J. LINDHARTH.

MEANS FOR AUTOMATIC CLOSING OF PUNCTURES IN PNEUMATIC TIRES.

APPLICATION FILED NOV. 27, 1907.

907,512.

Patented Dec. 22, 1908.

Fig 1

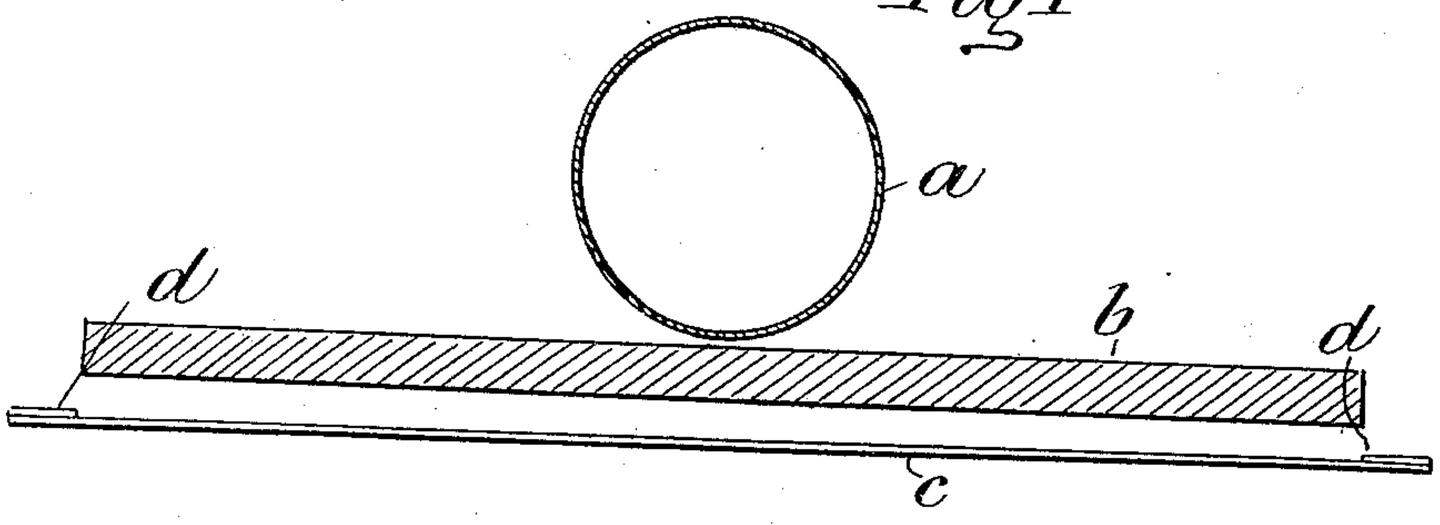


Fig 2

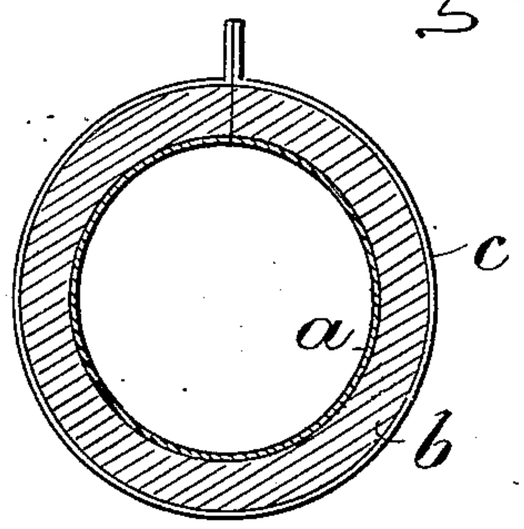
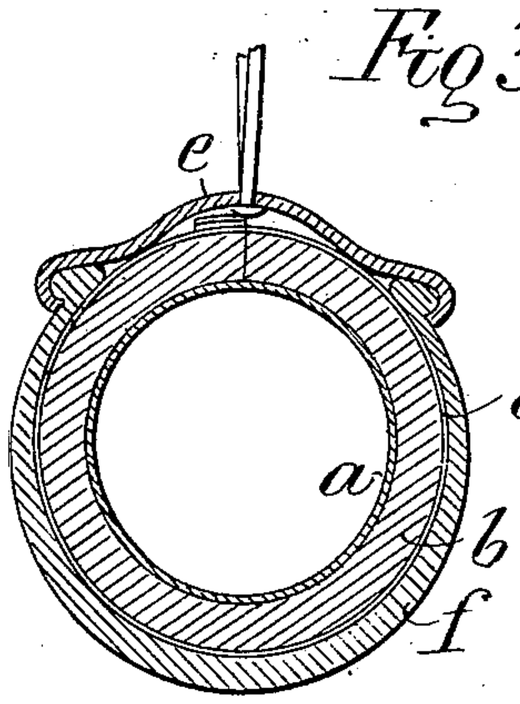


Fig 3



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MEANS FOR AUTOMATIC CLOSING OF PUNCTURES IN PNEUMATIC TIRES.

