

- [54] ROOM TEMPERATURE CURABLE TIRE PATCH
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- [51] Int. Cl.<sup>3</sup> ..... **B60C 21/00**
- [52] U.S. Cl. .... **152/370; 152/367; 152/371; 156/95; 156/97; 264/36; 427/140; 428/63**
- [58] Field of Search ..... 156/97, 95, 307.3, 315; 427/140; 152/367, 371, 370; 428/63; 264/36

4,300,970	11/1981	Honda et al. ....	156/244.11
4,311,181	1/1982	Hausch .....	152/353 R
4,327,138	4/1982	Hausch .....	428/36
4,352,704	10/1982	Williams .....	156/125

**FOREIGN PATENT DOCUMENTS**

1352645 5/1971 United Kingdom .

**OTHER PUBLICATIONS**

"Room Temperature Vulcanizing Adhesive Based on Ethylene-Propylene-Diene Terpolymer," Cantor, Uniroyal, Paper No. 18, 10/10/73, Hughson Chemical Division, Lord Corporation, Products TS-2682-71.

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*Attorney, Agent, or Firm*—Daniel N. Hall

[56] **References Cited**

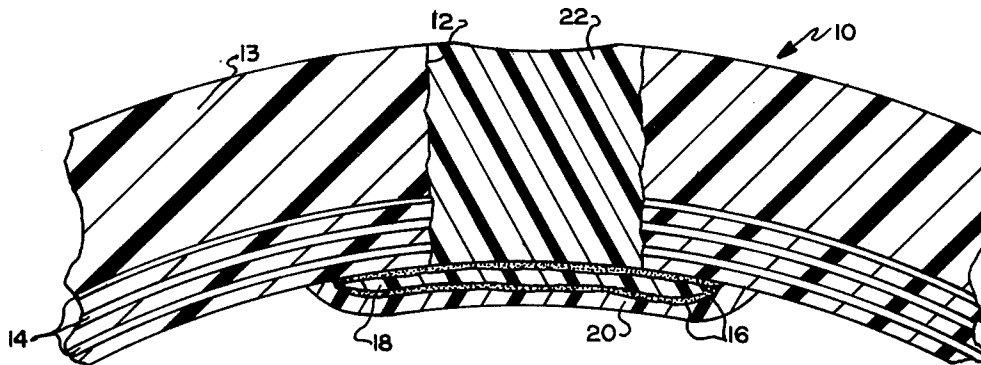
**U.S. PATENT DOCUMENTS**

3,644,256	2/1972	Broisman .....	269/29
3,718,587	2/1973	Bhakuni .....	252/8.6
3,755,261	8/1973	VanGulick .....	260/77.5
3,779,794	12/1973	DeSantis .....	117/72
3,834,934	9/1974	Broisman .....	117/76 T
3,888,831	6/1975	Kogon .....	260/77.5
3,966,530	6/1976	Cutts et al. ....	156/308
3,991,255	11/1976	Blaskiewicz et al. ....	428/425
4,085,283	4/1978	Den Otter et al. ....	260/248
4,125,522	11/1978	Becker .....	528/61
4,136,219	1/1979	Odam et al. ....	427/385 B
4,143,454	3/1979	Utsunomiya .....	29/460
4,158,378	6/1979	Pearson et al. ....	152/353 R
4,240,852	12/1980	Gomberg .....	156/96

[57] **ABSTRACT**

The repair of a reinforced elastomer article having a hollow therein relates to utilizing an amine curable polymer or prepolymer and a cured elastomer patch. The hollow in the elastomer, which can extend either partially or completely through the article, is filled with a gum rubber which is thereafter cured by conventional means, such as with spotters. The area beneath the now filled hollow is coated with a treating agent, followed by the amine curable polymer or prepolymer and a cured patch. The polymer is then cured at room temperature. One area of use is in the repair of tires.

