute their adaptability, first, to the fact that they are of a tapering form and that when they are presented to a hole or aperture the taper end will be forced through and under the pneumatic pressure the other limbs or arms of the feather will tend to choke the hole in such a way as to completely seal the same. This reference is particularly made with regard to large apertures made in a pneumatic tire. With reference to small apertures—such, for instance, as may be made by an ordinary nail—the feather will overlie the aperture and heal the same, or if forced through at all it will take the form above indicated. The same is true of any long fiber such as I have described or any manufactured fiber having a tapering form that would form or make a wedge-shaped plug to fill the hole or would act as an overlying barrier to bridge the gap forming the aperture, one fiber overlying the other to seal the same. My observation in the operation of this sealing method has disclosed the fact that large apertures made in a pneumatic tire will be promptly sealed by the operation of the feathers or other fibers indicated by me. It will be understood that these feathers or fibers are carried by a semifluid material in proximity to the periphery of the pneumatic tire and in position to be immediately operated upon by the pneumatic pressure as soon as a puncture occurs.

Referring to the prior state of the art, I am aware that others have attempted to accomplish the result above described. In some cases feathers have been used in a dry form—simply introduced into the interior of a pneumatic tire with the expectation that they would fly to fill an aperture or puncture when the same occurred. My experience has been that this form of employing feathers is inoperative. Again, I find in the art numerous attempts to mix a healing compound with various substances—such, for instance, as finely-divided rubber, finely-divided asbestos, finely-divided cork, finely-divided mica, and other pulverized substances. In all of these cases, so far as my information goes, the whole compound intended for use as stated has been finely divided for the specific purpose of having the same readily introduced into the tire through the valve. These compounds with their combination of elements have been found inefficient except in cases where the puncture was very small and where the compound would, by reason of its healing qualities, pass into the aperture and seal the same.

I desire to differentiate my invention from all of those above referred to by reason of the fact that I employ fiber having a particular form and being of sufficent length to accomplish the result of either plugging the hole or bridging the same, or both. My invention lies in the selection by me of a fiber such as I have described, and I believe that I have discovered a means by which pneumatic tires are effectually healed where a puncture occurs, whether the same be large or small.

In order that I may be entirely clear, I desire to state that one of the fundamental elements of my invention lies in the fact that I provide means consisting of fibers having a particular form, length, and structure capable of either plugging up a hole or bridging the same in such a way as to cause a seal, in either case operating to prevent the further passage of the liquid carrying the fibers, and thus sealing the aperture against the further escape of the air. In other words, the operation when a puncture occurs and the instrument is withdrawn is that of building up a network or mesh into or over a hole in such a way as to cause an artificial superstructure to be built within and over the same.

I have illustrated my invention in the accompanying drawings, designating the parts by numerals, referring to like parts by like numerals.

Figures 1 to 7, inclusive, are vertical sections of a tire, while Figs. 8 to 11, inclusive, and 16, are enlarged views, in vertical section, with the exception of Fig. 9, which is a plan view. Figs. 12 to 15 are diagrammatic views.

Fig. 1 shows my invention in vertical section as applied to what is known as a "single-tube" tire, 1 representing the inner section, 3 the outer section, while 2 is the compound contained between the inner and outer sections.

Fig. 2 represents a vertical section of that form of tire wherein the inner tube is contained within a shoe, 1 representing the inside wall of the inner tube, 3 the outside wall of the inner tube, 2 the compound contained between the walls of the inner tube, 4 the exterior shoe, while 5 is the rim securing the shoe to the wheel.

Fig. 3 is a vertical section of an inner tube such as is illustrated in Fig. 2, wherein more clearly can be seen the form of the inner tube, which consists of two parts, to wit: two tubes, one being of smaller diameter than the other, the smaller tube being contained within the larger and having interposed between them the compound employed by me to close an aperture.

Fig. 4 is a vertical section of another form of inner tube wherein 1 represents the inner tube. 3 represents a section of a tube adapted to be sealed and secured over the inner tube 1

to form a pocket for the reception of the compound employed by me to close apertures. This compound I have indicated as 2.

Fig. 5 represents an inner tube or tire of the usual form and construction with my invention for closing apertures contained within the same.

Figs. 6 and 7 illustrate another form of applying my invention. Fig. 6 is a vertical section of a tube into which I introduce my compound and which is flattened out to form a band or belt adapted to partially embrace the inner tube and be secured thereto in a way to become integral therewith. Fig. 7 shows this belt laid on the inner tube and secured thereto in a position to be operative. Fig. 7 shows 1 as the inner tube, while 2 represents the belt, and 3 the compound.

Fig. 8 is a vertical section illustrating an enlarged view of my device, showing the operation of the same when a small puncture occurs, while Fig. 9 is a horizontal section taken on the line X X.

