Patented Aug. 22, 1939 2,170,394

UNITED STATES PATENT OFFICE

2,170,394

TREATING METAL MIXTURES

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No Drawing. Application June 25, 1938, Serial No. 215,913. In Germany July 1, 1937

2 Claims. (Cl. 75—121)

This invention relates to a method of removing magnesium from mechanical mixtures of metallic beryllium and metallic magnesium, such as are obtained when machining magnesium and beryllium side by side, and more especially in the thermal reduction of beryllium compounds with the aid of magnesium.

The only method hitherto available for the foregoing purpose consists in treating the mixture of metals, generally in the form of flakes or turnings, and preferably in compressed form, with hot water for a prolonged period, for the purpose of converting the metallic magnesium into the form of hydroxide, which can then be separated from the residue of metallic beryllium.

Since magnesium is attacked only slowly by hot water, the foregoing method is practicable only when small amounts of magnesium have to be removed. Although no actual dissolution of beryllium takes place in the process, nevertheless a superficial oxidation of the beryllium metal occurs in the course of time and can be discerned by the flakes gradually losing their original lustre. The film of oxide formed interferes with the subsequent melting down of the beryllium. In addition, it is difficult to separate from the beryllium, the magnesium hydroxide formed by the treatment with water, so that said hydroxide also interferes with the subsequent melting down of beryllium residue, and may even be reconverted into metallic magnesium by becoming reduced by the metallic beryllium at the temperatures required to melt down the latter.

Attempts to accelerate the separation, by using aqueous solutions of alkali metal bicarbonates or ammonium carbonate, which are known to be capable of attacking metallic magnesium to form water-soluble compounds and which in view of their neutral or weakly alkaline reaction might be assumed to remain inert towards metallic beryllium, have however shown that the rate of attack of magnesium by the aforesaid compounds is extremely slow and that the reaction moreover gives rise to the precipitation of insoluble compounds, such as basic magnesium carbonates, which interfere with the subsequent melting down of the metallic beryllium to the same extent as the magnesium hydroxide previously referred to.

The present invention contemplates converting the magnesium of beryllium-magnesium mixtures of the kind hereinbefore set forth, into water-soluble magnesium salts.

It has been ascertained that this can be effected in a rapid and reliable manner, if the metal mixture be treated with at least twice, but preferably more than twice, the theoretical quantity of such ammonium salts, in the form of aqueous solution, which are capable of reacting with metallic magnesium to form water soluble compounds. Such ammonium salts are especially ammonium chloride, ammonium sulphate, ammonium nitrate and ammonium acetate.

Whilst aqueous solutions of the aforesaid ammonium salts attack metallic magnesium very actively even at ordinary temperatures and rapidly dissolve the same, it is rather surprising that these solutions, the majority of which have a weakly acid reaction and might thus be assumed to attack beryllium, do not, in fact, attack the beryllium of the mixture at all, and thus permit of a perfect and complete removal of the magnesium without loss or superficial oxidation of the beryllium.

Based on the foregoing observation, the present invention provides a method of removing magnesium from mechanical mixtures of metallic beryllium and metallic magnesium, which comprises treating the said mixtures with at least twice, and preferably more than twice, the theoretical amount, of such an ammonium salt or salts, in the form of an aqueous solution as is or are inert towards metallic beryllium and capable of reacting with metallic magnesium to form a water-soluble compound or compounds.

The invention can be carried out with ammonium salt solutions of any desired concentration. However concentrations of between 5 and 20% are preferably employed.

The process of the present invention has the advantage of greatly accelerating the removal of the magnesium whilst at the same time permitting the metallic beryllium to retain its lustre; no difficulty is therefore encountered in the subsequent melting down of the beryllium residue. Moreover when applied to the purification of the crude beryllium obtained in the reduction of beryllium compounds with the aid of magnesium, the hereindescribed process not only ensures the efficient removal of any metallic magnesium remaining in the crude mixture of reaction products but also removes any magnesium chloride present as a result of the reaction or any magnesium hydroxide formed therefrom by hydrolysis.

Example I

500 grammes of a mixture containing 90% of beryllium and 7.5% of magnesium in the form of crystalline powder, were treated for twenty minutes with 10 litres of an ammonium chloride solution of 10% concentration, whilst occasion-

ally stirring the mixture. The generation of hydrogen ceased after about ten minutes. The whole was then filtered, leaving a metal powder which was free from magnesium whilst the clear filtrate contained all the magnesium contained in the stirring mixture but no beryllium. The resulting metal powder was dried and could be melted down without any difficulty.

Example II

500 grammes of mixture containing 94.2% of beryllium and 3% of magnesium were treated for twenty minutes with 10 litres of a solution of ammonium sulphate of 10% concentration. The generation of hydrogen ceased after about ten minutes. After filtration and drying a metal powder containing 99% of beryllium and only 0.1% of magnesium was obtained, while the filtrate contained the remainder of the magnesium but was free from beryllium.

Example III

500 grammes of mixture containing 94.2% of beryllium and 3% of magnesium were treated for ten minutes with 10 litres of a solution of ammonium acetate of 10% concentration. The reaction terminated after about five minutes. After filtration and drying, the beryllium powder contained only traces of magnesium practically all of which was found in the filtrate.

I claim:

1. A method of removing magnesium from mechanical mixtures of metallic beryllium and metallic magnesium, which comprises treating the said mixtures with an aqueous solution containing at least about twice the theoretical amount of at least one member of the group consisting of ammonium chloride, ammonium sulphate, ammonium nitrate and ammonium acetate.

2. A method of removing magnesium from mechanical mixtures of metallic beryllium and metallic magnesium, which comprises treating the said mixtures with an aqueous solution containing at least about twice the theoretical amount of at least one member of the group consisting of ammonium chloride, ammonium sulphate, ammonium nitrate and ammonium acetate, the concentration of such aqueous solution being between about 5 and about 20 per cent.

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