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UNITED STATES PATENT OFFICE.

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CALORIZING IRON OR STEEL SURFACES.

No Drawing. Application filed July 7, 1923. Serial No. 650,162.

To all whom it may concern:

Be it known that I, SAMUEL F. COX, a citizen of the United States, residing at Wilkinsburg, Allegheny county, Pennsylvania, have invented a new and useful Improvement in Calorizing Iron or Steel Surfaces, of which the following is a full, clear, and exact description.

The present invention relates to calorizing, and more particularly to the calorizing of steel or iron surfaces. The term "calorizing" has been recently adopted in the art to identify the process of rendering the surface of oxidizable metals inoxidizable by heat treatment with another metal, usually aluminum, which forms a surface alloy which is inoxidizable at high temperatures.

Methods of calorizing are disclosed in the following patents: Van Aller, 1,155,974; Gilson, 1,091,057; Ortiz, 1,409,017; Ruder, 1,346,062, and Dantsizen, 1,381,085.

The present invention relates particularly to the application of the calorizing process, as outlined in the above patents, to calorizing iron and steel articles. It has been found that the lower the carbon content of the steel or iron, the better the calorizing. For example, special low carbon irons, such as the so called ingot iron, can be calorized better than irons or steels containing a greater amount of carbon. For many purpurposes, however, it is undesirable or impracticable to employ the special grades of low carbon iron.

By means of my process, the ordinary commercial grades of iron and steel, such for example, as open-hearth steel, may have their surfaces calorized with as good an effect as the special low carbon steels.

This is accomplished by a surface decarbonization by which the surface, to a depth of approximately that of the desired penetration of the aluminum, is chemically decarbonized.

The articles whose surfaces are to be calorized may be decarbonized by any of the usual methods. One way of surface decarbonization is heating the iron and steel in contact with metal scale. Another method of decarbonizing consists in heating the articles in a furnace with free contact of air until the articles are coated with scale, and the desired surface decarbonization is secured. The decarbonization can be accelerated by passing air over the surfaces at high velocity.

The decarbonized surfaces are, of course, thoroughly cleaned, as for example, by pickling, and are then in condition to be calorized by any of the usual calorizing methods. Since the specific methods of calorizing form no part of this invention, they are not described in detail. Any of the methods described in the patents above referred to may be employed, or the method of calorizing described in my copending application, Serial No. 650,163, filed of even date herewith, may be employed.

My process of calorizing which involves surface decarbonization apparently gives a better endurance to the calorizing, particularly where the articles are exposed to high heat for long periods, than does the simple calorizing of special low carbon irons. The effect of carbon is apparently to hinder penetration of the aluminum. In my process, the surface of the iron in which the high aluminum alloy is desired is decarbonized so that penetration will take place readily into the decarbonized layer. The higher carbon content of the steel beneath the surface layer, however, hinders the penetration and undesirable dissipation of the aluminum into the interior of the article.

While I have specifically described the preferred embodiment of my invention, it will be understood that the invention is not limited to the details above described, but may be otherwise embodied within the scope of the following claims.

I claim:

1. Those steps in the process of rendering a steel or iron surface substantially inoxidizable at high temperatures, which consists in chemically decarbonizing the steel or iron surface portion, and thereafter calorizing the decarbonized surface.

2. Those steps in the process of rendering a steel or iron surface substantially inoxidizable at high temperatures, which consist in scaling the steel or iron surface, and oxidizing an element in a layer below the surface, cleaning it, and thereafter calorizing it.

3. Those steps in the process of rendering a steel or iron surface substantially inoxidizable, which consist in increasing the alloying characteristics of the outer layer of the metal by the reduction in content of an

element therein, and coating and penetrating the surface of said metal by a calorizing metal and alloying said metals at their points of contact.

4. Those steps in the process of rendering a steel or iron surface substantially non-oxidizable to a predetermined depth, which consist in removing the carbon by oxidation from a surface layer of predetermined thickness, leaving a surface layer of increased penetrability, and penetrating and alloying said surface layer with a calorizing metal.

5. As a new article of manufacture, a steel or iron article having its surface portion only decarbonized, the decarbonized surface being also calorized.

6. As a new article of manufacture, an iron or steel article having its surface portion of increased penetrability and alloying characteristics compared with its interior, and a calorizing metallic coating thereon and alloyed thereto within the surface portion.

In testimony whereof I have hereunto set my hand.

SAMUEL F. COX.