In Fig. 10 I have illustrated a larger puncture than that illustrated in Fig. 8, showing the effect of the air-pressure upon my compound. Fig. 11 illustrates a still larger puncture, illustrating the effect of wedge-shaped materials when operated upon by the air-pressure.

Fig. 12 is a vertical section of a wedge-shaped piece such as I have described, while Fig. 13 shows a double-pointed wedge. Fig. 14 is a fiber having an enlargement in its diameter, and Fig. 15 illustrates a feather. All of these, as heretofore described in my specification, are employed by me in the manufacture of the compound which I employ to close apertures in pneumatic tires.

Fig. 16 shows the operation of the air upon materials such as those illustrated in Figs. 12 to 15, all of which, it will be noted, have a tendency to clog the hole as a result of their wedge-shaped form.

In Figs. 1 to 16, inclusive, I have referred to the inner tube as 1, the compound generally as 2, the external part of the inner tube or band as 3, the shoe as 4, and the puncture as 5. The wedge-shaped fibrous material or artificial wedge-shaped material employed by me in manufacturing my compound I have designated throughout as 2^a. In view of the full description of my invention heretofore developed these illustrations will require but little explanation. I may, however, state that in Figs. 1 to 7, inclusive, I have shown what I regard as my preferred form of construction for applying my compound in a satisfactor, position to be effective when a puncture occurs. In Figs. 9 to 16, inclusive, I have endeavored to illustrate more effectually my understanding of the manner in which my invention operates. Fig. 8 shows the long tapering fibers which I employ lying across a small aperture. In such case as this the fibers will mat over the hole under the air-pressure and form a seal. In Fig. 10 I have shown this hole somewhat larger where the air-pressure will tend to force some of the fibers into the hole, operating as a cork to seal the hole. In Fig. 11 I have shown a still larger hole, where the wedge-shaped materials form a dam to seal the hole, one operating upon the other. In Fig. 16 I have shown how the tapering feathers or fibers of tapering form find their way through the aperture in the tire, entering the same the small end first and becoming clogged therein by reason of their tapering or wedge-shaped form, all of which offers a resistance to the passage and eventually closes the aperture.

I am aware that many inventions have been made for the purpose of developing materials suitable for sealing punctures. These materials have consisted of various finely-divided materials—such as chalk, graphite, and cotton fibers cut into short lengths, ground rubber, mica, and the like. These previous inventions do not exhibit the nature of my invention, in that my discovery relates to the efficiency in action of fibers of certain lengths and forms in the mixture which definitely serve to build up a structure over or in the orifice preventing the further escape of the paste. In the inventions heretofore referred to only extremely small punctures could be stopped by the material used. The small particles of cork tended to choke up the orifice, which was afterward closed by the sealing compound. While these compounds have served to close very small holes, they failed to operate successfully on larger cuts or punctures. The reason for this is apparent. Where the hole is small, the particles of cork or other finely-divided material clog up the hole, and the healing fluid seals the same; but where the aperture is of any considerable size the finely-divided particles are immediately blown through the hole, as no resistance is offered to their passage. My invention, on the other hand, provides means by which the nature of the fiber in every case serves to hermetically seal large or small openings in the tire. The composite paste of flour and water or any other suitable semifluid is mixed to a considerable degree of thickness with fibers selected for their length and peculiar forms. These fibers should preferably be of from one-half inch to two inches in length and their forms of a tapering nature. While feathers operate in practice very successfully, suitable fibers could be found in nature having the approximately correct form or they could be manufactured artificially for the purpose. An important feature of my invention lies in the utility of these long and specially-shaped fibers. When confined in the tire, they form a mat-like fabric permeated with the pasty fluid. In order to puncture the air-chamber,

the puncturing instrument has to pass through this fabric, the fibers of which are free to move apart to permit the passage of the puncturing instrument. When the instrument is withdrawn, the puncture will be closed in one of three ways.

First. If the hole is a small one, the fibers will be returned by the paste to their original position over the hole, bridging the same with a fine textile fabric. If the air-pressure can drive the thick pasty fluid through this texture, it can do so only by adding to the fabric whatever fibers it bears with it, thus quickly sealing the puncture against further flow of the fluid, the presence of the fluid filling the interstices in the fabric, preventing the escape of air. This condition of affairs is exhibited in Figs. 8 and 9.

Second. In case the opening or cut is larger than the one just described the fibers will tend to be doubled and be forced into the opening by the air-pressure. The length of the fibers and their tapering form will in this case tend to jam in the opening, as exhibited in Fig. 10, in that before one set of fibers is forced through the hole others have been added to it, and the flow of the paste is again checked.

