

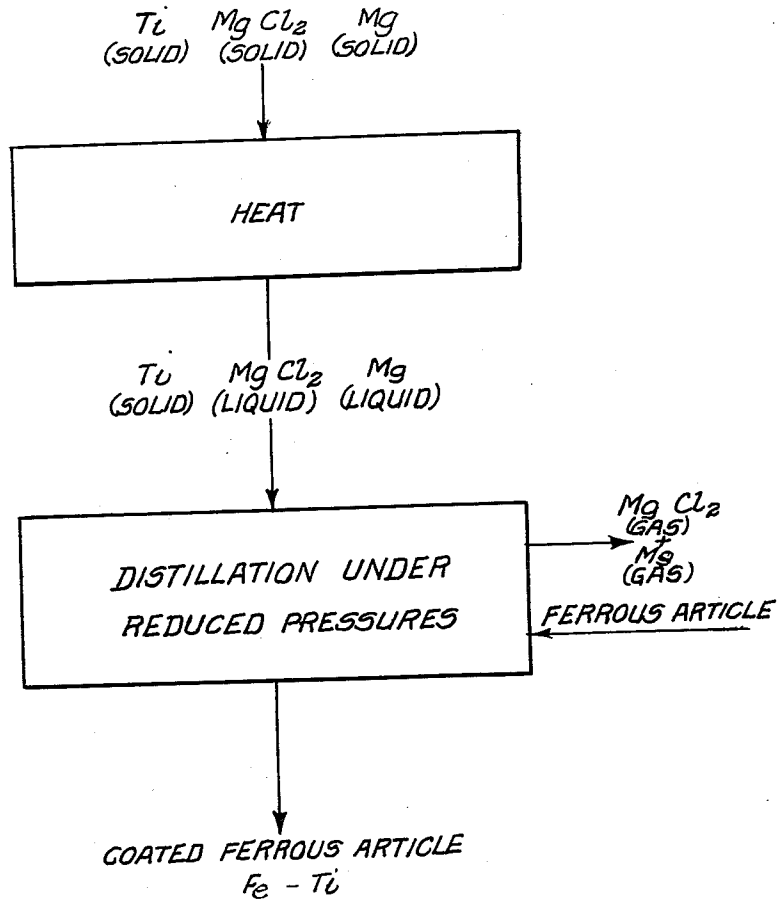
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METHOD OF COATING FERROUS ARTICLES WITH TITANIUM

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1

3,058,841 METHOD OF COATING FERROUS ARTICLES WITH TITANIUM

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5 Claims. (Cl. 117-102)

This invention relates as indicated to the coating of ferrous articles with refractory metals, and more particularly, to the coating of iron and steel with titanium metal.

In the production of titanium by the process generally known as the Kroll process, described in U.S. Patent No. 2,205,854, a molten reducing agent, for example, magnesium is reacted with titanium tetrachloride to form a metal titanium and the by-product magnesium chloride. The reaction between magnesium and titanium tetrachloride is ordinarily carried out in an iron reaction vessel.

If the reaction vessel is new, the titanium sponge formed on the side walls, in most instances, contains high amounts of iron, for example, 0.25 to 0.40% by weight. This is undoubtedly due to the contact between the titanium sponge and the clean reactor side wall.

It is often desired to coat ferrous articles with titanium for various uses, for instance, in addition to reactor vessels, it may be desirable to employ various devices in association with the titanium sponge during the various steps in the manufacture of the titanium metal. Contamination of the titanium might be prevented, if these various devices have been previously plated with a layer of titanium.

It is, therefore, an object of the present invention to coat ferrous articles with metal. It is another object of the invention to treat various ferrous articles, so as to reduce the contamination of titanium metal contacted thereby. Further objects and advantages of this invention will become evident as the description proceeds.

Briefly stated, the present invention relates to a method of coating ferrous articles which comprises contacting the ferrous articles with a mixture of magnesium chloride, magnesium, and titanium metal, and distilling said magnesium chloride and magnesium from said mixture.

The single sheet of drawing is a flow sheet illustrating the process of the present invention.

The ferrous articles to be treated include those formed of iron or mild steel. New equipment to be used in the Kroll process, for example, the reaction vessel, may be treated by the process herein disclosed, so as to reduce the iron contents in the titanium sponge.

The reaction vessel to be treated is charged with magnesium, magnesium chloride and titanium metal. If ferrous articles are also to be treated they are placed in the reaction vessel.

Sufficient titanium metal is added to the mixture to coat the articles to be treated. It will be apparent that the amount of titanium employed will be determined by the surface area of the ferrous articles to be treated.

