

UNITED STATES PATENT OFFICE.

AUGUSTE J. ROSSI, OF NEW YORK, N. Y., ASSIGNOR TO TITANIUM ALLOY MANUFACTURING COMPANY, OF NEW YORK, N. Y., A CORPORATION OF MAINE.

PROCESS OF PRODUCING ALLOYS OR MIXTURES OF METALS WITH PURIFYING OR SEASONING ELEMENTS.

No. 877,518.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, AUGUSTE J. ROSSI, a citizen of the United States, and a resident of the borough of Manhattan, city, county, and State of New York, have invented certain new and useful Improvements in Processes for Producing Alloys or Mixtures of Metals with Titanic Elements, of which the following is a specification.

My present invention relates particularly to those well known processes whereby certain metals in molten state, such as cast iron, steel or copper, are treated by bringing into their presence titanium or its compounds, for the purpose of imparting to the bath, and thus to its resulting metallic product, desired properties, and my said invention may also be utilized to advantage in the process of alloying titanium with other metals. When, for instance, iron is to be thus treated, the titanium is usually introduced in the form of so-called "ferro-alloys" thereof, or of compounds, or mixtures, of iron in some of its forms with the titanic element, the presence of which is relied on for such seasoning or purification.

Were the titanic element fusible at approximately the temperature of fusion of the iron, steel, or other metal to be improved thereby, its proper incorporation into the bath would present no special difficulty, but the contrary is the case, the titanic elements thus used as "seasoners" or "purifiers" requiring for their fusion much higher temperatures than the metals thereto treated, so that the incorporation of the former appears to proceed by a species of dissolution rather than by fusion properly speaking, whereas their rate of fusion of their alloys or compounds seems directly proportional to the per cent. of their content of other metal, or substance, having lower temperature of fusion. Furthermore the specific gravity of the said titanic elements is decidedly less than that of the metal thereby treated in the bath. Thus, for example, the fusion point of cast iron is from 1250 degrees to 1350 degrees C, and its specific gravity 7. to 7.2, while the fusion point of titanium is 2700 degrees to 3000 degrees C and its specific gravity 4.85 and the fusion point of copper is 1065 degrees C and its specific gravity 8.7 to 8.8. Therefore when titanium, or its "ferro", or

alloy with iron, is introduced into a bath of molten iron for the purpose of purifying or seasoning the latter, it becomes particularly important to maintain as high a temperature as is admissible and especially at the surface of the bath, since the titanium tends to rise and float there. This tendency of titanium to rise, and float upon the surface of the molten metals therewith sought to be treated under the high temperatures required in the bath, results not only in undesirable reduction of the temperature of the titanium, thus hindering its desired incorporation, but also, and even more injuriously, in costly losses thereof due to oxidation on approximation to, or contact with the atmosphere under the conditions mentioned.

In cases in which the incorporation of the titanic "seasoner" has been attempted in the crucible, the difficulties of the problem, in the matter of temperature at least, have proved less insurmountable, owing to the possibility, in such cases, of maintaining the necessary temperature of the bath; but when, as is more often the case, the incorporation is sought to be effected in the ladle, it has been necessary, in order to accomplish any result prior to undue cooling, to introduce the titanic elements in previously prepared alloys or mixtures thereof with metal like that of the bath and containing such low percentages or proportions of the former as to be obviously, and for many reasons, undesirable.

The object of my present invention is to provide an improvement in the aforesaid processes which will largely, if not entirely, overcome the obstacles described, and insure a more thorough, immediate and less expensive incorporation of said purifying and seasoning titanic elements with the metals thereto treated.

I accomplish this object, broadly speaking, by preparing, applying, and maintaining between the bath of molten metal under treatment including its charge of the said titanic elements, and whether in the crucible, ladle or other container, a continuous, plastic, comparatively non-heat conducting covering, or "blanket" substantially impervious to those elements of the atmosphere which it is desired to separate from the contents of the bath.

My invention consists, then, in providing the said bath with a comparatively neutral covering, or blanket, consisting of fused ingredients having comparatively small affinity either for oxygen or other elements contained either in the bath or in the atmosphere, being also a comparatively poor conductor of temperature, and having a lesser specific gravity than the bath, or, any of its ingredients. Examples of my said blanket which I have found particularly efficacious, for the purpose in hand, may properly be classified under the general designation "slags". Some of the constituents of ingredients which I have thus employed with success for the purposes mentioned correspond in their combined fused form, in constitution and analysis, to actual "slags" so called; indeed common slag run from ordinary blast furnaces in the usual production of the lower grades of pig iron; such slag containing a silicate of lime, alumina, and magnesia, is well adapted to constitute my said blanket for the purposes mentioned. To be more explicit, my invention may be practiced by obtaining, or producing for the purpose, a slag of the following composition, which may be termed a blast furnace slag, viz:

