Patented Jan. 16, 1940 **2,187,525**

UNITED STATES PATENT OFFICE

2,187,525

ARTICLE OF WELDED CONSTRUCTION

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No Drawing. Original application September 19, 1929, Serial No. 393,835. Divided and this application May 27, 1939, Serial No. 276,230. In Germany June 26, 1929

4 Claims. (Cl. 113—112)

Our invention relates to corrosion-proof articles composed of austenitic chromium nickel steel alloys containing vanadium.

This application is a division of our application Serial No. 393,835, filed September 19, 1929.

Experience has shown that austenitic chromium nickel steel alloys, hitherto employed as chemically neutral, become brittle, and are no longer resistant, for instance, to the attack of acid or salt solutions, when they have experienced a heating up to about 500–800° C., which can be compared to a drawing treatment, as occurs, for instance, in welding constructional parts. It has already been proposed, with satisfying results, to employ for the manufacture of objects of austenitic chromium nickel steel alloys, which, either in their manufacture or during service, are exposed to a heating equivalent to a drawing treatment, and cannot subsequently be given a high heat treatment, to restore the pure austenitic condition, austenitic chromium nickel steel alloys, the carbon content of which is less than .07%. This invention has for its object to afford another solution of this problem by which the technical difficulty of lowering the carbon content to very slight values is avoided. This object is obtained, according to the invention, by adding to the austenitic chromium nickel steel alloys, for instance, to those containing from 18–25% of chromium and 7–12% of nickel, to prevent them from becoming brittle-short when heated up to the chromium carbide precipitation range of about 500–800° C., an alloy constituent, to wit, vanadium. Vanadium forms a stable chemical compound with a portion of the carbon dissolved in the austenitic base structure. The proportion of vanadium to the carbon is so determined that practically all of the carbon is bound to this alloy constituent. Tests made with two chromium nickel steel alloys that contained about 18% of chromium, 9% of nickel, .12% of carbon, and, respectively, .5% and 2% of vanadium, have shown that steel alloys of this type are fully resistant to active chemical attacks even when in a condition resulting from exposure to a heating up to about 500–800° C. without a subsequent high heat treatment. Measurements of the magnetic saturation made to investigate the structure have shown that the values of magnetic saturation of the material, when quenched and drawn, are not substantially higher than those of the magnetic saturation of the same material when merely quenched. For comparison purposes, it may be noted that the corresponding values of a vanadiumless austenitic chromium nickel steel alloy are far higher in the temperature range of 500–800° C. than in a cool state. The fact that the values of saturation are practically equal in the re-heated and in the quenched state in contradistinction to vanadiumless chromium nickel steels proves that in the vanadium chromium nickel steel alloys, the drawing operation is much less capable of altering the nature of the base structure than in the corresponding vanadiumless chromium nickel steel alloys. In the inventors' opinion the reason for this phenomenon resides in the following:

The presence of vanadium has the effect of binding to itself almost the entire carbon, in a manner not jeopardizing the chemical stability of the alloy, so that the base structure, which, as to the rest, is austenitic, is practically free of dissolved carbon, which therefore cannot assume another form, and thus cause the alloy to become brittle when the alloy is heated to about 500–800° C.

Potential tests, made with the above two vanadium chromium nickel steel alloys, have shown that these alloys, even after having been drawn to about 500–800° C., and tested in a solution of sulfuric acid of 5%, at room temperature, and practically freed from oxygen by evacuation, possess a potential that is above the potential of hydrogen, while corresponding austenitic chromium nickel steel alloys that do not contain vanadium, after re-heating and under equal conditions, show a potential which is below that of hydrogen. The addition of vanadium therefore causes an increase of the potential beyond that of hydrogen, and thus an increase of the chemical stability, whereby these alloys are made resistant to very severe attacks by chemical agents, and, more particularly, are protected from becoming brittle under the action of a drawing treatment.

Our invention is of particular value in connection with articles of welded construction, for use in the chemical and metallurgical fields, which, without being annealed after welding, stubbornly resist intergranular corrosion within the zone tempered by the welding operation when subjected to corroding media, because substantially the whole of the carbon in the alloy is in stable combination with the vanadium. Such articles of welded construction are composed, as hereinabove described, of austenitic chromium nickel steel alloy containing preferably from approximately 18 to 25% chromium, approximately 7 to 12% nickel, carbon less than 1%, and vanadium up to about 6%. Within this range, the range usually preferred for commercial construction is approximately 18% chromium, about 8 or 9% nickel, carbon from approximately .07 to .2%, and vanadium from .3% to 2%.

We claim:

1. An article of welded construction for use in the chemical and metallurgical fields which, without being annealed after welding, stubbornly resists intergranular corrosion within the zone tempered by the welding operation when subjected to corroding media, and which is made of a stable austenitic alloy composed of approximately 18 to 25% chromium, approximately 7 to 12% nickel, a small proportion of carbon, and vanadium, the vanadium and the carbon being present in the alloy in such proportions and relation to each other, that practically the whole of said carbon in said alloy appears therein in stable combination with the vanadium, iron constituting substantially the entire balance.

2. An article of welded construction for use in the chemical and metallurgical fields which, without being annealed after welding, stubbornly resists intergranular corrosion within the zone tempered by the welding operation when subjected to corroding media, and which is made of a stable austenitic alloy composed of approximately 18 to 25% chromium, approximately 7 to 12% nickel, carbon less than 1%, vanadium up to approximately 6%, iron constituting substantially the entire balance.

3. An article of welded construction for use in the chemical and metallurgical fields which, without being annealed after welding, stubbornly resists intergranular corrosion within the zone tempered by the welding operation when subjected to corroding media, and which is made of a stable austenitic alloy composed of about 18% chromium, about 8% nickel, about .07 to .2% carbon, and about .3 to 2% vanadium, iron constituting substantially the entire balance.

4. An article of welded construction for use in the chemical and metallurgical fields which, without being annealed after welding, stubbornly resists intergranular corrosion within the zone tempered by the welding operation when subjected to corroding media, and which is made of a stable austenitic alloy composed of about 18% chromium, about 9% nickel, about .12% carbon, and about .5 to 2% vanadium, iron constituting substantially the entire balance.

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