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METHOD OF COATING WIRE

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5 Claims. (Cl. 154—2)

The present invention relates to methods by means of which the surface of wire or other metal objects may be caused to adhere effectively to rubber. More particularly, the invention relates to coated wires and the method of manufacture thereof by means of which the wire may be caused to adhere effectively to rubber when it is imbedded therein.

This is a continuation in part of my application, Serial No. 45,784, filed October 19, 1935.

In the manufacture of vehicle tires, it is common to use a bead wire to maintain the rim-engaging portion of the tire constant in circumference, the wire being imbedded in a coating of rubber. One of the requirements for use in this connection is that the wire must adhere effectively to the rubber, a condition which has proved difficult to secure.

In accordance with the present invention it is proposed to provide a wire, or other metal object, to the surface of which rubber may be caused to adhere effectively.

A further object of the invention is to provide a wire, the surface of which is formed in such fashion as to enable the wire to be imbedded in rubber, as, for example, when utilized as a bead wire for a vehicle tire, the rubber adhering effectively to the surface of the wire.

A further object of the invention is to provide a method by means of which the surface of a wire or other metal object may be treated to cause rubber to adhere effectively thereto.

A further object of the invention is to provide a method by means of which wire or other metal may be coated in such fashion as to cause rubber to adhere effectively thereto.

A further object of the invention is to provide a method by means of which wire or other metal may be caused to adhere effectively to rubber by providing on such wire or other metal a non-metallic coating, such coating preferably containing salts of certain metals.

Further objects of the invention will be apparent as it is described in further detail and, in order that the invention may be more readily understood, one specific embodiment thereof will now be described.

In order that the surface of the wire may be such as to cause rubber to adhere closely and effectively thereto, the wire is first cleaned thoroughly, as by pickling in an acid solution, and may then either be treated directly with the coating bath later described, or coated with zinc or cadmium. The zinc or cadmium may be applied in any desired maner, employing any of the methods now commonly used in coating wire and other objects, the particular manner in which the coating of zinc or cadmium is applied to the wire being of no importance insofar as the present invention is concerned.

The cleaned or zinc or cadmium coated wire is immersed in a bath containing copper sulphate and ammonium molybdate. The solution in which the coated wire is immersed thus contains a salt or combination of salts of heavy metals, copper sulphate and ammonium molybdate having been found to produce particularly good results.

A solution for coating the wire which has been found to be exceptionally satisfactory is as follows:

	Parts
Copper sulphate	5.0
Ammonia water	0.7
Nitric acid	1.3
Molybdic acid	0.3
Water	92.7

The above described coating bath may, of course, be varied by increasing or decreasing the proportions of the various ingredients, as may be found desirable.

The foregoing process forms, on the metallic surface which is to adhere to rubber, a film which apparently reacts with the sulphur contained as a binder in the rubber. It is believed that such reaction liberates a small amount of sulphur which in turn combines with the metallic surface to form a continuous bond between the rubber and the surface.

It is to be noted that a factor of great importance in connection with the present invention resides in the use of a non-metallic film on the metal surface, such film consisting of products of the reaction between the metallic surface and the solutions into which the surface is dipped. The coating contains some copper and possibly slight traces of molybdenum, as well as salts of these metals. Actual analyses made of the zinc or cadmium coated wires having the coating above described show the coating to be composed of copper and molybdenum and zinc or cadmium sulphates, nitrites and sulphites. Since the solution is acidulated by nitric acid, nitrates of the metals are formed. It appears that some reaction takes place with the metallic coating of the wire reducing the nitrates to nitrites, thereby resulting in the presence of the above nitrites. When the term "coaction product" of copper sulphate and ammonium molybdate are used hereinafter in the specification or claims, the term will be understood to embrace substantially the

above mentioned compounds and elements, combining the same in proportions varying with the treatment accorded the particular metal.

The adhesion values derived from connections of this character are tested by placing the coated wire or other metallic object in a suitable mold and introducing raw rubber around it so that two inches of the wire are embedded in the rubber. The whole is then placed in a hydraulic press and cured at 270° F. for 55 minutes. The rubber conforms to the size of the mold, which is 2" x 4". After the rubber and wire have been allowed to stand 24 hours, the wire is pulled out of the rubber, the number of pounds required to pull the wire from the rubber being the adhesion value obtained. Comparative tests on wire coated in the copper sulphate-ammonium molybdate bath and with various other coating compositions gave the following results. Ordinary steel wire requires about 8 pounds, while zinc coated wire requires about 43 pounds. The type of coating obtained by immersion in the copper-sulphate-ammonium molybdate bath produces values in the neighborhood of 100 pounds. Copper sulphate, acidulated by sulphuric acid (about 5%) results in a value of about 60 pounds, while copper sulphate solution made ammoniacal by the addition of 10 c. c. of ammonia results in a value of about 80 to 85 pounds.

It has been found, also, that wire coated in accordance with the above-described process retains its adhesion value almost indefinitely. As is well known, copper or other metal coated wires tend to lose their adhesiveness for rubber, either after vulcanizing, or deteriorate to a point where no improved adhesive effect over ordinary metal is obtained, if not promptly vulcanized to rubber.

While the invention has been described with specific reference to the method and substances outlined above, it is obvious that similar and equivalent substances having like properties may be utilized without departing from the scope of the present invention, as defined in the appended claims.

I claim:

1. The process of vulcanizing rubber to a metal selected from the group consisting of zinc and cadmium, immersing the metal in an acidified solution of copper sulphate and ammonium molybdate and vulcanizing rubber to the coated metal.

2. The process of vulcanizing rubber to metal comprising coating the metal with a metal selected from the group consisting of zinc and cadmium, the coating metal used differing from the coated metal, immersing the coated metal in an acidified solution of the reaction products produced by mixing about 5 parts copper sulphate, about 0.3 part of molybdic acid and about 0.7 part of ammonia water and vulcanizing rubber to the coated metal.

3. The process of vulcanizing rubber to metal comprising cleaning the object, immersing the object in an aqueous solution prepared by dissolving about 5 parts of copper sulphate, about .3 part of molybdic acid in slightly ammoniacal water and acidifying said solution to form a non-metallic coating comprising a reaction product of said metal and solution, drying the metallic object, and vulcanizing rubber to the coated metal.

4. A method of making a rubber coated wire comprising forming on a wire containing a metal selected from the group consisting of zinc and cadmium, a non-metallic coating by immersing the wire in a bath prepared by dissolving copper sulphate and molybdic acid in a slightly ammoniacal aqueous solution and acidifying the solution, placing the coated wire in a mold, introducing rubber around the wire in said mold and heating under pressure for a sufficient length of time to cure the rubber and cause it to adhere to said coated wire.

5. A rubber coated article comprising a metallic body, a metallic coating thereon of copper and molybdenum, a metal selected from the group consisting of zinc and cadmium, a non-metallic coating consisting of the sulphates, sulphites and nitrites of copper, molybdenum and said metal and a tightly adherent coating of rubber formed on said non-metallic coating.

BENJAMIN LEWIS McCARTHY.

CERTIFICATE OF CORRECTION.

Patent No. 2,226,938. December 31, 1940.

BENJAMIN LEWIS McCARTHY.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, second column, line 39, claim 5, strike out the comma and insert instead the word --and--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 4th day of February, A. D. 1941.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.