

# UNITED STATES PATENT OFFICE.

PAUL FRANÇOIS DE SUSINI AND EUGÈNE AUGUSTE LÉON LANGLOIS, OF  
PARIS, FRANCE.

## QUARTERNARY ALLOY.

SPECIFICATION forming part of Letters Patent No. 533,970, dated February 12, 1895.

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*To all whom it may concern:*

Be it known that we, PAUL FRANÇOIS DE SUSINI and EUGÈNE AUGUSTE LÉON LANGLOIS, of Paris, France, have invented a certain new and useful Quarternary Alloy, which is fully described in the following specification.

The object of the invention is the production of a quarternary alloy constituting, so to speak, a new metal which has absolutely new physical and chemical properties.

This alloy is mainly characterized by very great mechanical resistance to tension, shock and compression; also by its beautiful golden color and by its superior inoxidizability. It moreover, is capable of being rolled with the utmost facility, either cold or hot, to all thicknesses. It may be molded with ease to great thinness without presenting blowholes in sand, metal or other molds. Having great resistance and a high ductility it may be extended to capillary diameters. It may be forged like iron with facility and may therefore be adapted to the manufacture of most delicate and complicated objects. Its malleability, ductility and elasticity are those of metals possessing these qualities in the highest degree. It may be drawn out in tubes of all diameters and thicknesses, either hot or cold, and may be stamped or embossed, for any mechanical or artistic purpose like gold, silver, copper, brass, &c. According to its degree of hammer hardening or annealing it may be elongated to from three to forty per cent.

This new quarternary alloy possesses elasticity and resistance equal to those of the best steels, together with ductility, malleability elongation equal to those of copper, brass, gold and silver. Owing to these properties it may with advantage take the place of all the metals usually employed in most of the industrial applications beginning with steel and iron, including copper, brass, bronze and including also most precious metals and their alloys.

The new alloy is composed of copper, aluminium, tungsten and phosphorus. The composition being always the same it may, nev-

ertheless, vary according to the quantities of the several component bodies, such variations depending upon the degree of resistance to elongation, ductility and malleability sought to be obtained to answer the purposes for which it is intended and which allows of the production of metals according to a scale of numbers corresponding to the most varied uses.

We have found that by varying the composition, quantitatively, the following eight fundamental types may be obtained:

First, copper, ninety per cent.; aluminium, five per cent.; tungsten, four and one-half per cent.; phosphorus, one-half per cent.

Second, copper, eighty-nine per cent.; aluminium, six per cent.; tungsten, four and one-half per cent.; phosphorus, one-half per cent.

Third, copper, eighty-eight per cent.; aluminium, seven per cent.; tungsten, four and one-half per cent.; phosphorus, one-half per cent.

Fourth, copper, eighty-seven per cent.; aluminium, eight per cent.; tungsten, four and one-half per cent.; phosphorus one-half per cent.

Fifth, copper, eighty-six per cent.; aluminium, eight per cent.; tungsten, five and one-half per cent.; phosphorus, one-half per cent.

Sixth, copper, eighty-five per cent.; aluminium, nine per cent.; tungsten, five and one-half per cent.; phosphorus, one-half per cent.

Seventh, copper, eighty-three per cent.; aluminium, ten per cent.; tungsten, six and one-half per cent.; phosphorus, one-half per cent.

Eighth, copper, ninety-five per cent.; aluminium, three per cent.; tungsten, one and one-half per cent.; phosphorus, one-half per cent.

We proceed in the manner as follows: First, the first operation consists in combining the tungsten with copper. To effect this without employing pure metallic tungsten, which is very costly and difficult to obtain, we resort to the direct reduction of tungstiferous ore by electrolytic copper, chemically pure, in the presence of carbon (charcoal) in a brasque

crucible highly treated in a crucible furnace. We then obtain a metallic mass containing fifty per cent. of copper and fifty per cent. of tungsten, alloyed with traces of other metals which happened to be in the ore, which however, do not injure the composition. Second, the alloy thus obtained is put in a crucible with a quantity of copper necessary to produce with it one of the eight above mentioned compositions. Third, when the compound is melted at white-red heat and intimately mixed, we add the quantity of aluminium indicated in the formula. Fourth, the aluminium melts immediately. The mass is then given another good stirring and finally to it is added one-half of a per centum of phosphorus which refines it, frees it from all impurities which will gather on the surface of the bath, whence it may be removed and poured at cherry heat into sand or other suitable ingot molds. The unmolding may be effected immediately and the bars, plates, or other form of castings are ready at once to further manipulations of rolling, drawing, forging, &c. The new quarternary alloy herein described, composed of copper, aluminium, tungsten and

phosphorus, and having the characteristics referred to, is known as "cyrnium."

What we claim is—

1. The new quarternary alloy, composed of copper, aluminium, tungsten and phosphorus in substantially the proportions set forth.

2. The process herein described for producing the quarternary alloy herein described, which process consists in first combining copper and tungsten by reducing tungstiferous ore by means of copper in the presence of carbon at a high temperature, adding the desired quantity of copper to the cupro-tungsten mass obtained and melting the resultant compound, adding aluminium when the mass is perfectly melted, and finally adding phosphorus as set forth.

In testimony whereof we have signed this specification in the presence of two subscribing witnesses.

PAUL FRANÇOIS DE SUSINI,  
EUGÈNE AUGUSTE LÉON LANGLOIS.

Witnesses:  
CLYDE SHROPSHIRE,  
H. ACORT.