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UNITED STATES PATENT OFFICE.

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COMPOSITION OF MATTER FOR ALLOY OF METALS.

No Drawing. Original application filed November 15, 1924, Serial No. 750,132. Divided and this application filed June 2, 1925. Serial No. 34,476.

The alloy herein set forth is a division of the patent application, filed under the date of Nov. 15, 1924, bearing the United States Serial Number 750,132, and according to the division required therein.

Our invention relates to a composition of various elements and metals for forming a suitable alloy for making non-oxidizable castings, having special heat resisting properties as may be required for castings constantly exposed to extreme heat and highly oxidizing conditions.

Another object is to produce an alloy suitable for moulding metal parts on steel machined sections, forming complete fusion therewith without distorting or changing the steel section, the alloy having an extremely high melting point and rapid heat conduction properties making it solidify quickly upon a slight lowering of the temperature, as when coming into contact with cast-in metal parts.

A further object is to produce an alloy having great heat resisting properties, preventing the resulting alloy from any molecular change in the metal, either by warping or change in hardness, when subjected to high heat temperatures.

A still further object is to produce an alloy that will resist oxidization under extreme conditions, even to nearly its fusing point.

It is common practice in manufacturing castings for gas engine valves, to use an alloy having special heat resisting properties, for the valve cap, casting a machined steel stem therein, by placing the steel stem within the mold before pouring the molten alloy therein, then turning the comoined casting and stem into a finished steel part. In this construction the alloy cap must be so designed as to cover the exposed steel stem in places subjected to extremely high temperatures, and the enclosing alloy must possess properties for resisting any molecular change and immune from the annealing effect of the high heat temperature, which would allow the valve cap to soften and jam on the valve seat of the engine, causing leakage and rendering the valve useless.

Alloys suitable for this purpose, and for similar casting used under highly oxidizing conditions and subjected to great heat, require an extremely high fusing point, both for withstanding the extreme heat and for instantly fusing with the surface of inclosed steel parts when placed within the mold, yet having a low heat conductivity causing it to almost instantly cool and solidify, after fusing with the surface, before melting or changing the inclosed steel part. Our alloy is especially adapted for this purpose, and for making valve castings in combination with steel stems, or any other castings in combination with other steel parts, where high heat resisting properties and non-oxidizing cast parts are required, and where a pre-determined hardness and accuracy in retaining its shape, under changing heat temperatures, are a requisite, and the cast portion free from any tendency to warp or scale from the heat. It is known that this alloy is not as efficient in the power to resist extreme oxidizing conditions, as the formula set forth in the original patent heretofore mentioned, due to the lack of silicon, yet the alloy has a highly efficient non-oxidizing property, offering great resistance to an oxidizing flame. The alloy is capable of being cast in molds, or rolled into sheets, or drawn into bars.

In preparing our alloy we prefer to use the following elements; nickel, chromium, manganese, iron, tungsten and copper, all melted and fused into a mass. The preferred proportions for compounding an alloy having the highest efficiency in non-oxidizing and heat resisting properties are as follows, given in percentage by weight:

	Per cent.
Nickel	58
Chromium	8
Manganese	7
Iron	14
Tungsten	1
Copper	12

This alloy having a medium hardness which cannot be changed either to a harder of softer metal, and has a melting point between 3000 degrees and 4000 degrees Fahrenheit, and possesses extremely high heat conductivity, and which provides for almost instant fusing with any inclosed steel parts placed within a mold and rapidly solidifying of the alloy before changing the inclosed steel section. The heat resisting properties preventing any molecular change therein makes the cast section immune from warping

or annealing when subjected to the extreme heat conditions.

While the foregoing proportions set forth the preferred composition for producing the highest heat resisting properties, yet it is obvious that these proportions may be varied between certain limits for producing various grades of alloy suitable for less extreme conditions, and with very effective results, without departing from the spirit of our invention, and very good results are produced when varying the proportions of any one or more of the elements therein between the following limits, also given in percentage by weight:

	Per cent.	
Nickel from	50	to 59
Chromium from	5	to 10
Manganese from	4	to 12
Iron from	10	to 20
Tungsten from	½	to 1
Copper from	8	to 15

The manganese acting as a deoxidizing agent for resisting the scaling and oxidization of the alloy when subjected to extremely high temperatures.

It is obvious that in varying the proportions of any of the elements, a corresponding change in the resulting alloy will be produced, making it possible to compound cheaper grades of metal if desired.

It is known, and has been determined by these inventors, that in this alloy nickel and cobalt possess very similar properties, and produce practically the same results herein by substituting the cobalt in the place of the nickel, the resulting alloy being almost identical in its properties and characteristics, and we, therefore, claim the right to substitute the element cobalt in the place of the nickel throughout this patent. The metals chromium and tungsten both acting on the hardness of the alloy, and combining with the other elements in such a manner as to make the resulting composition immune to any molecular change even when subjected to an extremely high temperature. In certain cases the tungsten may be omitted by increasing the proportions of the chromium.

It has been determined by successive experiments that a good grade of commercial casting may be obtained by the substitution of aluminum in the place of the tungsten in the above formulas, as the hardening agent, although the resulting castings are not as high grade as when the tungsten is used therein.

Having fully described our alloy, what we claim as our invention, and desire to secure by Letters Patent is:

1. A non-oxidizable alloy adapted for making combination alloy and steel parts, comprising nickel 58 percent, chromium 8 percent, manganese 7 percent, iron 14 percent, tungsten 1 percent, and copper 12 percent.

2. An alloy comprising 58 percent of a metal of the nickel group, 8 percent chromium, 7 percent manganese, 14 percent iron, 1 percent tungsten, and 12 percent copper.

3. A non-oxidizable, heat resisting alloy comprising elements varied between the following proportions; nickel from 50 to 59 percent, chromium from 5 to 10 percent, manganese from 4 to 12 percent, iron from 10 to 20 percent, tungsten from ½ to 1 percent, and copper from 8 to 15 percent.

4. An alloy comprising 58 percent nickel, 9 percent of metals from the chromium group, 7 percent manganese, 14 percent iron, 12 percent copper.

5. An alloy comprising 58 percent nickel, 9 percent of metal from the chromium group, 7 percent of deoxidizing material, 14 percent iron, and 12 percent copper.

6. An alloy comprising 58 percent of metal from the nickel group, 9 percent of metals from the chromium group, 7 percent of deoxidizing materials, 14 percent iron, and 12 percent of copper.

7. An alloy adapted for making castings comprising cobalt 58 percent, metals of the chromium group 9 percent, manganese 7 percent, iron 14 percent, and copper 12 percent.

8. An alloy comprising cobalt 58 percent, chromium 8 percent, manganese 7 percent, iron 14 percent, tungsten 1 percent, and copper 12 percent.

In witness whereon we sign these specifications.

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