Patented Oct. 6, 1936 2,056,589

UNITED STATES PATENT OFFICE

2,056,589

ARTICLES WITH REDUCED TENDENCY TO CORRODE

Hermann Schulz and Carl Carius, Dortmund, Germany, assignors to the firm Vereinigte Stahlwerke Aktiengesellschaft, Dusseldorf, Germany

No Drawing. Original application May 31, 1933, Serial No. 673,792. Divided and this application June 30, 1936, Serial No. 88,265. In Germany May 20, 1932

1 Claim. (Cl. 75—125)

The invention relates to articles made from steel and cast iron with reduced tendency to corrode, especially when subjected to the action of water, especially sea water and moist soil and forms a division from our copending application Serial No. 673,792, filed May 31, 1933.

The present invention is an improvement of the steel and cast iron described and claimed by the applicant in his prior application Serial No. 450,878, which matured into Patent No. 2,013,600 on Sept. 3, 1935, which is also resistant against sea water and moist soil. The prior process is based upon special electrolytic actions which are thereby caused, that the steel or cast iron is alloyed with copper, antimony, arsenic or tin and in combination with one or several of these additions with magnesium, nickel or aluminum. Said elements are used in the prior process in the following amounts: antimony, arsenic, tin in amounts between 0.05 and 5%, singly or together, copper in amounts up to 1%, magnesium between 0.1 and 5%, aluminum between 0.05 and 5%.

Further researches have shown that the titanium and vanadium elements act in a similar way as the magnesium and aluminum elements used secondly according to the main patent, and they are not only equivalent to these elements, especially aluminum, but even superior thereto. Since this has been found out, it is possible to replace the aluminum as well as magnesium partly by titanium or vanadium. The favourable influence of these two elements could not be foreseen either on account of their electrochemical or chemical behaviour.

A further economically advantageously acting influence of titanium and vanadium, owing to which steels alloyed with these elements will excel compared with aluminum containing steels, is that the capacity of steels alloyed with titanium and vanadium of offering increased resistance to the attacks of water will find expression already a short time after the beginning of corrosion in a considerable reduction of corroding speed. For example the corroding speed in sea water will be reduced already after 14 days approximately 20% and in river water about 40% compared with that of copper-nickel steels alloyed with aluminum. Steels according to the invention are further distinguished by a perfectly uniform rusting of their surface exposed to the corroding agent. Local corrosion attacks in the form of dents or holes or notch-like depressions, which cause a reduction of the mechanical qualities of a steel, do not happen. From the point of view of foundry technics and metallurgy too, the possibility of substituting titanium or vanadium for aluminum affords an advantage in so far as steels mixed with titanium and vanadium can be worked better than those having an addition of aluminum.

The two elements will have the effect described already at very slight amounts thereof, namely, if both metals together are present in a quantity of 0.1% upwardly, the amount of metals with respect to their corrosion-stopping influence is unlimited. However, it is advisable when adding titanium not to exceed 1% and in case of vanadium 0.5%, as a greater addition would not afford any extra advantages.

Thus the invention comprises articles with a reduced tendency to corrode under the action of a corroding agent, more particularly the moisture contained in water, seawater and moist soil; said articles being made from a ferrometal alloy containing 0,2–1% copper, titanium between about 0.1 and 1%, vanadium between about 0.1 and 5% and in addition magnesium in amounts between about 0.1 and 5% and the balance substantially all iron, the alloying elements copper, and magnesium forming together with titanium and vanadium a firmly adhering skin on the articles, due to the corroding attack by said corroding agent.

It may be mentioned that the further composition of the alloys besides the elements above specified is the usual one. Thus the alloy may be alloyed for some other reasons with the usual amounts of elements such as for example manganese, silicon, phosphorus, chromium, tungsten, molybdenum, cobalt, boron, zirconium, beryllium, as has been stated in my prior patent and in the case of steels the accompanying elements may be present in approximately the following amounts:

	Per cent
Carbon	traces up to 1
Silicon	traces up to 0.5
Manganese	0.1 to 1
Sulphur	traces up to 0.12
Phosphorus	traces up to 0.2

and in the case of iron in approximately the following amounts:

	Per cent
Carbon	2 to 3.6
Silicon	0.3 to 3
Manganese	0.3 to 1.2
Sulphur	traces up to 0.12
Phosphorus	traces up to 1.0

We claim:

Articles with a reduced tendency to corrode under the action of a corroding agent, more particularly the moisture contained in water, seawater and moist soil; said articles being made from a ferrometal alloy containing 0.2–1% copper, titanium between about 0.1 and 1%, vanadium between about 0.1 and 0.5% and in addition magnesium in amounts between about 0.1 and 5% and the balance substantially all iron, the alloying elements copper and magnesium forming together with titanium and vanadium a firmly adhering skin on the articles, due to the corroding attack by said corroding agent.

HERMANN SCHULZ.
CARL CARIUS.