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COATED WIRE

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Fig. 1.

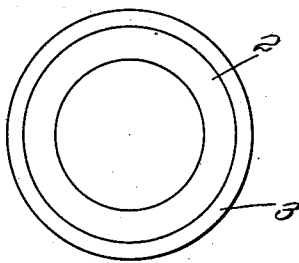
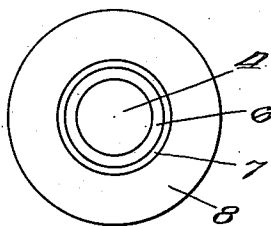


Fig. 2.



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COATED WIRE

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4 Claims. (Cl. 204—35)

This invention relates to a coated wire and a method of preparing the same.

As set forth in Domm Patents Nos. 2,002,261 and 2,002,263, issued May 21, 1935, wire suitable for incorporation in a rubber tire bead compound may be produced by coating a ferrous base wire separately with zinc and copper, the copper being thin enough to alloy throughout with the zinc under atmospheric or vulcanizing temperatures so that a layer of brass is produced at the surface which will then adhere firmly to the rubber.

The present process is an improvement upon the process set forth in the Domm patents, in that the wire is produced at a lower cost and, because of the new method of production, it is possible to use lesser amounts of zinc and copper in order to produce the same effect from the standpoint of permanence, adherence and corrosion-resistance.

In the Domm process the wires were first drawn down to the desired size, generally around .039 to .043 inches in diameter, after which they had to be carefully cleaned to remove the cleaning compound used in drawing. The wires were then hot galvanized, after which they were copper-plated to the desired thickness.

In the present process the wires are galvanized before drawing, and are then coated with copper of the desired thickness and drawn to the desired size. It was anticipated that this method of procedure would leave the wires deficient in zinc, inasmuch as the amount of zinc applicable by the hot dipping method is fixed within narrow limits.

The invention is illustrated in the drawing in which Figure 1 illustrates the original coated wire and Figure 2 represents the drawn wire coated with rubber. As shown in Figure 1, a ferrous base wire is coated with a thin coating of hot galvanized zinc 2 to which is applied a layer of electroplated copper 3.

In the corresponding view in Figure 2 the wire has been reduced in area and the reduced wire 4 is shown coated with a thinner layer of zinc 5, a reduced layer of copper 7 and a vulcanized rubber coating 8.

Instead of zinc, tin, lead or cadmium may be employed.

As an example of the process, steel tire bead wires having a diameter of .060 to .070 are thoroughly cleaned, drawn through a flux, such as a saturated solution of zinc ammonium chloride, the excess solution removed, and the wires drawn through a bath of molten zinc.

The temperature of the zinc bath is prefer-

ably in the range of approximately 820° to 840° F. The wire is wiped after the zinc plating operation by what is known as the "tight wipe" method. In this process the amount of zinc added is approximately 6 to 15 grams per kilogram of .070 wire, or approximately .00013 to .00033 inch in thickness.

The zinc coated wire is then cleaned and passed into a copper plating bath. The plating is preferably carried out by the cyanide process, using a solution, for example, containing 4½ ounces of sodium cyanide, 3 ounces of copper cyanide, 2 ounces of sodium carbonate and ¼ ounce of sodium hyposulphite per gallon. Generally several consecutive plating baths are used. A satisfactory current density is 30 amperes per square foot.

Care must be observed in avoiding gas bubbles and it is preferred to circulate the electrolyte continuously at a temperature of about 120° F.

Copper is applied to the wire in the amount of approximately ½ to 3 grams per kilogram of .070 inch wire.

The plated wires are washed and may then be drawn without special lubricant to reduce them to the desired size. This may be within the range of .039 to .043 inch, but it is preferred to reduce the diameter to .025 inch. The copper itself acts as an effective lubricating material. The drawing does not adversely affect the adherence of the coating to rubber.

When so reduced the zinc coating has a thickness of approximately .00004 to .0001 inch. This range is materially less than that shown to be desirable for the zinc coating in the Domm patents. Nevertheless the corrosion resistance of the wire under conditions of use is quite comparable.

The thickness of the copper coating ranges from approximately ¼₄₀₀₀₀₀ inch to ¼₆₀₀₀₀ inch. While these figures overlap the range described in the Domm patents, the minimum thickness suitable under the present process is about 40% lower than the minimum shown in the Domm patents. This is in spite of the fact that some of the copper is lost in the drawing operation.

The reason for the improvement is not understood, but it may lie in the fact that the copper is more uniformly distributed over the surface than was the case with the Domm process.

As already explained, in place of the zinc other corrosion-resisting metals may be used, and particularly those which will alloy with copper or will produce with the copper a rubber adherent coating. Such metals include (besides zinc), cad-

mium, tin and lead, and alloys thereof. In general it is preferred to apply such corrosion-resisting metals in substantially pure state, that is, at least 90% of the added metal of the initial layer will normally consist of one or more of the corrosion-resisting metals, but it is frequently possible to use alloys containing less than this proportion of the corrosion-resisting metal. The metals alloyed with the corrosion-resisting metals in the initial coat may be any metal desired for that purpose and which does not interfere with the subsequent operations. Small percentages of aluminum, magnesium, antimony, copper or arsenic are frequently used in the lower coat.

The use of zinc or cadmium is much preferred to lead or tin. Zinc and cadmium provide an electro-positive coating which acts electrolytically and protects even though the coating is not complete. Tin and lead provide mechanical protection which is excellent if complete, but under present methods of application this is not accomplished. The coating of corrosion-resistant metal is, however, more continuous under the present system than before. While cadmium is chemically preferred to zinc, it is much more expensive, so that economically zinc is preferable. Tin is considerably more effective than lead.

During the drawing operation the wire of course rises to a temperature of several hundred degrees. At this temperature, due to the extreme thinness of the copper coating, there is some incipient alloying with the zinc, but the color of the wire does not change to that of brass. It is possible that the advanced temperature, with the resultant increased diffusion and the initial alloying which may occur, is responsible for some of the improved properties. The pressure of the drawing operation of course tends to increase the intermixture of copper and zinc.

I claim:

1. A copper coated article comprising a ferrous metal wire, a coating of a corrosion resistant metal of the class consisting of zinc, cadmium, lead and tin on the wire, said coating having a thickness between approximately 0.00004 and 0.0001 inch, a thin copper coating thereon having a thickness of less than approximately $\frac{1}{400000}$ inch and not less than $\frac{1}{4000000}$ inch, the wire and coatings having been substantially reduced in cross sectional area by drawing through a die, and the resulting wire having a corrosion resistance markedly greater than an undrawn wire having the same thickness of the metal of the class consisting of zinc, cadmium, lead and tin.

2. An article as set forth in claim 1, in which the underlying coating is zinc.

3. In the production of copper coated ferrous base articles, the step of producing a rubber adherent coating by separately coating ferrous wire with a thin layer of corrosion resistant metal of the class consisting of zinc, cadmium, tin and lead, said coating having a thickness between 0.00013 and 0.00033 inch, applying a layer of electro-plated copper thereon, and drawing the coated wire substantially to reduce its diameter until the metal of the class consisting of zinc, cadmium, lead and tin has a thickness of approximately 0.00004 to 0.0001 inch, the copper being of a thickness initially to produce at the conclusion of the drawing a coating having a thickness of less than approximately $\frac{1}{400000}$ inch and not less than $\frac{1}{4000000}$ inch, the resulting wire having a corrosion resistance markedly greater than an undrawn wire having the same thickness of the metal of the class consisting of zinc, cadmium, lead and tin.

4. The method as set forth in claim 3, in which the first coating metal is zinc.

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