No. 907,512. Specification of Letters Patent. Patented Dec. 22, 1908.

Application filed November 27, 1907. Serial No. 404,195.

To all whom it may concern:

Be it known that I, JULIUS LINDHARTH, subject of the King of Denmark, and a resident of Copenhagen, Denmark, Aaboulevarden 6, engineer, have invented new and useful Improvements in Means for Automatic Closing of Punctures in Pneumatic Tires, of which the following is a specification.

The present invention has for its object an improved arrangement and method for the automatic closing of punctures in pneumatic tires of cycles, automobiles and other vehicles, and the like, caused either by involuntary damage during the riding or by wilful injury. To attain this, several means have been proposed, but none of these has so far found application in practice, presumably mainly because they have been ineffective against more serious injuries. There has been proposed the use of various liquid adhesive compounds to be introduced in the air tube, the idea being that part thereof would be driven out, along with the escaping air, into the hole produced in the tube, thereby closing the hole. Further it has been proposed to add to such fluid compound in the air tube certain more or less finely ground or fibrous substances, in order to enhance the closing effect. Or it has been proposed, on the strip of the outer face of the tube which is particularly exposed to punctures during the riding, to paste a tape, the object being to counteract on this strip the elasticity of the tube, and thereby to cause a puncture, here effected, to remain in a capillary state and therefore likely to be closed simply by the formation of a film of liquid therein. Finally it has been proposed to apply the adhesive fluid on the outside of the tube, in combination with a fibrous substance serving as absorbing agent for the said fluid.

According to the present invention the problem is solved by introducing into the tube an adhesive fluid of suitable composition and consistency and enveloping the tube by a loosely fitting bandage consisting of a soft, non-elastic and fibrous substance.

In the accompanying drawings I have shown, by way of example, how my invention may be carried into effect.

Similar characters of reference indicate corresponding parts in all the views.

Figure 1 shows in cross-section the air tube and the parts employed to produce its bandage. Fig. 2 shows, also in cross section, the tube with the bandage applied, and Fig. 3 shows, also in cross-section, the finished tube placed on the rim and protected by the usual rubber cover.

Referring now to the drawings *a* indicates the moderately inflated tube, *b* a strip of fibrous substance, such as cotton, wool or wadding, sufficiently long to reach entirely around the tube's periphery and wide enough to cover its sectional outline, and *c* is a strip of shirting, muslin or other suitable material, somewhat longer and wider than the strip *b*, and having its edges *d* coated by rubber solution or the like.

When the tube is moderately inflated, the strip *b* is applied around it and is, in its turn, covered by the strip *c*, whose edges are then pressed together and thereby pasted to one another. This arrangement is of such nature that the pasting together will not hinder the inflation of the tube, as the joint will simply yield and expand a little, if the muslin strip happens to be tightened too much around the band of fibrous substance. The finished bandaged tube has then the appearance represented in Fig. 2 and may now, in the usual manner, be placed in position on the wheel rim *e* and covered by the tire *f* (Fig. 3).

The viscous fluid may be introduced into the inner tube through the valve seat, after the valve plug has been removed and this of course may be done either before or after the tube is placed in position on the wheel. The necessary requirements for the fluid are that it shall moisten the rubber tube, adhere and partly evaporate on its outer face where evaporation may freely take place. Still it must not be apt to dry up completely, *i. e.* it must retain a certain softness and elasticity, so that the partly dried fluid film or skin formed over and around a puncture may follow the expansions and contractions of the tube without cracking or separating therefrom or otherwise being injured. Further it must not consolidate at ordinary winter temperature and must not be subject to any chemical alteration, nor be influenced by or influence the rubber, and it must be so viscous that during the alternate rotation and rest of the wheel it will remain distributed as a thin film throughout the inside of the tube, and not, when the cycle is at rest, entirely collect at a single point of the tube. A fluid answering these requirements may preferably be composed of dextrin (burnt starch), water, glycerin and a little alcohol

or the like in suitable proportions, and I have found that for instance 200 parts by weight of dextrin, 150 parts of water, 3 parts of glycerin and 4 parts of absolute alcohol form an especially suitable compound. I have further found that with very great advantage there may be added to the fluid certain finely powdered substances whereto it readily sticks, such as sawdust or ground wood, because such substance when being introduced into the puncture together with the fluid will most efficiently close the puncture.

