Patented June 30, 1925. 1,544,037

UNITED STATES PATENT OFFICE.

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NICKEL-CHROMIUM ALLOY AND PROCESS OF MAKING SAME.

No Drawing. Application filed June 13, 1919, Serial No. 304,019. Renewed August 19, 1924.

To all whom it may concern:

Be it known that I, MILTON J. ROSENCRANTZ, a citizen of the United States of America, residing in the borough of Manhattan, city, county, and State of New York, have invented certain new and useful Improvements in Nickel-Chromium Alloys and Processes of Making Same, of which the following is a specification.

This invention relates to metal alloys, and to processes of producing the same, and aims to provide improvements therein.

The present invention provides an alloy having as its principal constituents, nickel and chromium which is highly useful in the treatment of other metals and alloys.

The present alloy has the property of increasing the tensile strength, of rendering less oxidizable and less carbonizable at high and ordinary temperatures, of making more acid and alkali resistant, and of rendering more readily machinable, malleable and ductible, other metals with which it may be alloyed or combined. The present alloy also improves castings of other metals to which it may be added or alloyed.

The invention further provides a process for producing such alloy.

The following gives a full description of the invention, together with one particular example of a method, according to the present invention, of producing an alloy embodying the invention.

Nickel from 40% to 80% (for example 60%), chromium from 10% to 30% (for example 18%), and silicon, from 5% to 15% (for example 10%), are placed in a crucible, which preferably has been previously warmed, and the batch brought to a molten state, the temperature of fusion being about 2800° to 2900° F. Molybdenum, about 2%, and zirconium, are now to be added to the melt. The zirconium is preferably added in the form of ferro-zirconium, from 5% to 20% of ferro-zirconium being used (for example 10%). Samples of ferro-zirconium which have been thus used have shown on analysis about 25% zirconium, the remaining constituents in the ferro-zirconium being silicon, aluminum, and iron.

Summary:—Nickel, 40–80%; chromium, 10–30%; silicon, 5–15%; molybdenum, 0–2%; ferro-zirconium, 5–20%.

The introduction of the molybdenum and ferro-zirconium into the melt must be carried out with special precautions, if the beneficial action of these metals upon the melt, and which I have found to be practically necessary, are to be obtained, as there is in any case a violent reaction, accompanied by a rapid gasification owing to the fact that a part of the molybdenum and zirconium forms oxids or other compounds with impurities in the melt, which oxids and other compounds being either gaseous or liquid, flow or escape to the surface of the molten metal and form slag or go off into the air. In order to effect the introduction of the molybdenum and ferro-zirconium into the melt, I have found it highly desirable to previously heat the molybdenum and ferro-zirconium to a degree just under their melting point, and to then immediately and quickly introduce them into the melt, immediately stir, and thereupon to bring the temperature down as rapidly as possible, preferably by immediately casting into ingots. The union of the molybdenum and ferro-zirconium with the melted nickel, chromium and silicon, should be made to take place almost instantly, as if the molybdenum and ferro-zirconium are maintained at a temperature at or near their melting point for any length of time, they volatilize and pass off, leaving only slag.

In practice it is best to use graphite crucibles in which to make the alloy, but it is found practically necessary to line these with a refractory non-carbonaceous lining, as, for example, fused alumina, which lining prevents contact between the fused contents and the carbon of which the crucible is made.

It has been found to be of much importance in producing the alloy to exclude carbon as much as possible.

Analysis of the alloy shows none or but a small proportion of molybdenum and ferro-zirconium originally introduced into the melt, the action of the molybdenum and ferro-zirconium being not clearly understood, except as to the results obtained, being probably a deoxidizing or scavenging action. There is, however, produced an effect in the alloy, which is carried into other metals or alloys to which the present alloy may be added.

The alloy has a coarse, crystalline structure, and at the present time no particular use therefor is known to me other than its use in connection with the production of other alloys or metals.

In forming the alloy, the molybdenum may be omitted, in which case it is advisable to slightly increase the percentage of ferro-zirconium used.

Moreover, in forming the alloy, the silicon may be omitted. The effect of this would be to make the alloy more ductile and less acid-resistant and hence to carry these properties into the other metals or alloys to which the present alloy may be added.

Moreover, by decreasing the percentage of chromium in the alloy, and correspondingly increasing the percentage of nickel therein, the alloy is less acid-resistant and more ductile, and vice versa where the chromium percentage is increased and the nickel percentage correspondingly decreased. The corresponding properties are carried into the other metals or alloys to which the present alloy may be added. The present alloy is conveniently designated by the name "Berlozite."

By using a small percentage, as, for example, 2%, of the present alloy in steel, its tensile strength is considerably increased and it is rendered more acid-resistant. The steel is also more ductile and malleable and less oxidizable and carbonizable at high temperatures than when not treated with the present alloy.

Moreover, as described in an application filed June 13, 1919 Serial No. 304,018, by adding the present alloy to alloys of nickel and chromium, an exceptionally close-grained, ductile, malleable, acid and alkali-resistant, non-oxidizable and non-carbonizable metal is obtained.

The inventive ideas herein disclosed are capable of being expressed in practices other than as herein specifically described. Moreover, it will be apparent that the alloy may be varied within wide limits as to its constituents, while maintaining its generic virtues.

What is claimed is:—

1. A process of making a nickel-chromium alloy, comprising melting nickel and chromium, and introducing zirconium into the melt.

2. A process of making a nickel-chromium alloy, comprising melting nickel and chromium, introducing zirconium into the melt and excluding carbon from the melt during the process.

3. A process of making a nickel-chromium alloy, comprising melting nickel and chromium and introducing zirconium and molybdenum into the melt.

4. A process of making a nickel-chromium alloy, comprising melting nickel and chromium and introducing zirconium into the melt, the zirconium being in the form of ferro-zirconium.

5. A process of making a nickel-chromium alloy, comprising melting nickel, chromium and silicon, and introducing zirconium into the melt.

6. A process of making a nickel-chromium alloy, comprising melting nickel, chromium and silicon, the percentage of nickel being from 40–80%, the percentage of chromium being from 10–30%, and the percentage of silicon being from 5–15%, introducing zirconium and molybdenum into the melt, the percentage of zirconium in the form of ferro-zirconium being from 5–20%, and the percentage of molybdenum being up to 2%, and excluding carbon from the melt during the process.

7. An alloy of nickel and chromium containing from 40–80% nickel and 10–30% chromium, said alloy having a coarse crystalline structure, being extremely acid-resistant and highly heat-resistant, having a small percentage or traces of zirconium, and having the property of imparting a dense and homogeneous structure to other metals with which it may be added, as well as improving the casting of metals.

8. An alloy of nickel and chromium containing from 40–80% nickel, 10–30% chromium and 5–15% silicon, said alloy having a coarse crystalline structure being extremely acid-resistant and highly heat-resistant, having a small percentage or traces of zirconium, and having the property of imparting a dense and homogeneous structure to other metals with which it may be added, as well as improving the casting of metals.

In witness whereof, I have hereunto signed my name.

MILTON JOHN ROSENCRANTZ.