

UNITED STATES PATENT OFFICE.

ADOLF HUBER, OF BERLIN, GERMANY, ASSIGNOR TO THE FIRM OF KUNHEIM AND CO.,
OF BERLIN, GERMANY.

METALLIC ALLOY.

993,998.

Specification of Letters Patent.

Patented May 30, 1911.

No Drawing.

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To all whom it may concern:

Be it known that I, ADOLF HUBER, chemist and engineer, a citizen of the Confederation of Switzerland, residing at 37 Goerlitzer Ufer, Berlin, Germany, have invented certain new and useful Improvements in Metallic Alloys, of which the following is a specification.

10 Metallic alloys, which give sparks when scratched with hard substances have hitherto been prepared by fusing together metals of the so-called "rare earths," especially cerium, and heavy metals, like iron, an example of such being described in U. S. Letters Patent, No. 837,017 of November 27, 15 1906. The applicant has discovered that spark giving alloys can also be obtained from the common earthy metals, especially aluminium, when the amount of them added to metals of the cerium group of the "rare 20 earths" does not exceed the weight of the latter metals, in the case of alloys containing less than 50% of the cerium metals the property of spontaneous ignition of the particles separated at the ordinary temperature has almost entirely disappeared.

Though it seemed possible to obtain spark-giving alloys with aluminium, it was nevertheless found at first that the alloys containing high proportions (up to 50%) of 30 aluminium, were far too brittle to be suitable for practical use for purposes of ignition, in cases where the alloys have to be employed in a coherent form, such as rods, disks and the like. Alloys of this kind, 35 when poured into molds, break even on cooling, into a number of small portions, exhibiting a decidedly conchoidal fracture. On the other hand, however, the alloys containing over 25% of aluminium, are admirably suited for use in cases where the powder form comes under consideration, such as in the manufacture of explosives and fireworks. It has also been found, that 45 the brittleness of the said alloys diminishes as the content of "rare earth" metal increases without impairing the spark-giving power. Since the metals of the "rare earths" are not of themselves spark-giving 50 without special treatment, there must exist an *optimum* condition of the alloy, in which the properties of easy workability and the production of sparks appear at their

greatest. This condition is realized when the aluminium content in the alloy reaches 55 12%. Nevertheless, readily workable alloys are obtained with from 0.5-25% of aluminium; and these alloys can be conveniently cast in molds without disintegrating on cooling and will furnish long and highly luminous sparks when scratched with hard substances. 60

The alloys described are superior to the iron alloys hereinbefore referred to, since the sparks, in addition to their higher 65 calorific power, are far brighter and longer, thus increasing the value of the alloy for lighting purposes. Moreover, in use, the lower specific gravity and the consequently larger volume of the alloy in relation to the 70 "rare earth" metal content, reduce the loss of the "rare earth" metal by abrasion. Finally another considerable advantage is based on the circumstance, that the melting point of the alloys of the "rare earth" 75 metals and aluminium is much lower than that of the heavy metal alloys such, for example, as described in said Letters Patent, a point which greatly facilitates casting and other mechanical treatment. 80

In place of aluminium alone, a mixture of aluminium with magnesium can be introduced into the alloy, provided that in such case also, the percentage does not appreciably increase the *optimum* of 50% or in the 85 case of application to purposes of ignition about 12%. Finally, a portion of the aluminium in the aluminium-magnesium-alloy can be replaced by silicon, without appreciably affecting the properties of the resulting alloy, especially the capacity for spontaneous ignition of the separated particles. 90

The alloys can be prepared by melting together the weighed quantities of rare earth metal and aluminium with or without the 95 addition of magnesium or silicon, metallic silicids, silica or silicates, out of contact with air, for instance under a covering layer of sodium chlorid and potassium chlorid. The alloys, however, can also be obtained during the recovery of the "rare earth" metal 10 in a decomposing cell in the presence of an electric current. In this case, the composition of the electrolyte, consisting of compounds (chlorids) of the "rare earth" metals and aluminium, and the amperage of the 10

current is to be selected in such a manner that the alloys are deposited with the desired percentage of aluminium.

5 The so-called "rare earth metals" are difficult to separate so that in practice it is almost always necessary to treat a mixture of cerium with lanthanum and didymium, *i. e.*, a mixture of the metals of the cerium group of the rare earth metals.

10 What is claimed is:

1. Spark-giving metallic alloys containing metals of the cerium group of the so-called "rare earths" and aluminium, the proportion of the latter not exceeding 50%.

15 2. Spark-giving metallic alloys containing metals of the cerium group of the so-

called "rare earths," aluminium and magnesium, the proportion of the latter metals not exceeding 50%.

3. Spark-giving metallic alloys containing metals of the cerium group of the so-called "rare earths," aluminium, magnesium and silicon, the proportion of the latter metals not exceeding 50%.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

ADOLF HUBER.

Witnesses:

HENRY HASPER,

ARTHUR SCHROEDER.