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UNITED STATES PATENT OFFICE.

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OXIDATION-RESISTING MATERIAL.

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The invention relates to metallic alloys which are resistive to oxidation at high temperatures, and it is the object of the invention to obtain a material which combines with this characteristic other valuable properties. In the present state of the art certain known alloys have the property of resisting destructive oxidation under high temperature by the formation of a protecting coating of oxide of one of the ingredients on the exposed surface. These materials, while useful for many purposes such, for instance, as electrical resistors, are lacking in properties essential to other uses in the arts. In particular, such alloys are usually lacking in tensile strength, are coarse grained and liable to fracture in casting. I have discovered a means for correcting these objectionable characteristics and have obtained a product which, in addition to its oxidation-resisting quality, possesses other valuable physical properties.

Because of their low cost, ferrous alloys are preferable to alloys using less abundant metals. It is known that a small percentage of aluminum combined with iron will form a durable material for an electrical resistor, but such an alloy is not suited for other uses for reasons above described. Thus, most of the useful characteristics of iron and steel, such as high tensile strength, fine grain, etc., are destroyed by the addition of a relatively small percent of the aluminum. With the present invention the objectionable characteristics are eliminated and I have discovered, as one means of effecting this result, a specific proportion of the ingredients. Thus where aluminum is used as the protective element and is combined with iron or steel, I have discovered that an alloy having nineteen and one-half percent of the aluminum has a much greater tensile strength than any alloy with a larger or smaller percentage of this ingredient and I use these metals in these proportions to obtain this result.

Another corrective for the objectionable properties is the introduction into the alloy of a material having grain-refining characteristics. I have discovered that for aluminum steel alloy a suitable grain-refining material is titanium in the proportion of from one to five percent. Other metals which may be employed for this purpose are nickel, chromium, vanadium, manganese, molybdenum, tungsten, cobalt, zirconium, silicon, uranium, boron, magnesium, copper and cerium.

In the manufacture of the alloy the aluminum and the iron or steel are separately melted at temperatures corresponding to their respective fusing points. The fused metals are then thoroughly commingled under conditions protecting the same from excessive oxidation. Titanium, or other grain-refining element, is also introduced into the mixture and thoroughly commingled. I have found that a rocking furnace is suitable for this purpose and preferably one in which the heat is generated electrically, the metals being protected by a neutral gas or slag.

In casting the metal it is of the utmost importance to prevent the inclusion of any oxide of the metal in the molten mass within the mold cavity and I use methods of casting that exclude and prevent the intermingling of any oxide of either metal in the mass of the metal.

The new product is useful for many purposes, one specific instance being the manufacture of carbonizing boxes. Such boxes are exposed at high temperature to an oxidizing atmosphere, and as they are filled with metallic articles which are being heat-treated, a considerable amount of mechanical strength is required. My alloy is both oxidation resisting and of sufficient mechanical strength to be used for such purposes.

What I claim as my invention is:

1. A heat resisting ferrous alloy having an aluminum content of from 12 to 20 percent and at least one per cent of a grain-refining material.

2. A heat resisting ferrous alloy having an aluminum content of from 12 to 20 percent and at least one per cent of titanium.

3. A ferrous alloy having an aluminum content of approximately nineteen and one-half percent and at least one per cent of a grain-refining material.

4. A ferrous alloy having an aluminum content of approximately nineteen and one-half percent and from one to five per cent of titanium.

In testimony whereof I affix my signature.

RUDOLPH F. FLINTERMANN.