

UNITED STATES PATENT OFFICE

2,220,934

ALLOY STEEL ARTICLES

Vsevolod Nicholas Krivobok, Pittsburgh, Pa., assignor to Rustless Iron and Steel Corporation, a corporation of Delaware

No Drawing. Original application January 20, 1934, Serial No. 707,614. Divided and this application October 19, 1937, Serial No. 169,910

1 Claim. (Cl. 138—47)

This application is a division of my earlier copending application Serial Number 707,614, filed January 20, 1934, and entitled Alloy and manufactures, and the invention relates to austenitic chromium-nickel irons and steels and to articles and manufactures of the same.

Among the objects of my invention is the simple, efficient and economical production of comparatively inexpensive alloy irons and steels, which are strong, tough and durable and which are workable, as by forging, upsetting and hot and cold rolling into sheet, strip and bar stock, which lends itself to a number of working and forming operations, such as drilling, machining, punching, blanking, deep-drawing, spinning and welding to achieve a great number of tubular articles, products or manufactures.

The invention accordingly consists in the combination of elements, composition of ingredients and mixture of materials, and in the articles, products and manufactures thereof, as described herein, the scope of the application of which is indicated in the following claim.

As conducive to a clearer understanding of certain features of my invention it may be noted at this point that the austenitic chromium-nickel irons and steels containing approximately, 10% to 25% chromium, 7% to 15% nickel, and the balance substantially iron, are used in the production of a wide variety of corrosion-resistant and mildly heat-resistant products or articles of manufacture. These austenitic irons and steels, especially the 18-8 irons and steels containing approximately, 18% chromium, 8% nickel, and the balance substantially iron, are used in a number of interior or exterior architectural applications, such as decorative trim, ornamentation and fixtures. Similarly, these irons and steels are employed for a variety of kitchen, soda fountain, dairy and hospital applications, as in cooking and serving utensils, containers and appliances, counter and furniture trim and the like, where permanently bright corrosion-resistant metal capable of withstanding the corrosive action of various vegetable and fruit acids, is desired. Likewise, these irons and steels are widely adapted for various chemical plant apparatus and equipment where metal resistant to the corrosive attack of acids, alkalies and salts at room temperature or slightly elevated temperatures, is required.

These austenitic chromium-nickel irons and steels, however, are not especially adapted for extremely high temperature duty, particularly high temperature duty under strongly oxidizing

or corrosive conditions, or conditions of friction, abrasion and wear.

One of the outstanding objects of my invention is the production of strong, tough and durable austenitic chromium-nickel irons and steels, which are especially resistant to scaling, pitting, intergranular corrosion, wear and abrasion, all at high temperatures; which may be worked or formed into a variety of tubular articles, products and manufactures, and which are adapted to reliably and efficiently withstand long periods of continuous high temperature duty under the many varying conditions of actual, practical use.

As illustrative of the practice of my invention austenitic chromium-nickel iron or steel, analyzing approximately, 18% chromium, 8% nickel, 1% to 5% molybdenum, 1% to 3% copper, 2% to 3% tungsten, .03% to .4% carbon, and the balance substantially iron with the usual percentages of silicon, sulphur and phosphorus, is produced in any suitable manner, as for example, as more fully described in Patent No. 1,925,182 of Alexander L. Feild, entitled Process for the manufacture of rustless iron.

In the production of my chromium-nickel alloy iron and steel, the metal is first produced in the form of ingots and then fashioned into blooms or billets in accordance with known methods and conveniently rolled into sheet bar and strip bar sizes. These bars are then annealed and pickled and, for example, cold rolled into sheet or strip of desired thickness and subsequently fabricated into tubular articles, as more particularly noted below.

My austenitic chromium-nickel steel is resistant to the corrosive effects of various industrial gases, fumes, vapors and liquids, acid, alkali or salt in character, and is resistant to the effects of pitting, scaling or grain growth under high temperature operating conditions over long periods of time. For example, a bar of my alloy iron and steel analyzing approximately, 18% chromium, 8% nickel, 3% molybdenum, 2.5% tungsten, 2.5% copper, .10% carbon, and the balance substantially iron, has successfully withstood a 500 hour test under a stress of 8,000 pounds per square inch at a temperature maintained at 1500° F. under oxidizing atmospheric conditions. Ordinary 18-8 chromium-nickel iron analyzing approximately, 18% chromium, 8% nickel, .07% carbon and the balance substantially iron, has a life of about 12 hours to 14 hours under like operating conditions.

