UNITED STATES PATENT OFFICE.

GRENVILLE MELLEN, OF MOUNT VERNON, NEW YORK.

PROCESS OF MELTING ALUMINUM OR ALUMINUM ALLOYS.

1,160,430. Specification of Letters Patent. Patented Nov. 16, 1915.

No Drawing. Application filed February 10, 1911. Serial No. 607,364.

To all whom it may concern:

Be it known that I, GRENVILLE MELLEN, citizen of the United States, and resident of Mount Vernon, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Processes of Melting Aluminum or Aluminum Alloys, of which the following is a specification.

This invention relates to a new and useful process of melting aluminum and its alloys and has for its object to protect and preserve the metal from destruction by oxidation and to produce ingot and other forms of casting which shall be of a sounder nature to a degree that has been heretofore practically impossible to effect.

It is of course well understood by those familiar with the practice of melting aluminum or its alloys that while it would be extremely desirable to produce ingot or other forms of castings which shall be practically devoid of the tendency to "blow-holes" and other causes of imperfection which are due to the presence of numerous bubbles of gas disbursed throughout the mass, it has been found practically impossible to produce metal which has undergone the present method of melting aluminum or its alloys, and having these qualities to the desired extent. It is also extremely desirable to obtain a process or method of melting aluminum or its alloys which shall preserve the metal from the great loss suffered by oxidation.

It is generally known that if molten aluminum or any of its alloys is allowed to remain within the furnace, and the temperature gradually raised, the deterioration of the metal increases with the rise of the temperature. Numerous "blow-holes" occur when the metal is cast. If the metal is melted with care and skill, of course, many of these imperfections are avoided. But with the present methods and processes of melting aluminum or its alloys, the results are far from being satisfactory even if the greatest care is taken by the most skilled hands. The imperfections are inevitable so long as the cause remains; and the causes of these difficulties with the present methods of melting aluminum or its alloys are ever present.

In the melting of "scrap" aluminum (this aluminum is in the majority of cases seldom even commercially pure, it being generally an aluminum alloy with copper, sometimes zinc, either or both, and occasionally, though rarely containing other elements), which consist of "clippings" and "stampings" of the sheet metal (generally purer aluminum than that which composes the castings), and the "turnings", "grindings", and "filings" which are parts of the alloys which are adapted to the casting requirements, a great loss is suffered through oxidation. This loss, is generally less in the metals whose compositions more nearly approach pure aluminum. The percentage of loss suffered by these at present varies between ten and forty. It is in the case of the "turnings", "clippings", and "filings" that the greatest loss is suffered; the loss ranging between twenty-five and forty per cent. of the whole. In practice this great loss is seldom less than thirty per cent. This loss is practically a total destruction and an absolute waste of valuable metal.

In the instance of the imperfections arising from the "blow-holes" and the like, I have found that this is due to the presence of occluded gases, and to the partial dissolution of the oxids, and other foreign and injurious matter.

In the case of the great loss by oxidation, I have found that this is due to the presence of oxygen, which exists free as a constituent of the air, and in the water vapor which is present in the atmosphere. It is generally known that aluminum decomposes water vapor, forming the oxid of aluminum and liberating the two atoms of hydrogen.

My novel process overcomes these difficulties, and produces the metal with the tendency to "blow-holes" and gas bubbles practically obviated. It also preserves the metal to a minimum loss by oxidation; the percentage of loss being reduced to between one-half and five.

With these and other objects in view, I have made numerous experiments in the melting of aluminum and its alloys, and both of these are in the form of "scrap".

It is readily obvious that matter existing in the forms of "scrap-aluminum," and the "scrap" of aluminum alloys exposes a surface area which bears a great numerical proportion to the entire volume of the mass. Therefore a large portion of the metal exists in intimate contact with the oxygen present in the atmosphere. This same surface is exposed to the number of gases which con-

stitute the atmosphere within the furnace. This atmosphere generally contains carbon dioxid, sulfur-dioxid, water-vapor, free oxygen, free nitrogen, and some free hydrogen. All metals will occlude gas under certain conditions, though each may show some partiality as to the nature of the gas.

In carrying out my novel process I prefer to use either of the following methods: The aluminum or the aluminum alloy to be melted is placed in a crucible or in any suitable melting chamber which is inclosed in an air tight chamber. The air is then removed from the said air tight chamber, thus creating a partial vacuum therein. Any inert gas is now admitted into the said air-tight chamber. The metal is melted in this atmosphere. The object of this inert gas is to provide an atmosphere which shall serve as a means of conducting the heat to all parts of the metal not in direct contact with the heated walls of the said crucible or melting chamber, and to provide an atmosphere which shall be free from active oxygen or other corrosive gases which act upon aluminum or aluminum alloys. After the metal is melted in this inert atmosphere and while the metal is yet molten, the inert gas is removed, thus again creating a partial vacuum within the said air-tight chamber.

The molten metal is allowed to remain therein until much of the occluded gas is expelled from the pores of the aluminum or the aluminum alloy. The metal is then ready for pouring which should be done as quickly as possible to prevent the further occlusion of gas.

In the melting of aluminum or aluminum alloys to prevent the occlusion of gases by the metal and to prevent its great loss by oxidation, if preferred the metal may be placed in a crucible or other suitable melting chamber, the whole inclosed within an airtight chamber and the air removed from within the said airtight chamber, thus creating a partial vacuum therein, and the metal melted therein. The aluminum or the aluminum alloy is in this way melted in the atmosphere of a partial vacuum.

Having thus described my invention, I claim:

1. The process of melting aluminum or an aluminum alloy which consists in melting the aluminum or the aluminum alloy in the atmosphere of a gas substantially chemically inert toward the aluminum or the aluminum alloy, then creating a partial vacuum within the melting chamber while the aluminum or the aluminum alloy is yet molten.

2. The process of melting aluminum or an aluminum alloy which consists in creating a partial vacuum within the melting chamber, then admitting a gas which is substantially chemically inert toward the aluminum or the aluminum alloy into the melting chamber, and then melting the aluminum or the aluminum alloy in this atmosphere which is substantially chemically inert toward the aluminum or the aluminum alloy.

3. The process of melting aluminum or an aluminum alloy which consists in creating a partial vacuum within the melting chamber, then admitting a gas which is substantially chemically inert toward the aluminum or the aluminum alloy into the melting chamber, then melting the aluminum or the aluminum alloy in this atmosphere which is substantially chemically inert toward the aluminum or the aluminum alloy, and then creating a partial vacuum within the said melting chamber while the aluminum or the aluminum alloy is yet molten.

4. The process of melting aluminum or an aluminum alloy which consists in creating a partial vacuum within the melting chamber, then admitting into the melting chamber a reagent which has the property of combining with the oxygen present within the melting chamber thereby producing an atmosphere within the melting chamber which is substantially chemically inert toward the aluminum or the aluminum alloy and then melting the aluminum or the aluminum alloy in this atmosphere which is substantially chemically inert toward the aluminum or the aluminum alloy.

Signed at New York city in the county of New York and State of New York this 9th day of February A. D. 1911.

GRENVILLE MELLEN.

Witnesses:
FRED. F. KUHLMANN,
S. R. MILLER.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."