TIRE REPAIR PLUG
Filed Dec. 4, 1939 2 Sheets—Sheet 2

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2,271,339

TIRE REPAIR PLUG

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Application December 4, 1939, Serial No. 307,476

2 Claims. (Cl. 155—370)

My present invention relates to the structure and manner of applying tire repair plugs to close the punctures in tire casings. The plug itself is of novel construction and of such character that by the use of a small stem, such as a wire or rod that is much smaller than the plug and which will freely pass through a puncture, without the use of a quill, metallic cap or the like, the soft rubber plug will be stretched and caused to freely enter the puncture.

In practice, I have found that the formation of the entering end of the plug is a very important matter and, by numerous experiments, I have determined that the form of plug end best adapted for insertion into a puncture is one in which the end of the plug is approximately semi-spherical, or in other words, rounded on the arc of a circle, the diameter of which is the diameter of the plug body.

The most desirable means for pulling the plug through the puncture, is a stem or small rod having a hooked end; and for application of the hooked end of such stem, the plug should have a diametrical perforation at the base of the semi-spherical point.

As the salient feature of the improved method or process, the plug-pulling or applying stem is utilized as a carrier of cement into the puncture as an initial step, followed by the pulling of the stretched plug through the puncture while the cement is still in fluid form, and will act as a lubricant in the application of the plug in the puncture. The above matter will be more fully considered and explained in the following description of the method and of the structural features of the invention.

Referring to the drawings, which illustrate the invention and wherein like characters indicate parts throughout the several views:

Fig. 1 is a transverse section showing a tire casing with a puncture therein;

Fig. 2 shows the plug in its preferred form, wherein the plug is provided with a head of the mushroom type;

Fig. 3 is a fragmentary section taken on the line 3—3 of Fig. 2;

Fig. 4 is a plan view showing the preferred form of puller stem or rod for pulling the stretched plug into the puncture;

Fig. 5 is a view corresponding to Fig. 1, but showing a puller stem inserted through the puncture and having a plug attached to the hook at its inner end; and

Figs. 6, 7, 8 and 9 are fragmentary sections indicating progressive steps in the application of the plug in the tire puncture.

The numeral 10 indicates the fabric inner portion, and the numeral 11 the outer rubber portion of an ordinary tire casing which, as shown in the drawings, has a puncture 12.

The cylindrical body 13 of the plug, which is of soft and elastic rubber, is shown as provided with a head 14 of the so-called mushroom type. The entering end 15 of the plug is, as already indicated, of semi-spherical form that is rounded on the arc of a circle, the diameter of which is the diameter of the plug body. At the maximum diameter base line of this semi-circular portion, the body is provided with a transverse perforation 16.

The stem is a small rod or heavy wire 17, which, at one end is provided with a hook 18 and at its other end with a handle 19 shown in the form of a loop. For application of the cement in the puncture, the stem 17 is provided with indentations or irregular portions that are adapted to carry fluid cement, and this is preferably accomplished by providing the stem with spiral grooves or threads 17.

Obviously, the stem 17 will, on the average, be found to be not much larger than the perforation in the tire casing, or at any rate, of such small size that it can be readily inserted through the puncture. The plug 13 will in all cases be normally of much greater diameter than that of the stem or puncture, but being of very elastic substance such as rubber, can be stretched and drawn through the puncture in diametrically reduced condition, providing the initial entrance of the plug is readily accomplished. In the use of the stem shown in the drawings, and in carrying out the method in the preferred way, the stem will be dipped in or coated with liquid cement and will be inserted inwardly through the puncture of the casing, and then the hooked end 18 will be passed through the perforation 16. By this insertion of the stem through the perforation, the liquid cement will be initially carried into the puncture. When the attached plug is drawn outward, the rounded end 15 of the plug will be brought into contact with the interior of the casing and by initial pull, will be stretched, out much like a rubber band, see particularly Fig. 6, and the displacement of the rubber at the rounded end of the plug will be first drawn out axially and the rounded outer portion of the head will be diametrically contracted with an initial pull, so that the end of the plug will be drawn into the puncture, as indicated,
much like a rubber band, and further pull, after the end of the plug has been entered into the puncture, will stretch the body of the plug so that it will be contracted to the diameter of the puncture. Of course, if the plug has a normal diameter, much greater than that of the puncture, it will longitudinally contract and diametrically expand after the pulling tension is released, until that portion of the plug within the puncture tightly fills the puncture and seals the same against entrance of moisture, while that portion of the plug outward of the casing will return to a normal diameter much greater than the diameter of the puncture. The extended end of the plug will be cut off close to the surface of the casing.