Third. The important value of the wedge-shaped form of these fibers in sealing very large punctures or cuts is exhibited in Fig. 11. Under these circumstances where the hole is sufficiently large the wedge-shaped materials tend to be forced bodily out of the orifice. If they are presented large end first, they are sometimes blown through the orifice. If they are presented small end first, the fiber cannot pass through the orifice without dragging the large end through. This results in a wedging action of the fibers among themselves, which forms an inverted pyramid over the hole, which prevents the escape of the fluid. Feathers used in this connection operate very successfully, in that their small ends are extremely fine and the branches readily tangle with one another.

I have exhibited in Figs. 12 to 15, inclusive, various forms of fiber or manufactured material which could be used and would operate according to the foregoing principle. It will be clearly understood from what has preceded that the action of these fibers is to positively build a network in or over the hole, the tightness of which is being continually increased by the air-pressure or by the flow of any fluid through it. In practice I prefer to select for the feathers used a mixture of different sizes from very fine down up to feathers two inches or more in length. From these larger feathers the stems are cut off in order that they will not puncture the rubber fabric.

In the claims appended to this specification I employ the word "liquid" as forming part of the combination of the compound referred to therein. I desire to define the meaning that I intend to give to this word as follows: I do not intend to include therein any fluids such as air or gas, but only fluids having a body and substance greater than that of air and gas, as water, paste, or healing compounds formed of various materials known to the art. In other words, I define the word "liquid" as used by me in my claims herein as being a substance differentiated from air or gas by the expression "liquid material," such as water or combinations of liquids known in the arts as "healing compounds," wherein the combination forms a fluid or plastic material which may be of a plastic or semifluid nature or of any other nature suitable for the purposes other than gases or air.

What I claim, and desire to procure by Letters Patent, is—

1. A sealing mixture consisting of a liquid mixed with feathers.

2. A sealing mixture consisting of a liquid mixed with feathers and long fibers.

3. A sealing mixture for closing punctures consisting of a liquid mixed with feathers.

4. A sealing mixture for closing punctures consisting of liquid mixed with long fibers.

5. A sealing mixture for closing punctures consisting of fluid mixed with feathers and long fibers.

6. A sealing mixture for closing punctures consisting of a tire-healing fluid mixed with long fibers.

7. A sealing mixture for closing punctures consisting of a tire-healing fluid mixed with feathers and long fibers.

8. A sealing mixture for closing punctures consisting of a liquid mixed with fibrous materials of a tapering form.

9. A sealing mixture for closing punctures consisting of a fluid mixed with long fibers and finely-divided material.

10. The combination with a fluid-container, of a sealing compound therefor and contained therein consisting of a liquid and feathers.

11. The combination with a fluid-container, of a sealing compound therefor and contained therein consisting of a liquid and long fibers.

12. The combination with a fluid-container, of a sealing compound therefor and contained therein consisting of a liquid, feathers and long fibers.

13. The combination with a fluid-container, of a sealing compound therefor and contained therein consisting of a liquid and fibrous material of a tapering form.

14. The combination with a pneumatic tire, of a compound contained therein consisting of a liquid and feathers.

15. The combination with a pneumatic tire, of a compound contained therein consisting of a liquid and long fibers.

16. The combination with a pneumatic tire, of a compound contained therein consisting of a fluid and feathers and long fibers.

17. The combination with a pneumatic tire of a compound contained therein consisting of a healing fluid and feathers.

18. The combination with a pneumatic tire, of a compound contained therein consisting of a healing fluid and long fibers.

19. The combination with a pneumatic tire, of a compound contained therein consisting of a healing fluid, feathers and long fibers.

20. The combination with a pneumatic tire provided with a chamber between the walls of the tire, of a sealing compound in said chamber consisting of a liquid mixed with feathers.

21. The combination with a pneumatic tire provided with a chamber between the walls of the tire, of a sealing compound in said chamber consisting of a fluid mixed with long fibers.

22. The combination with a pneumatic tire provided with a chamber between the walls of the tire, of a sealing compound in said chamber consisting of a fluid mixed with feathers and fibers.

23. A pneumatic tire consisting of an inner tube and the retaining casing or shoe, the inner tube provided with a chamber between the walls of the inner tube, of a sealing compound in said chamber consisting of a mixture of liquid and feathers.

24. A pneumatic tire consisting of an inner tube and the retaining casing or shoe, the inner tube provided with a chamber between the walls of the inner tube, of a sealing compound in said chamber consisting of a liquid mixed with long fibers.

25. A pneumatic tire consisting of an inner tube and the retaining casing or shoe, the inner tube provided with a chamber between the walls of the inner tube, of a sealing compound in said chamber consisting of a fluid mixed with long fibers and feathers.

26. A pneumatic tire consisting of an inner tube and the retaining casing or shoe, the inner tube provided with a chamber between the walls of the inner tube, of a sealing compound in said chamber consisting of a liquid mixed with fibrous material of a tapering form.

Signed by me at New York city, county and State of New York, this 17th day of April, 1906.

ALEXANDER DOW.

Witnesses:
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PAUL ROYNGE.