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UNITED STATES PATENT OFFICE.

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ACID-RESISTING ALLOY.

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To all whom it may concern:

Be it known that I, ALVAH W. CLEMENT, a citizen of the United States, residing at East Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Acid-Resisting Alloys, of which the following is a full, clear, and exact description.

This invention relates to an alloy which has inherently many valuable properties, notable among which is its resistance to corrosion by the action of acids, acid fumes either dry or wet, as well as hot dilute acid, which as is well known, is one of the most difficult of corrosive substances to handle in a commercial way.

Its resistive property to the corrosive action of acids makes the alloy exceedingly useful in the manufacture of various articles and utensils which are necessary or useful in the handling of the acids in the various forms before mentioned, either in the manufacture of the acids, in processes which utilize acids in the performance thereof and therefore require suitable utensils and articles for the handling of the acid, or in containers or similar articles in which the acids in their various forms may be stored and from which they may be dispensed.

While I have mentioned as perhaps the most important property of the proposed alloy, its resistance to corrosion by acids, I do not limit myself in this particular, as the alloy is generally resistant to other corrosive substances; furthermore there are other properties inherent in the alloy which permit of its being put to other uses which are quite as important in the arts.

The proposed alloy consists of nickel, chromium, iron, molybdenum, manganese and carbon. The proportions in which the above mentioned elements may be combined will depend upon the particular corrosive substance to which it is desired that the alloy be resistant.

Where the alloy is to be used in the fabrication of articles designed to be utilized in the handling of sulphuric acid in its various forms, that is to say, either hot or cold, or concentrated or dilute, also in the handling of hydrochloric acid in its various forms and in the handling either of the before mentioned acids in gaseous form, I may utilize nickel, chromium, iron, molybdenum and manganese as the metal portions of the alloy with a certain amount of carbon which appears in the final alloy in its combined state.

As before stated, varying proportions of the various elements mentioned may be utilized in accordance with the particular degree of resistance which is desired, and I will state the following as an example of an alloy which I have found to give very satisfactory results: 65 per cent nickel, 15 per cent chromium, 8 per cent molybdenum, 2 per cent manganese, 1½ to 2 per cent carbon, balance, iron.

In making the alloy the ingredients may be added in their metal metallic state, or a ferro-chrome may be first melted and refined to the proper degree with respect to the carbon and then the other metals added in the proper proportions as stated.

In such an alloy the carbon will for the most part be found in the final alloy in its combined state, appearing as a carbide of iron, chromium and molybdenum. The maganese aids in securing the carbon in its combined form in the final alloy.

In order to insure that the carbon in the final alloy is in combined condition, I may proceed in utilizing the alloy, by fabricating the desired article from the alloy without regard to the condition in which the carbon may be found in the alloy. After the article is made, it may be heated to approximately a bright orange color and quenched in cold water. This treatment will cause a very complete formation of the carbides of iron, chromium and molybdenum which will render the article made from the alloy exceedingly resistant to the action of sulphuric acid and hydrochloric acid in the various forms in which it may be handled.

The foregoing treatment of the article is but suggestive of the way in which articles may be formed so as to produce high carbide effects in the finished alloy, and I do not mean thereby to limit my invention to this particular manner of producing the carbides in the alloy.

The alloy is readily castable and fills intricate molds without difficulty, and it has been found that structures in which the walls are comparatively thin are highly satisfactory for holding corrosive liquids even under high pressures.

The alloy has a high melting point in the neighborhood of 2200 degrees, is malleable

and ductile when hot or cold, and is easily machinable.

The alloy is also well adapted for use as an electrical resistance element.

Having described my invention, what I claim is:

1. An alloy containing principally nickel, chromium and iron, in which the nickel is greater than 50%, the chromium approximately 15%, the balance consisting principally of iron together with an appreciable amount of molybdenum but not greater than approximately 8%.

2. An alloy containing principally nickel, chromium and iron, in which the chromium is approximately 15%, the nickel approximately 65%, and the balance consisting principally of iron together with an appreciable amount of molybdenum but not greater than approximately 8%.

3. An alloy containing principally nickel, chromium and iron in which the nickel and chromium form more than 50% of the alloy and the chromium being approximately 15%, and the balance consisting principally of iron together with an appreciable amount of molybdenum but not greater than approximately 8%.

4. An alloy containing nickel, chromium, iron and molybdenum in which the nickel forms more than 50% of the alloy, the chromium being present in appreciable amount but less than half the amount of nickel present and the molybdenum present in appreciable quantity but less than 10%, the balance being principally of iron.

5. An alloy containing nickel, chromium, iron and molybdenum in which the nickel is approximately 65%, the chromium approximately 15%, the molybdenum approximately 8%, the remainder consisting principally of iron.

6. An alloy containing substantially 65 per cent of nickel, substantially 15 per cent of chromium, substantially 8 per cent of molybdenum, substantially 2 per cent of manganese, substantially 1½ to 2 per cent of carbon, and the balance iron.

In testimony whereof, I hereunto affix my signature.

ALVAH W. CLEMENT.