30	Silica	40.00
	Alumina	15.00
	Lime	35.00
	Magnesia	10.00
35		100.00

The slag may also advantageously contain some compound of titanium as say TiO or TiO_2 , its composition being for instance:

40	Silica	25.00
	Titanic acid	25.00
	Lime	25.00
	Alumina	15.00
	Magnesia	10.00
45		100.00

It will however be noted that, without departing from my invention, other slags, or mixtures of fused ingredients may be employed, as experience, and the special requirements of each case may require, and as will be readily determined in practice by those skilled in the metallurgical art, care being always taken to exclude any constituents detrimental to the metals of the bath.

If operating in the crucible, the slag, already formed, and solid, may be charged in along with the metal to be treated, or it may be introduced after fusion of the latter and along with the titanic elements. If operating in the ladle, it is preferable to first introduce the titanic elements at the bottom of the ladle, then pour thereover

the molten metal to be treated and finally add the slag blanket by pouring this in molten state over all.

It will be observed that the blanket of slag is highly beneficial, if only for the purpose of checking heat radiation, and thus retarding the cooling of the charge in the ladle.

When the incorporation of the titanic element with the metal treated is thought to be as complete as possible, the treated metal will be withdrawn or tapped out into proper molds, leaving the slag which was on the surface available for use to the same effect as before with the next charge, and also fresh additions of molten slag made from time to time as required to supply waste or secure again fluidity.

The proportion of slag employed relatively to the entire charge may be varied according to the requirements of each case, it being merely necessary, as a general rule, to have such proportion as to insure, without thereby unduly loading the container of the bath, a blanket, or covering, of the slag sufficiently thick to efficiently interfere with reactions between the ingredients of the bath and the atmosphere, and to obstruct, as much as practicable, radiation of heat from the metallic contents of the bath.

My said blanket, or covering, will also be found of advantage in cases in which the prime object of the operation is merely the production of alloys of titanium with metals of greater specific gravity, and less affinity for oxygen under the temperature of the alloying bath.

I am aware that a supernatant flux of fused cryolite or borax has been recommended to insure coating therewith of chromium during introduction of latter into a bath of molten cryolite or aluminium, said chromium having a high fusing point and a low oxidation point, but in this instance the specific gravity of the chromium exceeding that of aluminium, the said flux does not operate as in my process, nor do I wish to be understood as claiming any such process, or the application of such supernatant flux to metals having the relation to each other of aluminium and chromium, as regards specific gravity, fusing and oxidation points.

I am also aware that a layer of undisclosed thickness composed of slag produced by melting fluorspar has been claimed to be advantageous when superimposed over a bath of molten nickel, to which has been added, to improve it, some magnesium, or zinc also if an alloy of that metal is desired, but in this instance also both the melting point and the specific gravity of the nickel exceed those of the zinc, or magnesium, and means other than the slag are required to keep the zinc submerged in the bath. I do not wish to be understood as claiming such processes or such uses of such a slag blanket.

What I claim as new and desire to secure by Letters Patent is the following, viz:—

1. The process of producing alloys, or mix-
5 tures of titanium with other metal having
higher specific gravity and lower melting
point, which consists in superimposing, and
maintaining during fusion on the surface of
the bath of said titanium and other metal a
non-metallic molten covering having lower
10 specific gravity and heat conductivity than
said titanium.

2. The process of producing alloys, or mix-
tures of titanium with other metal having
higher specific gravity and lower melting
15 point, which consists in superimposing, and
maintaining during fusion on the surface of
the bath of said titanium and other metal a
covering of molten slag.

3. The process of producing alloys, or mix-
20 tures of titanium with other metal having
higher specific gravity and lower melting
point, which consists in superimposing, and
maintaining during fusion on the surface of

the bath of said titanium and other metal a
covering of molten slag comprising an oxid 25
of titanium.

4. The process of producing alloys, or mix-
tures of titanium with other metal having
higher specific gravity and lower melting
point, which consists in superimposing, and 30
maintaining during fusion on the surface of
the bath of said titanium and other metal a
covering of blast furnace slag.

5. The process of producing alloys, or mix-
tures of titanium with other metal having 35
higher specific gravity and lower melting
point, which consists in superimposing, and
maintaining during fusion on the surface of
the bath of said titanium and other metal a
covering of blast furnace slag to which has 40
been added oxid of titanium.

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Witnesses:

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PHILIP C. PECK.