

# UNITED STATES PATENT OFFICE.

WALTER RUEBEL, OF HAMBURG, GERMANY, ASSIGNOR TO ALBERT JACOBSEN, OF HAMBURG, GERMANY.

## MANUFACTURE OF ALLOYS.

No. 864,139.

Specification of Letters Patent.

Patented Aug. 20, 1907.

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*To all whom it may concern:*

Be it known that WALTER RUEBEL, a subject of the Emperor of Germany, residing at 26 Neuer Wall, Hamburg, in the Empire of Germany, engineer, has invented certain new and useful Improvements in and Relating to the Manufacture of Alloys, of which the following is a specification.

This invention has for its object a process for the manufacture of novel metallic alloys, the said process being essentially characterized by the fact that combinations of atomic quantities of aluminium, copper, nickel and iron are used either alone or as additions to copper and zinc.

It is already known that by the addition of a compound of one atom each of copper, aluminium, zinc, and silicium to copper, zinc and aluminium or to copper and aluminium, bronzes presenting great tensile strength are produced.

The product obtained in accordance with the present invention exhibits the further advantage as compared with these alloys of being considerably less costly to produce, so that they are of course capable of far more extensive use.

The copper-aluminium-nickel-iron-compound is manufactured by employing for each two atoms of copper and iron one atom of nickel and aluminium, so that the product finally obtained must be regarded as being composed in accordance with the formula



In practice the procedure is such that two atomic weights of iron or steel as poor as possible in carbon are placed at the bottom of the melting pot whereupon one atomic weight of cube nickel is added. The melting pot is then well covered and brought to a white incandescent heat. When this point has been reached, one tenth of the one atomic weight of aluminium is first of all added, whereupon the iron and nickel, which have not necessarily melted before, are at once melted. Thereupon during constant agitation two atomic weights of copper are added in as small pieces as possible and then the rest of the one atomic weight of aluminium. The whole is then mixed together as thoroughly as possible with a stick of carbon and the melting pot is allowed to remain on the fire for another ten minutes, whereupon the metal, after a further agitation is cast into bars or directly in the desired molds. The alloy thus obtained is as hard as nickel steel and presents greater strength. It is not attackable by seawater, water, moist air or by most acids and is therefore especially well adapted for machine and ship construction, and also for the manufacture of gun barrels.

A bronze presenting very good properties is obtained if 6 parts of the nickel-aluminium-copper-iron compound obtained in accordance with the above is added to 54 parts of copper and 40 parts of zinc. In the production of this alloy the copper-aluminium-iron-nickel compound is first of all melted and the necessary quantity of copper is added, or the two substances are added, but in this case care must be had that the nickel-aluminium-iron-copper alloy, which is more difficult to fuse than copper and floats upon the same, is really melted, which can be recognized from the fact that the molten mass then appears not of a blue-green, like copper, but white and thick. When a uniform molten mass has been obtained, the necessary quantity of zinc is added and this should be done in small pieces and very carefully, as much heat is thereby generated, so that if a piece of zinc of two kilograms in weight is added, for example, the entire contents of the melting pot would be instantly vaporized. The finished product is, after being well agitated, cast into bars and again melted when it is desired to cast it into molds, and care should be exercised that in remelting the bars they should be very quickly melted down and removed and if this be attended to the loss due to adherence to the melting pot and the like will not exceed 1% at the most.

The material so obtained costs about 1 mark per kilogram and equals in strength, hardness and resistance the best bronzes hitherto produced. It is therefore suitable for replacing such bronzes.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. The process which consists in heating a mixture of iron and nickel to incandescence and adding aluminium to produce melting of the same; then adding copper and lastly aluminium, and reducing the mixture to a molten state.

2. The process which consists in heating a mixture of iron and nickel to incandescence and adding aluminium to produce melting of the same: then adding copper and lastly aluminium, and reducing the mixture to a molten state; and lastly mixing 6 parts of the alloy so formed with 54 parts of copper and 40 parts of zinc and reducing said mixture to a molten state.

3. An alloy made up of  $(\text{CuFe})_2\text{NiAl}$ .

4. An alloy made by mixing and fusing together 6 parts  $(\text{CuFe})_2\text{NiAl}$  and 54 parts of copper and 40 parts of zinc.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses this 7th day of April, 1904.

WALTER RUEBEL.

Witnesses:

J. CHRIST. HAUFMANN,  
OTTO W. HELLMICH.