**19 Claims, 2 Drawing Figures**



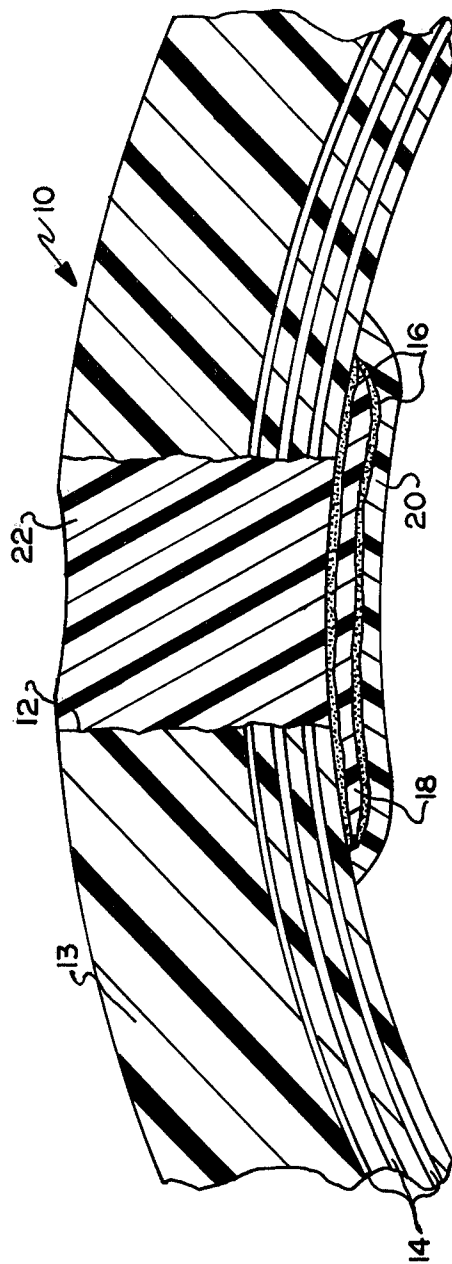


FIG. 1

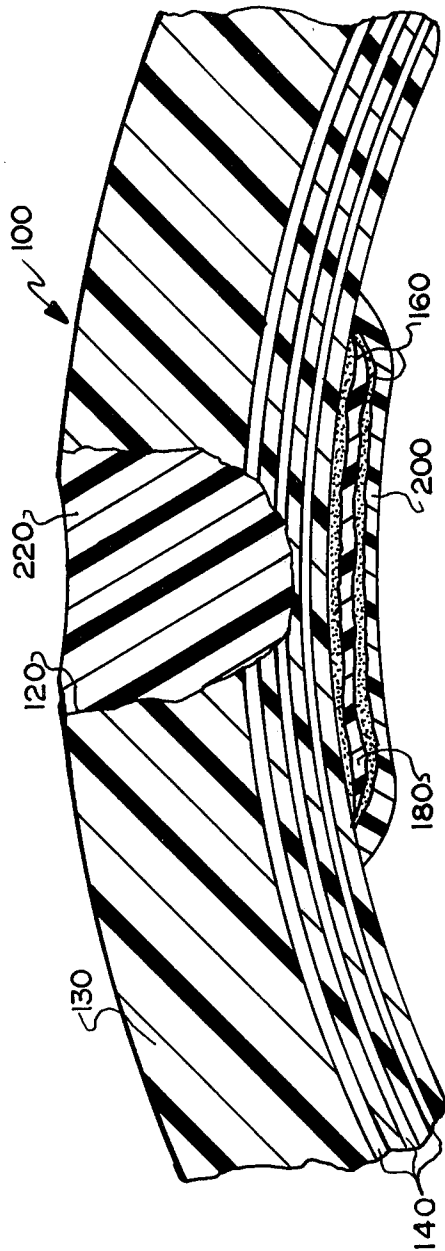


FIG. 2

**ROOM TEMPERATURE CURABLE TIRE PATCH****TECHNICAL FIELD**

The present invention relates to a composition and method for repairing reinforced elastomer articles having a hollow therein, such as for example a puncture in a tire. More specifically, the present invention relates to the utilization of a patch in association with the elastomer article and an amine curable polymer or prepolymer which is curable at ambient temperatures and which acts as an adhesive agent.

**BACKGROUND ART**

Heretofore, reinforced rubber articles such as tires having a cut or opening therein have been repaired with a patch. Generally the opening is first filled with an uncured gum rubber which is thereafter cured by such means as portable heating units or spotters. If required, a patch is applied to the inner surface of the tire or other article. Usually such a patch is needed if the reinforcing materials in the article, primarily cords or belts have been partially or completely severed, providing a weakened area prone to subsequent failure. In providing a patch reinforced to the same degree as the amount of lost reinforcement, the repaired article is, at least in theory, as strong as before the injury.

Prior art patches fall into two classes, the chemical cure patches which are high in cost and provide only poor adhesion to the substrate and uncured patches which require the use of heat for proper cure and adhesion. Unlike the method of heat application for the gum rubber filler, a rather sophisticated process must be used to cure this latter type of patch, to wit, a tire mold or similar device. Thus when a patch is required, on the spot or in situ repair is exceedingly cumbersome at best and in most cases impossible, requiring the article to be returned to the shop.

The present invention utilizes a cured rubber patch secured to the elastomer substrate through an adhesive system which is curable at ambient temperatures. There is therefore no need for the use of a tire mold to effect repair and the article can easily and quickly be treated in the field, saving both time and expense. The adhesive system utilizes an amine curable polyurethane or other prepolymer and a treating agent.