The ratio of magnesium chloride to titanium may be in the range from 2 to 7:1, in parts by weight. The ratio of magnesium to titanium may be in the range from 0.5 to 10:1, in parts by weight. These ratios have been found satisfactory; however, it will be obvious that they may be varied.

The titanium metal preferably is in finely divided form, in order to obtain the highest efficiency of the treatment. Titanium of a particle size which will pass a 20 U.S. mesh screen is satisfactory.

While the mixture is in contact with the ferrous articles, the magnesium and magnesium chloride are distilled there-

2

from, for example, at temperatures in excess of their boiling points at atmospheric pressures. If desired, it may be found desirable to distill the magnesium and magnesium chloride at reduced pressures.

The titanium metal, which is the residue of the distillation operation, is found as a tenacious coating on the ferrous articles.

The process may be repeated several times, although a single treatment may be sufficient to accomplish the desired coating. The distillate of magnesium and magnesium chloride may be used in subsequent treatments, although it will be necessary to add titanium metal.

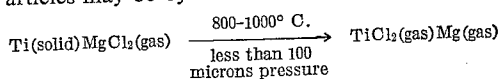
In order to further understand the invention the following example is given. It is intended, however, that the example is merely by way of illustration and is not intended to limit the invention.

Example I

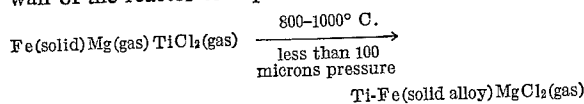
A new iron reaction vessel was charged with 2500 pounds of magnesium, 100 to 200 pounds of magnesium chloride, and 30 to 40 pounds of titanium metal. The titanium metal had a particle size sufficiently small to pass 20 U.S. mesh screen. In addition, other ferrous articles to be coated with titanium were inserted in the vessel.

The reaction vessel to be treated was placed in the hot furnace and the magnesium and magnesium chloride were distilled into a second vessel under reduced pressure of 100 microns of mercury. After distillation was completed, the reaction vessel was removed from the furnace and cooled. A black residue appeared on the interior surface of the reaction vessel, and the ferrous articles contained therein. The black residue was brushed off. The interior walls of the reaction vessel and the surfaces of the ferrous articles possessed a tough adherent coating of titanium metal.

The mechanism by which the ferrous articles are coated with titanium is not definitely known. The following theory is presented merely as an aid to understanding the invention. It should not be considered as a restriction on the invention. It is believed that the titanium formed on the articles may be by the following reactions:



and the subsequent reaction with magnesium on the side wall of the reactor to deposit the titanium.



Other modes of applying the principle of the invention may be employed, change being made as regards the details described, provided the features stated in any of the following claims or the equivalent of such be employed.

We, therefore, particularly point out and distinctly claim as our invention:

1. A method of coating ferrous articles with titanium which comprises contacting ferrous articles with a mixture of magnesium chloride, magnesium, and titanium metal, and distilling said magnesium chloride and magnesium from said mixture at temperatures less than about 1000° C. with pressures less than about 100 microns of mercury.

2. A method of coating ferrous articles with titanium which comprises contacting ferrous articles with a mixture of magnesium chloride, magnesium, and titanium metal, said titanium metal having a small particle size, and distilling said magnesium chloride and magnesium from said mixture at temperatures less than about 1000° C. with pressures less than about 100 microns of mercury.

3

3. A method of coating ferrous articles with titanium which comprises contacting ferrous articles with a mixture of magnesium chloride, magnesium, and titanium metal, said titanium metal having a particle size which will pass 20 U.S. mesh screen, and distilling said magnesium chloride and magnesium from said mixture at temperatures less than about 1000° C. with pressures less than about 100 microns of mercury.

4. A method of coating ferrous articles with titanium which comprises contacting ferrous articles with a mixture of magnesium chloride, magnesium, and titanium metal, said titanium metal having a small particle size, and while said mixture is in contact with said ferrous articles distilling said magnesium chloride and magnesium therefrom at temperature less than about 1000° C. with pressures less than about 100 microns of mercury.

5. A method of coating ferrous articles with titanium which comprises contacting ferrous articles with a mixture of magnesium chloride, magnesium, and titanium metal,

4

said titanium being present in said mixture in amounts at least sufficient to coat the surface of the ferrous articles to be treated, said magnesium chloride and magnesium being present in amounts at least equimolecular to said titanium, said titanium metal having a small particle size, and distilling said magnesium chloride and magnesium from said mixture at temperatures less than about 1000° C. with pressures less than about 100 microns of mercury.

References Cited in the file of this patent

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2,732,321	Gill et al.	Jan. 24, 1956

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