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UNITED STATES PATENT OFFICE.

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NICKEL-CHROMIUM ALLOY AND ARTICLES MADE THEREFROM.

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To all whom it may concern:

Be it known that I, WILLIAM F. COCHRANE, a citizen of the United States, a resident of Baltimore, State of Maryland, have invented a certain new and useful Nickel-Chromium Alloy and Articles Made Therefrom, of which the following is a specification.

This invention relates to certain nickel chromium alloys and articles of manufacture made therefrom as, for example, various engine parts, engine valves, valve seats, disks and turbine blades.

It is an object of this invention to produce an alloy which shall have special properties, among which are very high strength at elevated temperatures, resistance to corrosion and warping, and resistance to the action of superheated steam and sulfuric acid and various other acids, such as phosphoric acid, and capacity to resist pitting when manufactured in the form of engine valves and other parts subjected to strain and high temperatures.

It is a further object to produce engine valves and various other engine parts from such alloys so that said parts will have superior wearing qualities and superior high temperature resistance than the valves hitherto manufactured.

Further objects of the invention will appear as the following description proceeds.

In accordance with my invention I provide an alloy mix containing approximately the following constituents in the proportions named:

	Per cent.
Nickel	25 to 40
Chromium	1 to 5
Iron	1 to 5
Manganese	½ to 2½

And the remainder copper.

The proportion of 1% to 5% chromium is especially preferred although in certain cases the proportion may be made as high as 15%.

As a more specific example of an alloy having the functions and advantages previously set forth, the following mix may be made.

	Per cent.
Nickel	35
Chromium	5
Iron	5
Manganese	1¼ to 1½

And the remainder copper.

	Per cent.
Nickel	35
Chromium	1 to 5
Iron	1
Manganese	1¼ to 1½

And the remainder copper.

The nickel may be reduced to 20% although 25% is ordinarily as low as is desirable in such alloys.

The iron may be omitted and as illustrating such a mix the following is given:

	Per cent.
Nickel	20 to 40
Chromium	1 to 5
Manganese	2 or below

And the remainder copper.

The function of the manganese, is to a great extent, to act as a dioxidizer.

Among the chief characteristics of this alloy are the relatively low nickel content, as compared with Monel metal, and the percentage of chromium. In other words, the alloy may be termed a nickel chromium alloy having a relatively low percentage of nickel and a high percentage of copper. Among the various advantages which such alloys possess may be mentioned their high strength at elevated temperatures, such as 1000° F. The alloys when manufactured into various engine parts, as aforesaid, will, therefore, show very excellent properties in that there will be substantially no warping or weakening of the mechanical structure until relatively high temperatures are reached. Furthermore, the alloys show excellent properties as regards pitting and they are non-corrosive, and are able to resist the action of superheated steam and acids. such as sulfuric and

phosphoric acids. Such engine valves may be used for a long period of time without any necessity of being ground down in the manner practiced at the present time with engine valves of ordinary construction and composition.

The alloys described may also be used for the manufacture of parts and fittings for use in connection with superheated steam, for example, valve stems, valve disks, and valve seats. The alloys are also adapted for use in chemical work, as, for example, valves and shafting for agitators, etc.

While in the above description the advantages accruing from the use of such alloys for engine valves and various other parts have been specifically set forth, it will be understood that these alloys are likewise adapted for other uses and structures in which their advantages and meritorious qualities are of value.

As many apparently widely different embodiments of this invention may be made without departing from the spirit thereof, it is to be understood that I do not intend to limit myself to the specific embodiment thereof.

I claim:

1. An alloy which comprises chromium 1% to 5%, nickel, 20% to 40%, and the balance largely copper.

2. An alloy which comprises chromium, 1% to 5%, nickel, 20% to 40%, iron, 1% to 5%, and the balance copper.

3. An alloy which comprises chromium, 1% to 5%, nickel, 20% to 40%, a small proportion of a deoxidizer, and the balance copper.

4. An alloy which comprises chromium, 1% to 5%, nickel, 20% to 40%, iron, 1% to 5%, a small proportion of a deoxidizer, and the balance copper.

5. An alloy which comprises chromium, 1% to 5%, nickel, 25% to 40%, a small proportion of a deoxidizer, and the balance copper.

6. An alloy which comprises 1% to 5% chromium, 20% to 40% nickel, below 5% of iron, and the balance copper, and which has the property of maintaining its strength and elastic limit up to about 1000° F. without substantial impairment.

7. An engine part of a character which is ordinarily subjected to a high temperature and which is composed of an alloy comprising 1% to 5% chromium, 25% to 40% nickel, a small amount of deoxidizer, and 1% to 5% iron and copper.

8. An engine part of a character which is ordinarily subjected to a high temperature and which is composed of an alloy comprising 1% to 5% chromium, 25% to 40% nickel, a small amount of deoxidizer, and the balance copper.

9. An engine part of a character which is ordinarily subjected to a high temperature and which is composed of an alloy comprising 20% to 40% nickel, 1% to 5% chromium, and the balance copper.

10. A valve for internal combustion engines made from an alloy comprising 20% to 40% nickel, 1% to 5% chromium, and the balance copper.

11. A valve for internal combustion engines made from an alloy comprising 20% to 40% nickel, 1% to 15% chromium, and the balance copper.

12. A valve for internal combustion engines made from an alloy comprising 20% to 40% nickel, 1% to 15% chromium, and substantially free from iron.

13. An alloy which comprises chromium 1% to 15%, nickel 20% to 40%, and the balance largely copper.

In testimony that I claim the foregoing, I have hereunto set my hand this 19th day of June, 1924.

WILLIAM F. COCHRANE.