Considering the prior art, U.S. Pat. Nos. 3,755,261 to VanGulick; 3,888,831 to Kogan; 3,834,934 to Broisman; 3,644,256 also to Broisman; and 3,718,587 to Bhakuni relate to amine curable curing agents, amine curable polymers, or R.F.L. type adhesives. However, these patents lack any suggestion of applicants' treating agent or repair of an elastomer article.

U.S. Pat. No. 3,779,794 to DeSantis relates to a moisture-curable polyurethane sealant primer system, whereas U.S. Pat. No. 4,085,283 to DenOtter relates to flame retardants utilized in cyanuric acid derivatives. Hughson Chemical Division, Lord Corporation, Product No. PS-2682-71 relates to a surface primer for elastomeric substances utilizing a proprietary compound thought to be mono- or dichloroisocyanuric acid. An article entitled "Room Temperature Vulcanizing Adhesive Based on Ethylene-Propylene-Diene Terpolymer," Cantor, Uniroyal, Paper No. 18, presented to the Division of Rubber Chemistry of the American Chemical Society, Denver, Colo., Oct. 10, 1973 relates to various

oxidants which effect ambient temperature cures of E.P.D.M.

U.S. Pat. No. 4,136,219 to Oldam relates to a polyurethane paint which is applied to vulcanized rubbers. British Pat. No. 1,352,645 relates to a polyurethane paint which is applied to vulcanized rubbers.

U.S. Pat. No. 4,125,522 to Becker relates to a polyurethane adhesive, whereas U.S. Pat. No. 3,966,530 to Cutts relates to triazoline diones which are utilized in lieu of chlorinated or halogenated donors for treating elastomeric surfaces to improve adhesion.

U.S. Pat. No. 4,143,454 to Utsonomiya relates to a method of attaching connecting parts of an offshore structure wherein a liquid rubber is applied over a treating solution which may contain a halogen molecule. As such, this reference lacks applicant's treating agent as well as repair of an elastomeric article having a patch thereon.

U.S. Pat. No. 4,158,378 to Pearson relates to a cured rubber tire having a specific polyurethane therein and to a chlorine water treatment. Hence, Pearson also fails to teach or suggest applicant's recited treating agent as well as the patched article.

British Pat. No. 1,352,645 relates to N- halogen sulfonamide treating agents which halogenize surfaces of synthetic and/or natural rubbers.

U.S. Pat. No. 3,991,255 to Blaskjiewicz relates to the adhesion of a polyurethane to an EPDM surface utilizing various adhesives, however, Blaskjiewicz does not use his treating agent to form a treating layer and utilizes elevated temperatures.

U.S. Pat. No. 4,300,970 to Honda does not disclose amine curable resins or an ambient temperature cure.

U.S. Pat. No. 4,240,852 to Gomberg relates only to the use of a cyanoacrylate adhesive.

U.S. Pat. No. 4,352,704 to Williams relates to applying tire tread to a tire. This patent lacks any suggestion of applicant's treating agent or the repair of a tire aperture.

U.S. Pat. No. 4,327,138 to Hausch fails to disclose a cured rubber patch in repairing a rubber article.

One prior art method of repairing a tire article relates to the utilization of a proprietary compound thought to be a mixture of rubber and accelerators which is applied to the aperture and then cured. In general, a very poor adhesion results and heat is required.

**DISCLOSURE OF THE INVENTION**

It is therefore an aspect of the present invention to provide a repaired reinforced elastomer article having a hollow therein utilizing a cured rubber patch and an amine curable polymer or prepolymer.

It is another aspect of the present invention to provide a repaired reinforced elastomer article, as above, in which the hollow extends into or through the reinforced material and the repair is made at ambient temperatures.

It is a still further aspect of the present invention to provide a repaired elastomer article, as above, in which a layer of a treating agent is positioned on the inner surface of said article and on the cured rubber patch.

It is yet a further aspect of the present invention to provide a repaired reinforced elastomer article, as above, wherein said repaired elastomer article is a tire, a conveyor belt or the like.

It is still another aspect of the invention to provide a repaired elastomer article, as above, wherein said cured rubber patch is located juxtaposition to said hollow.

It is yet another aspect of the present invention to provide a repaired reinforced elastomer article, as above, wherein said patch has one or more cords therein.

It is still another aspect of the present invention to provide a repaired reinforced elastomer article, as above, wherein said amine curable polymer or prepolymer is a urethane polymer or prepolymer, and wherein said treating agent is trichloroisocyanuric acid (trichloro-s-triazinetriene).

These and other aspects of the present invention, which will become more apparent from the following description, are achieved by: a repaired elastomer article, comprising: the elastomer article, said article having a hollow therein; a cured gum rubber disposed within said hollow; a treating agent applied to the inner surface of said article immediately surrounding said filled aperture, said treating agent selected from the group consisting of: N-halohydantoins, N-haloamides, N-haloimides, and combinations thereof; an amine curable polymer or prepolymer applied over the treated surface of said article; and a patch positioned over said polymer or prepolymer; wherein said polymer or prepolymer is cured in situ at room temperature; and wherein said elastomer article is cured and unsaturated.

#### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 relates to a cross-sectional view showing the repair of a reinforced elastomeric article having a hollow extending completely therethrough, according to the present invention.

FIG. 2 is a cross-sectional view showing the repair of a similar reinforced elastomeric article wherein the hollow extends only partially therethrough.

#### BEST MODE FOR CARRYING OUT THE INVENTION

The instant invention is useful in repairing reinforced elastomer articles wherein damage has been manifested as a chunk-out, leaving a hollow area in the article. The injury may extend completely through the article or only through a portion thereof, but reinforcement, that is cords, belts, or the like, contained in the article will have been partially or completely severed thereby providing a weakened area.

The invention can be seen with reference to the figures. As is readily apparent, the salient features in each are identical except that the hollow 120 in FIG. 2 does not extend completely through the substrate. For the sake of simplicity, all references to FIG. 1 shall have equal reference to FIG. 2, except for the dimensions of the hollow, as above. Referring then to FIG. 1, the article is generally indicated by the number 10, comprising a substrate 13 having embedded therein a plurality of reinforcement cords or belts 14, and a hollow 12.

The substrate 13 can be any conventional elastomer or rubber known to those skilled in the art and having unsaturated groups therein. For example, it can be made from conjugated dienes having from 4 to 12 carbon atoms such as butadiene, isoprene or the like. It can also be made from natural rubber, that is, from a substance which is obtained from various trees and plants which grow in the tropics or desert portions of the world. Such natural rubber generally has in excess of 90 and usually in excess of 95% of cis 1,4-polyisoprene content. The substrate may also be various elastomeric copolymers such as those made from monomers of conjugated dienes having from 4 to 12 carbon atoms as set forth

above and vinyl substituted aromatic compounds having from 8 to 15 carbon atoms. Examples of such vinyl substituted aromatic compounds include styrene, alpha-methylstyrene, and the like. An example of a specific copolymer is styrene-butadiene rubber. Naturally, other types of rubber compounds can be utilized such as the so called butyl rubbers, neoprene, that is polychloroprene, and the like.

The preparation of such above noted various elastomers is well known to the art and the article in need of repair is often in the form of a tire, especially an off the road tire, a conveyor belt, or similar article. Regardless however of the type or nature of the article, it is desirable to clean the surface of the hollow prior to repair. Cleaning can take place as through a physical treatment of the area to be repaired, for example, as through buffing or skiving, that is, cutting or as removing a portion of the surface. Another method involves the use of any conventional organic solvent to remove dirt and residue. Typical solvents include acetone and ethyl acetate.

The next step in utilizing the invention is the packing of a quantity of uncured gum rubber 22 into the hollow 12, most preferably from the outer surface defined as that surface of the substrate opposite where a patch 20 is later positioned. The gum rubber is then cured in placed using conventional means such as a pair of heated plates, otherwise known as spotters, one applied to the outer surface 24 and one to the inner surface of the substrate.

The types of gum rubber which can be used are well known in the art, being generally composed of compounds of natural rubber or rubber blends and typically having other compounding ingredients such as sulfur, carbon black, accelerators, and the like. A variety of all purpose repair gums, readily available commercially, can be used. Alternatively, one skilled in the art can readily devise a suitable gum rubber recipe without undue experimentation.

Once the gum rubber has been cured in place, the innerside is buffed around the now filled aperture and a treating agent 16 applied both to the substrate and the cured gum rubber surfaces, which should of course be first cleaned as outlined above. An amine curable polymer 18 is then applied to the inner surface after having been first allowed to thicken or partially "set up", resulting in an increase in viscosity to several thousand centipoise. This results in a toothpaste-like consistency helping hold the polymer in place while the patch is applied.

The patch, after being buffed and having received a coating of treating agent 16, is then applied to the polymer surface. It is thereafter temporarily taped into place and held by some form of applied pressure, such as, in the case of a tire, a curing tube or a plurality of sand bags. The repair is allowed to set in this position for approximately 24 hours. The end result is a repaired article having much better strength and durability than one repaired according to heretofore known methods.

In the embodiment of FIG. 2, the hollow 120 in the article 100 is in the form of a cavity wherein some cords 140 of the reinforced article have been damaged, severed, or the like. Usually at least 25 percent of the cords have been broken or damaged and the article is repaired utilizing a patch. Either the cavity can be filled or the patch applied first. In repair of cavity 120, the surface is first cleaned. The cavity is then filled with a gum rubber 220, generally to the level of the substrate 130. Natu-

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