My alloy iron or steel in addition to having a life under the severe operating conditions of high

tensile stress at high temperatures greatly in excess of heretofore known and/or used austenitic irons or steels, is strong, tough and durable and lends itself to a variety of hot and cold working or forming operations either from sheet, strip or bar stock. The metal may be cut, threaded, drilled and otherwise machined from bar stock, or the metal may be formed as by punching, blanking, deep-drawing, spinning and the like from sheet and strip followed by certain welding operations where desired, using either the oxy-acetylene torch or the electric arc (employing welding rods for the electric welding operations of approximately the same analysis as the stock welded) to achieve a great many articles, products and manufactures, such as tubing, fluid valves, couplings, flanges and bolts, tanks, trays and pans, all for high temperature duty, as in boilers, condensers, oil cracking stills, evaporator units and the like, for semi-chemical uses in the canning, dairy, oil and photographic film industries, or for chemical calciners as used in the production of iron-free chemicals, such as paints and dyes. (The various welded parts, articles or manufactures are preferably heat-treated in accordance with well known methods after the welding is completed in order to prevent intergranular corrosion and assure maximum chemical resistance in actual use.)

Thus it will be seen that there has been provided in this invention an austenitic chromium-nickel alloy and articles, products and manufactures, thereof, in which the various objects hereinbefore noted, together with many thoroughly practical advantages are successfully achieved. It will be seen that the alloy is strong, tough, durable, corrosion-resistant, heat-resistant and workable into a variety of commercial products and manufactures which are especially adapted to withstand continuous high temperature duty over long periods of time and under the many varying conditions of actual, practical use. My alloy iron or steel and articles or manufactures of the same is especially resistant to the corrosive attack and embrittling and fatiguing effects at high temperatures of the gases and vapors normally encountered in the atmosphere, the mineral waters met with in boiler and condenser applications, the sulphur-bearing liquids, vapors

and gases handled in the cracking of oils, and like corrosive agents encountered in many modern industries, as more particularly indicated above.

While as illustrative of my invention an austenitic chromium-nickel alloy and articles, products and manufactures thereof, containing approximately, 18% chromium, 8% nickel, 1% to 5% molybdenum, 1% to 3% copper, 2% to 3% tungsten, .03% to .4% carbon, and the balance substantially iron, are specifically described above, it is to be understood that good results are achieved where the chromium content ranges between 10% and 25% and the nickel content between 7% and 15%.

In my chromium-nickel alloy irons and steels, as in heretofore known and/or used austenitic chromium-nickel irons and steels, carbon is not an essential ingredient. In fact this element is present only because of the commercial impracticability of ridding the metal of carbon. Ordinarily, at the present time, metal with a carbon content of from about .03% to .10% is produced without difficulty although in some melting processes the carbon may amount to as much as .2%, .3% or even .4% as indicated above. As in known austenitic irons and steels, and in articles and manufactures of the same, metal of the lower carbon contents is preferred for most purposes.

As many possible embodiments may be made of my invention and as many changes may be made in the embodiments hereinbefore set forth, it is to be understood that the matter described herein is to be interpreted as illustrative, and not in a limiting sense.

I claim:

Wrought alloy austenitic 10 to 25 per cent chromium, 7 to 15 per cent nickel and .03 to .40 per cent carbon, stainless steel tubular articles, characterized by their freedom from corrosion embrittlement and by their resistance to the wash and scour of corrosive fluids, used under conditions of high internal pressures and at high temperatures, said characteristics being produced by the inclusion in said alloy steel of 1 to 5 per cent molybdenum, 1 to 3 per cent copper and 2 to 3 per cent tungsten.

VSEVOLOD NICHOLAS KRIVOBOK.