

# UNITED STATES PATENT OFFICE.

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## PYROPHORIC ALLOY.

1,118,138.

Specification of Letters Patent.

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No Drawing.

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*To all whom it may concern:*

Be it known that I, ANTON KRATKY, a subject of the Emperor of Austria-Hungary, residing at Vienna, Austria-Hungary, have invented new and useful Improvements in Pyrophoric Alloys, of which the following is a specification.

This invention relates to a metal alloy, particularly to what is known as a pyrophoric alloy, a substance which on being struck or rubbed by an object sufficiently hard, will detach fine particles therefrom and raise the temperature of the particles to such a point that they burn with a hot brilliant spark that will readily ignite gases, alcohol, and solid combustible substances.

The property possessed by cerium and other metals of the "rare earth" or cerium group of burning at a low temperature being known, one or more of these metals, particularly cerium, is employed as the base of the alloy forming the subject of the present invention.

The burning temperature point of cerium being low, but little friction is required to produce sufficient heat to ignite minute particles removed therefrom. But cerium alone is not suitable for general use, it being a soft, brittle metal easily broken, and the particles detached therefrom, even by a gentle blow or slight friction, are relatively large and do not ignite readily. Another objection to cerium alone is its tendency to oxidize rapidly on exposure to air, particularly if there be any moisture in the air. For these reasons other elements are alloyed with cerium to produce a substance which is harder than cerium alone and from which much smaller particles are detached when struck or rubbed by a hard material. Furthermore, the alloys of cerium are more stable than pure cerium and but slowly affected by the atmosphere. Cerium has heretofore, been mixed with various metals for producing pyrophoric alloys, but with one exception so far as known, these alloys have not proven successful. While they may produce sparks when struck or rubbed, there is a something about them or the process of their manufacture that has prevented successful introduction into commercial use.

A pyrophoric alloy to be a practical commercial success, should possess the following properties: 1. It should be sufficiently hard and brittle to give off particles when

abraded which are quite small and readily ignite, burning with a bright hot spark, and which will not cause the alloy to waste away quickly. 2. It should possess sufficient sensitiveness to ignite with as little friction or force as possible. 3. It should be reasonably stable when exposed to the air. 4. And finally, it should be of such composition as to be produced readily and cheaply in a commercial way without the attending danger of explosion. No alloy of cerium with a single metal, so far as known, will answer these requirements except the iron alloys, and in the alloy of the present invention, no iron is added. All other alloys are either too soft, too hard, or too brittle, the latter characteristic causing them to break up into small pieces too large to ignite, or they deteriorate in the atmosphere. Further objections relate to their manufacture which is too dangerous owing to their explosive nature, or too difficult or unsatisfactory because the final product is not of an even or uniform composition.

Cerium may be alloyed with magnesium to produce a pyrophoric material, but with these two metals alone some of the resulting alloys are found to be too hard, requiring too much effort and force to produce sparks, others are so brittle that relatively large pieces will be broken off when struck or rubbed by a suitable object, while yet other magnesium alloys are lacking in cohesion and, furthermore, are not sufficiently sensitive for the particles to ignite readily.

It has been discovered after long study, investigation and extensive practical and commercial use, that magnesium alloys of cerium and other "rare earth" metals can be transformed into very sensitive pyrophoric alloys which are softer, have more cohesiveness and give off finer particles that produce a more compact group of brilliant, intensely hot sparks, when abraded, and which alloys far surpass in their resistance to oxidation by the air, any known alloys, if a small quantity of some one or more of the lighter and softer metals of relatively low melting point be mixed therewith, as zinc, or any of its chemical equivalents. Any one or more of such elements may be alloyed with the cerium and magnesium to produce a pyrophoric alloy having special properties for a particular purpose in connection with the various types of lighting devices now in

commercial use which require different qualities in the pyrophoric alloys to produce the best results. Resistance to the air is inherent in the magnesium alloys, while the action of the other added element or elements increases the pyrophoric properties of the alloy by softening and in a measure toughening the otherwise too hard product, making it quite sensitive and of such consistence that minute particles are easily removed therefrom with small friction or force and give very bright and exceedingly hot sparks. The sparks obtained from this alloy do not spread as is usually the case with other and harder alloys, owing to their resiliency, but because of its comparative softness, the minute particles remain grouped and give off a large amount of heat when they ignite.

A most satisfactory alloy is produced by melting together in the well known manner, and in about the following proportions, cerium or other "rare earth" metal 84 per cent., magnesium 8 per cent., and zinc or its equivalent cadmium 8 per cent. This produces an alloy very suitable for lighting devices working on the strike principle. The proportions of the above formula may be changed more or less as conditions demand, but the percentages given are approximately correct. The percentage of zinc with relation to the total of the other constituents should be approximately 8.7. The fundamental principle of the invention is the production of a pyrophoric alloy made of cerium and magnesium as a base, to which is

added one or more of the lighter, softer, metals of relatively low melting point to soften and toughen the magnesium and cerium alloy, and give a product which when abraded or struck a blow will give off a compact group of brilliant intensely hot sparks which will readily light gases, alcohol and other combustible substances.

What I claim is:—

1. A pyrophoric alloy containing a mixture of the cerium group of rare earths and magnesium, to which a portion amounting to approximately 8.7 per cent. of the said mixture, of zinc has been added.

2. A pyrophoric alloy containing a mixture of a metal of the cerium group of rare earths of approximately 84 parts, magnesium of approximately 8 parts, and zinc of approximately 8 parts.

3. The herein described method of increasing the softness of a metallic alloy containing a mixture of a metal of the cerium group of rare earths and magnesium, which consists in adding to the mixture of cerium and magnesium, zinc in proportion of approximately 8.7 per cent. of the mixture of cerium and magnesium.

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

ANTON KRATKY.

Witnesses:

AUGUST FUGGER,  
ADA MARIA BERGER.