UNITED STATES PATENT OFFICE.

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

PYROPHORIC METALLIC SUBSTANCE.

967,775. Specification of Letters Patent. Patented Aug. 16, 1910.

No Drawing. Application filed August 5, 1909. Serial No. 511,340.

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 Berlin, Germany, 37 Goerlitzer Ufer, have invented certain new and useful Improvements in Pyrophoric Metallic Substances, of which the following is a specification.

The present invention relates to a method of making pyrophoric metallic substances from metals of the so-called "rare earths". Among such metals are to be included the elements cerium, lanthanum, didymium, yttrium, ytterbium, scandium and erbium. (See "*Analysis Deduction and Commercial Value of the Rare Metals*" by Dr. J. Ohly, Denver, Colorado, 1903, page 148).

It is known that among the alloys of the "rare earth" metals cerium, lanthanum and didymium with other metals, there are such which have the property of giving off sparks when scratched with hard substances, and that these alloys therefore can be employed for ignition and illumination purposes.

The applicant has now discovered the remarkable fact that the aforesaid spark-giving alloys have an increased useful property of producing ignition when they are treated at an increased temperature with hydrogen. Under this treatment, the alloys will be progressively saturated with hydrogen from the exterior to the interior according to the temperature employed and the length of exposure to the gas and by so treating such alloys, it is possible to obtain pyrophoric products of practically any desired power.

In comparison with the effect produced by the incorporation of hydrogen, the proportions of the components in the mixture play a relatively unimportant part; and these proportions may be varied within wide limits, even when alloys with the heavy metals are in question. In all cases, the treatment with hydrogen, or the incorporation of hydrids, results in a considerable augmentation of pyrophoric power, a result manifested by the greatly diminished force required for detaching minute particles, and by the fact that the detached particles are more readily and completely consumed than in the case of substances compounded in a similar manner but not treated with hydrogen or prepared without hydrids. This is an important point in connection with igniting-substances for miners'-lamps. The choice of the temperature at which the treatment with hydrogen is effected is of high importance, and must be specially investigated in the case of each alloy. In the case of an alloy containing 15% of magnesium and 85% of metallic cerium, for example, the temperature is between 500° and 600° C. When the temperature has been properly selected, the alloys retain their shape and their stability in air, and the absorption of hydrogen merely alters their structure and pyrophoric properties. If the temperature has not been chosen correctly, the substance may fall entirely to powder, or the surface of the piece of metal will crack—presumably in consequence of the increase in volume caused by the absorbed hydrogen—or pipes are formed from which unattacked metal exudes. The duration of exposure to the action of hydrogen in the case of each alloy depends on the composition of the latter. As a rule the action may be regarded as finished when the substance exhibits a uniform fracture and no longer shows a gray core. If the supply of hydrogen be too abundant, especially in the alloys of rare-earth metals with heavy metals, the increase in pyrophoric properties may proceed to such an extent that the resulting substance takes fire spontaneously, or when struck ever so gently.

Example: A fire-clay muffle is charged with bars or plates of an alloy of mixed cerium metals and magnesium, containing 15% of magnesium. The muffle is heated in an electrical resistance furnace to 550° C., whereupon hydrogen is admitted so long as any absorption can be detected by a comparison of the quantities of gas entering and issuing from the muffle. After being cooled down in the current of gas the metallic alloy is ready for use. It has completely changed in appearance, the original silver-gray fracture has become modified into greenish gray; and any incomplete conversion into the hydrogen compound is revealed by the presence of a light gray core in the mass, in which event the hydrogen treatment must be repeated.

The so-called "rare earth" metals are difficult to separate and consequently it is almost always necessary in practice to treat a mixture of cerium with lanthanum and

didymium, that is to say, a mixture of the metals of the cerium-group of the "rare earth" metals.

What I claim is:

1. The hereindescribed method of increasing the pyrophoric properties of metallic alloys containing metals of the cerium-group of the so-called "rare earths" in combination with other metals, which consists in treating such alloys with hydrogen at a high temperature.

2. The composition of matter consisting of a pyrophoric alloy combined with hydrogen, said alloy containing a metal of the cerium-group of the "rare earth" metals.

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

ADOLF HUBER.

Witnesses:
HENRY HASPER,
ARTHUR SCHROEDER.