Of the above mentioned compound I introduce into an ordinary bicycle tire from $3\frac{1}{2}$ to $5\frac{1}{2}$ ounces.

The substance used for the bandage *b* outside of the tube must be loose and soft and not much elastic, and preferably of fibrous or thready texture. Its object is to act by being pressed into the tube together with the implement causing the puncture, and it must not then, by its own elasticity, tend to draw itself out of the hole again, when the wounding implement is removed from the tube. Further it must not be tightly stretched around the tube, nor pasted thereto, as in that case it would hinder the full inflation of the tube, and finally it must not absorb to any material degree, the fluid contained in the tube, as it would then allow the fluid to percolate through the puncture, without forcing it to expand on the outside of the tube, thereby forming a skin or plaster adhering to the tube and covering the hole. On the other hand, the fluid must act adhesively on the fibrous substance, actually causing its threads to adhere to the tube in and around any hole produced therein. Of the substances answering the requirements mentioned we have found non-hygroscopic cotton to be particularly suitable, especially the commercial sheet wadding. We have found that the cotton wadding may to advantage be impregnated with paraffin oil, it being immersed for instance in a mixture of 1 part weight of paraffin oil and 8 parts of benzin and then wrung; whereby it becomes suitably non-hygroscopic and attains a certain tough softness, so as not to be worn or ground to pieces during the riding.

For the outer covering may be used any suitable thin and strong fabric, for instance muslin, shirting or the like, with or without sizing. Even tough paper may be used for this purpose.

The tube treated according to my invention will act in the following manner. If a flint chip, for instance, a horse shoe nail or the like, is pressed up through the outer covering and enters through the pneumatic tube, then it will carry along with it into the hole a tuft of the fibrous layer. When the wounding body is removed, the fibers pressed in will remain in the hole and the small amount of air, if any, escaping through the hole will at once introduce some of the adhesive liquid therein, and this liquid will then close up all the interstices between the fibers and the walls of the punctured hole, thereby instantly healing the latter. A bit of the liquid will percolate along the surface of the tube, there solidifying in combination with the nearest fibers and forming an air tight elastic crust or skin of thready structure covering the hole. As the fibrous layer is non-absorbent, there is no danger of the fluid extending further out through the fibrous layer, thereby on the one hand causing the crust or skin to become too soft and on the other hand perhaps causing the liquid to penetrate all the way out to the inside of the outer cover, thus gluing the latter to the fibrous layer.

Air tubes protected according to my invention have proved perfectly invulnerable, even when treated as violently as when being pierced by a pocket knife, and the superiority of my method of protection over the above mentioned heretofore proposed treatments is especially great in such violent and serious injury. This is mainly due to the fibrous layer being located outside of the tube and the fluid inside of the same, as by such arrangement the dry fibrous layer will be pressed into the hole produced, while the air will press the fluid into the hole. If, on the other hand, the fibrous layer and the liquid both were located outside of the tube, then the liquid would be blown, by the escaping air, away from the walls of the hole, and besides there must necessarily be used a tight inclosure outside of the fibrous layer, in order to prevent the liquid from coming into contact with the inner side of the outer tube or cover and thereby pasting the fibrous layer thereto.

Another reason for the superiority of the protection afforded by this invention is that the fibrous layer is of loose, soft and rather non-elastic texture, so that it has no tendency to resist its own introduction, together with the wounding implement, through the wall of the tube, and further is not likely to slip out again from the hole, when the implement is drawn out, or when acted upon by the air pressure.

A final advantage is that the fibrous layer may be applied very loosely around the tube, without being pasted to its surface, and it may thus be made to encircle the entire tube surface without diminishing its ability to freely expand and contract elastically.

What I claim, and desire to secure by Letters Patent, is:

1. A means for preventing injury to vehicle tires by punctures etc., consisting of a soft fibrous non-elastic covering for the inner tube, a non-elastic covering over the fibrous material, and a solution within the inner

tube composed of 200 parts of dextrin, 150 parts of water, 3 parts of glycerin, and 4 parts of absolute alcohol, and sawdust, the said fibrous covering being permeated with a solution consisting of 1 part of paraffin oil, and 8 parts of benzin.

2. A means for preventing injury to vehicle tires by puncture, etc., consisting of a soft fibrous non-elastic covering for the inner tube, a non-elastic covering over the fibrous material, and a solution within the inner tube composed of 200 parts of dextrin, 150 parts of water, 3 parts of glycerin, 4 parts of absolute alcohol, and sawdust.

Signed by me at Copenhagen, Denmark this 28th day of October 1907.

JULIUS LINDHARTH.

Witnesses:

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