

# UNITED STATES PATENT OFFICE.

JOHN W. LANGLEY, OF EDGEWOODVILLE, ASSIGNOR OF ONE-HALF TO HUNT & CLAPP, OF PITTSBURG, PENNSYLVANIA.

## ALUMINIUM ALLOY.

SPECIFICATION forming part of Letters Patent No. 451,405, dated April 28, 1891.

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*To all whom it may concern:*

Be it known that I, JOHN W. LANGLEY, of Edgewoodville, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Aluminium Alloys, of which the following is a full, clear, and exact description.

My invention, which relates to an improvement in alloys of aluminium, is based upon a discovery which I have made that aluminium when alloyed with titanium, especially in certain proportions, gives a new product, which, together with the many useful properties of aluminium which render it capable of such varied application in the arts, possesses other beneficial properties in which aluminium is deficient. Thus I have found that although pure aluminium is somewhat soft and only slightly elastic, even after hammering or rolling, if it be alloyed with less than ten per cent., preferably between one-half of one per cent. and ten per cent. of titanium, a product is obtained intrinsically harder than aluminium, approximately as incorrodible, and capable of acquiring by hammering or rolling a degree of elasticity and hardness comparable to spring-brass. Such alloy is fusible at a temperature below the melting-point of steel, and it is with reference to this temperature that I use the word "fusible" in the specification and claims. Its fusing-point and specific gravity increase with the proportion of titanium which it contains. When the proportion of titanium is less than five per cent., the alloy is nearly as malleable as pure aluminium, and its malleability decreases and its hardness increases as the proportion of titanium in the alloy is increased. I have found that the best material for commercial use, where elasticity combined with easy malleability is required, is an alloy containing titanium from about one-half of one per cent. (more or less) to two per cent. The alloy, when it contains less than ten per cent. of titanium, is of marked value in the arts. I have found that the presence of iron or silicon in the alloy is deleterious and tends to make it brittle and non-malleable. Care should therefore be taken in the manufacture of the alloy that these elements should not be combined in any considerable proportion.

I shall now describe a method by which my improved alloy can be made economically and with facility. This method, which I deem to be the best to be used for this purpose, I have made the subject of a separate patent application, and I do not intend to limit the claims of this application to its employment, since within the scope of the present invention my new alloy can be produced by fusion with aluminium of a rich alloy containing aluminium and titanium. In practicing said method I proceed as follows: I make by fusion a bath of fluorides of aluminium and sodium, or of fluoride of sodium, or of fluorides of aluminium, sodium, and calcium, or generally a fluoride or fluorides of a metal or metals more electro-positive than aluminium. I may add to these fluorides chlorides of the alkalis or alkaline earths; but these are unnecessary. Cryolite of commerce may be used as the fluoride constituent of the bath; but, although I do not exclude its use from the scope of the broad claim of this application, it is in some respects disadvantageous because of its iron, which in the alloying process hereinafter described is reduced, and by mingling with the alloy impairs its quality. For this reason I prefer to employ the above-mentioned fluorides in as pure state as possible. Either before or after the fusion of this fluoride bath I add to it a reducible oxide or salt of the rare metal to be alloyed (in making an alloy of aluminium and titanium titanate oxide is preferably used) and after thorough admixture of these substances I introduce the aluminium. A reaction between the aluminium and said oxide or salt at once takes place. The oxide or salt is reduced. Its oxygen or acid radical combines with a part of the aluminium, and the freed metallic base immediately alloys with the remainder of the aluminium.

In practice I prefer to use as the fluoride bath fluorides of aluminium and sodium, which may be employed in amount ranging from one hundred to four hundred per cent. of the weight of the aluminium intended to be added. This bath I melt in a carbon crucible and add thereto the oxide or salt of the metal to be alloyed. When the whole mass is incorporated and as nearly fluid as possible, I charge metallic aluminium into the cru-

cible, the relative proportions of the aluminium and oxide or salt being such that the percentage of oxide or salt shall be about twice the percentage in which its metallic base is desired to be present in the alloy. Immediately on the introduction of the aluminium the reaction above noted takes place between the aluminium and the oxide or salt, and is accompanied by a rapid elevation of temperature of the bath. After waiting until further reaction ceases, which is indicated by cessation of rise of the temperature, the contents of the crucible are poured into a suitable receptacle, and after cooling somewhat the melted fluoride can be separated as a supernatant slag from the metallic alloy at the bottom of the vessel. The alloy is then collected and is preferably remelted to cleanse it thoroughly from slag and otherwise to improve its properties. It is important that the

reduction of the oxide or salt of titanium and its alloying with the aluminium should be conducted in a non-silicious crucible, (preferably a carbon crucible,) since if the vessel be silicious in its composition a considerable portion of silicon will be alloyed with the aluminium and titanium, producing a compound of inferior quality.

I claim—

As a new article of manufacture, an alloy of titanium and aluminium containing less than ten per cent. of titanium, substantially as specified.

In testimony whereof I have hereunto set my hand this 18th day of September, A. D. 1890.

JOHN W. LANGLEY.

Witnesses:

THOMAS W. BAKEWELL,  
W. B. CORWIN.