In numerous experiments that I have made, I have found that with the plug formed with a flat or substantially flat front edge surface, initial pull at the axis of the head will first diametrically expand the blunt end, making entrance of the plug into the puncture extremely difficult and usually impossible. In fact, the end of the plug rounded and applied as described seems to make the difference between substantial failure and a highly efficient device. Fig. 7 shows the plug as it will appear just as the head of the plug is contacted with the interior of the casing; Fig. 8 shows the condition of the plug after it has been inserted and released from the stem; Fig. 9 shows the plug after it has been cut off flush with the exterior of the casing.

The outward pull of the stem with the fluid cement carried thereby will further distribute the cement in the puncture and, as a very important feature, lubricates the walls of the puncture and the exterior of the plug so that the latter will be very much more freely and readily drawn into the puncture than when in dry condition. Of course, the outward movement of the stem and the pulling of the plug into the puncture must take place substantially as one operation and before the cement hardens, and while it still serves as an efficient lubricant for the plug.

The above, as is obvious, is the preferred and most practical way of applying the plug; however, if the handle or large outer end of the stem should be cut off as, for example, indicated by the line marked $x-x$ on Fig. 8, it would be possible to first enter the stem through the puncture by movement outward from the interior of the casing; but in this event, the cement would be applied to the stem and the stem forced endwise outward through the puncture and thereafter engaged by pliers and the like and drawn outward so as to enter the puncture while the cement is still serving as a lubricant for the plug. In either event, by outward movement of the stem and the plug, the cement would be distributed in the puncture and by a substantially continuous operation or outward pull or movement of the stem, the lubricated plug will be seated in the puncture.

Also, of course, the plug is adapted to be pulled into the puncture by other means than described, such for example, a doubled length of common wire.

In actual practice, the above described plug and the manner of applying the plug in the puncture, has been a great improvement over hitherto employed structures and methods of operation, and it will be understood that the invention described is capable of modifications and variations in operations within the scope of the invention defined in the appended claims.

In a sense, the present invention is in the nature of an improvement on the plug of the prior Patent 1,831,000, of November 10, 1931, to A. A. Hawkins. The prior art plug referred to has proven very effective over a period of years insofar as sealing up punctures against the entrance of moisture and the like, but said prior art plug has been difficult to commercialize on a wide scale due to a relatively great cost of equipping each plug with an individual small diameter inserting stem or quill. The present plug, however, is equally effective, and has the great commercial advantage of costing but a fraction of the cost of the said prior Hawkins plug.

The word rubber is herein used in a broad and liberal sense with the intention of covering, in addition to rubber, any elastic substance suitable for the purpose, and including various synthetic rubber compositions.

What I claim is:

1. A tire repair plug comprising an elastic approximately cylindrical body formed with an approximately semi-spherical entry end the base of which semi-spherical end is the full diameter of the plug body, said body having a diametrical perforation at the maximum diameter base line of its semi-spherical entry end.

2. An elastic repair plug for closing punctures in tire casings and the like comprising a cylindrical elastic body having a flattened head at one end thereof, and the opposite end of said elastic body being semi-spherically rounded with its base equal in diameter to that of the body and provided with a pull receiving perforation whose axis is essentially in the base of said semi-spherical end portion, whereby to provide for ready entry of said body directly into a puncture by effecting uniformity in elongation and transverse contraction of said elastic body from the outermost extremity of its elastic round end progressively throughout the length of the body upon being pulled from the perforation in the base of said rounded end into and through a puncture.

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