The present invention relates to a material for, and a method of, selective carburizing of steel involving the formation during the carburizing operation of a continuous metallic coating for those portions of the workpiece which are to be protected from the carburizing reagents.

It is the principal object of the present invention to provide an improved and simplified material and method for protecting portions of articles against the action of carburizing materials in order to produce a steel article having a portion of its surface carburized and the remainder retained in its initial soft condition.

More specifically, it is an object of the present invention to provide a stop-off paint adapted to protect the area of a steel article on which it is coated from the action of a molten salt cyanide carburizing bath.

Other objects and advantages of the invention will become apparent from the following specification and the claims hereinafter set forth.

In accordance with the present invention, the article to be carburized is painted with a mixture of two powdered metals suspended in a liquid adhesive vehicle which is of such character that it will dry to an adherent film.

The vehicle in which the powdered metals is suspended should be an organic compound which will dry into an adherent film and burn off at the carburizing temperature. The preferred vehicle is a paracoumarone resin type of varnish, but other types of varnish or lacquer may be employed with excellent results. Among the varnishes which have proven satisfactory are natural resin varnishes, maleic resin varnish, glycercynaphthalate resin varnish and phenol-formaldehyde resin varnish. Ordinary clear brushing lacquer is also effective. Water soluble paint, such as dextrin solutions, may also be employed, but are inferior to resins and lacquers in that they have a tendency to flake off unless handled with extreme care. It will be obvious that many other adhesive vehicles are available which may be employed for the same purpose.

The two metals required are copper, which has a high melting point, and a low melting point metal from the group consisting of tin, lead, and aluminum. If the amount of metal of low melting temperature is insufficient the coating will be porous, and will not protect the coated article from the carburizing bath. If the amount of low melting point metal is excessive, there will be a tendency of the material to flow on the surface. To avoid flowing of the material, it is generally necessary to employ a mixture of metals in which the metal of lower melting point does not exceed 20% of the total.

The preferred metals are copper and tin employed in proportions of from 90% to 98% copper and the balance tin. If less than 2% tin is employed, consistently good results are not obtained due to the fact that as the result of leakage through the coating some carburization of the underlying surface will occur. Amounts of tin in excess of 10% may be employed, but such larger amounts tend to cause a slight flow of the material onto the uncoated portion at carburizing temperatures (i. e., 1500° to 1750° F.).

Satisfactory results in the selective carburization of steel may be achieved by substituting similar proportions of either lead or aluminum for tin in the above described material.

The powdered metal and vehicle are preferably thoroughly mixed in the proportions of four parts of metal to one part of vehicle by weight. While this proportion appears to give most satisfactory results, it is not critical and, therefore, minor variations in the ratio of metal to vehicle may be indulged in without adverse results. The resulting paint may be coated on the work by spraying, dipping or brushing.

After the vehicle is dried, the coated article is placed in a molten cyanide salt bath of the type conventionally employed for steel carburizing. Such baths contain as the principal active agent sodium cyanide, together with other salts, such as sodium chloride and sodium carbonate. Where it is necessary to hold the articles in the bath for any substantial period of time, as is often the case in carburizing steel, it is found that baths containing a large percentage of sodium cyanide attack the copper coating and destroy it. Consequently, it is preferred to use a bath containing a relatively small percentage of sodium cyanide, in the order of 3% to 12%, and from 40% to 80% of barium chloride, the remainder of the bath comprising any of the neutral salts commonly employed in carburizing baths, such as sodium chloride, sodium carbonate and the like. This type of bath is preferably operated with a cover of carbonaceous material, which is floated upon the top of the bath in the usual manner, since such covers reduce or eliminate fuming. Baths of this type are ordinarily operated at temperatures within the range of 1500° to 1750° Fahrenheit, and at such temperatures a satisfactory protective coating is produced with the above mentioned
mixtures of copper and tin, copper and lead, or copper and aluminum.

It will be apparent that there is provided in accordance with the present invention an exceedingly simple and effective method of selective carburizing which does not require skilled electroplaters or electroplating apparatus but may be practiced by unskilled persons in any heat treating plant. It is further apparent that the invention greatly simplifies the problem of selective carburizing by making it possible to selectively carburize articles in a single operation with a minimum of preparation.

The selective carburizing method of the present invention is limited to molten cyanide salt bath carburizing because the atmosphere in solid pack or gas furnace carburizing does not have reducing properties to the degree necessary.

What is claimed is:

1. The method of selectively carburizing a steel article in a molten bath of salts containing sodium cyanide which consists in coating a portion of the article to be carburized with a liquid vehicle adapted to dry into an adherent film that will burn off in its entirety at carburizing temperatures in which vehicle is suspended a mixture of one part of powdered metal from the group consisting of tin, lead and aluminum and from about four to fifty parts of powdered copper, allowing the vehicle to dry and then immersing the coated article in the carburizing bath at a temperature between 1500° F. and 1750° F.

2. A stop-off paint for selective carburizing in molten cyanide salt baths comprising an organic liquid vehicle adapted to dry to an adherent film that will burn off in its entirety at carburizing temperatures, and a mixture of powdered copper and a powdered metal from the group consisting of tin, lead and aluminum suspended in the vehicle, the proportions of the two metals being approximately four to fifty parts of copper to one part of the other metal.

3. A stop-off paint for selective carburizing in molten cyanide salt baths comprising an organic varnish which will burn off in its entirety at carburizing temperatures, and a mixture of powdered copper and a powdered metal from the group consisting of tin, lead and aluminum suspended in the varnish, the proportions of the two metals being approximately four to fifty parts of copper to one part of the other metal.

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