Patented Oct. 4, 1932

1,880,538

UNITED STATES PATENT OFFICE

WILLIAM H. WAGGAMAN, OF LAKELAND, STAPLETON D. GOOCH, OF LAKE WALES, AND FRIEDRICH P. KERSCHBAUM, OF WINTER HAVEN, FLORIDA, ASSIGNORS TO CORONET PHOSPHATE COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK

PROTECTION OF PHOSPHORUS

No Drawing. Application filed February 27, 1931. Serial No. 518,888.

The present invention relates to the protection of phosphorus and more particularly to a method of protecting phosphorus against oxidation.

A major object of the present invention is to coat phosphorus, either in the pure yellow form or as crude elemental phosphorus, with a non-oxidizable layer or coating so as to eliminate the danger of oxidation of the phosphorus and to facilitate handling and shipping.

Another object is to treat phosphorus so as to permit the recharging of impure phosphorus sludge to a furnace without danger of loss so that the element may be revolatilized.

Yet another object is to provide as an article of manufacture a protected phosphorus which can immediately be used in the production of phosphorus alloys.

Yet another object is to provide as an article of commerce relatively non-oxidizable phosphorus.

With these and other equally important objects in view, the invention comprehends the concept of coating the phosphorus, either in the pure or impure form, with a relatively non-oxidizable coating. In the preferred form of the invention the material of the coating is so chosen as to permit the coated product to be used directly for the desired purposes without removal of the protective coating.

It will be appreciated that with the given concept in mind a variety of methods may be employed to achieve the improved results. In one preferred form the phosphorus, either as elemental pure phosphorus cakes or as lumps of phosphorus sludge, is treated with a solution of a salt of a readily reducible compound and thereafter precipitating upon the cakes or lumps of phosphorus either a phosphide or the reduced element of the compound, or a mixture of the phosphide and the element. For example, the beneficial results herein described may be obtained by treating lumps of phosphorus, at ordinary temperatures, with a dilute solution of a copper salt, such for example as copper sulphate. The amount of the salt need only be sufficient to insure the final protective coat. In such circumstances the quantity of salt employed in the solution equals approximately 2% of the weight of the phosphorus coated. In these circumstances a coating of copper and/or copper phosphide is precipitated upon the cake or lump of the phosphorus and renders the phosphorus substantially non-oxidizable, for it may be exposed to air with practically no danger of combustion.

In lieu of utilizing a solution of a copper salt, other salts of a readily reducible compound, such as tin or zinc, may be employed. It is to be noted that with these materials a secondary function is subserved when the phosphorus is to be employed in the manufacture of phosphorus alloys such as phosphor-bronzes. The copper, tin or zinc, either in metallic form or as a phosphide compound, not only serves as a protective coating for the phosphorus, but also serves as one of the components of the alloy. Hence the phosphorus in this form may be immediately added to the melt without any preliminary removal of the protective coating.

While the use of compounds of copper, tin and the like in the form of protective coatings is particularly useful when the final article is to be employed in the manufacture of alloys, it will be appreciated that the invention is not restricted to the use of these materials, for the major protective function may be insured by utilizing solutions of other readily reducible metallic compounds.

Also it is to be observed that the concept of the invention resides broadly in the production, as an article of manufacture, of a protected phosphorus particle. Therefore, other methods of applying the protective coating may be employed. For example, instead of precipitating the protective medium from a solution, this protective medium may be first made up and then applied to the phosphorus by means of an aqueous suspension. Thus, instead of forming the copper or tin phosphide in situ and on the surface of the phosphorus, this compound may first be made up and then suspended in a body of water from which it is allowed to settle or precipitate out upon the surface of the phosphorus particle.

It will be understood also that the application of the protective coating may be effected at any desired stage in the manufacture of the phosphorus. As noted hereinbefore, the use of the present protective method presents decided advantages when employed during the manufacture of the phosphorus. For elemental crude phosphorus, produced for example by the electric or blast furnace method, may be provided with a protective coating and then recharged to the furnace to be revolatilized to obtain phosphorus in a pure form. The recharging operation may be carried out without danger when the phosphorus is provided with the protective coating.

Typical examples of preferred methods and preferred ingredients have been described, but it is understood that these are given merely by way of example. The invention comprehends any suitable method of applying the protective coating and likewise any suitable ingredients. In lieu of the coatings of the insoluble and non-oxidizable cupric phosphide and stanic phosphate, the coating may comprise a mixture of these two or other protective compounds and/or a mixture of protective metals. Therefore, the invention is considered to reside broadly in the idea of providing phosphorus either in the pure or relatively impure form with a protective coating so as to render the phosphorus in fact substantially non-oxidizable.

We claim:

1. A process for protecting phosphorus against oxidation comprising treating said phosphorus with a solution of a readily reducible compound and precipitating thereon a protective surface of a non-inflammable substance.

2. A process for producing non-inflammable lumps and cakes of phosphorus comprising immersing said lumps and cakes in solutions of readily reducible compounds and precipitating on said phosphorus coatings which prevent contact of the air or oxygen with the phosphorus.

3. A process for rendering yellow phosphorus non-inflammable comprising immersing said phosphorus in a solution of a readily reducible compound and precipitating on the surface of the phosphorus a relatively non-oxidizable coating.

4. A process for protecting crude phosphorus against oxidation comprising immersing said phosphorus in a solution of a readily reducible compound and precipitating thereon a coating which prevents ready contact of air or oxygen with the crude phosphorus.

5. A process for protecting phosphorus against oxidation comprising immersing the phosphorus in a solution of the metallic salt and precipitating thereon a coating of the phosphide of the metal.

6. A process for protecting phosphorus against oxidation comprising treating said phosphorus with a solution of a copper salt and precipitating thereon a coating of phosphide of copper.

7. A process for protecting phosphorus against oxidation comprising treating the phosphorus with a solution of a copper salt and precipitating thereon metallic copper.

8. A process for protecting phosphorus against oxidation comprising treating the phosphorus with a solution of a copper salt and precipitating thereon a coating comprising a mixture of metallic copper and copper-phosphide.

9. A process for protecting crude phosphorus against oxidation comprising treating it with a solution of a tin salt and precipitating thereon a relatively non-oxidizable coating of phosphide of tin.

10. A process for protecting phosphorus against oxidation comprising immersing it in a solution of tin salt precipitating thereon a relatively non-oxidizable coating of metallic tin.

11. A process for protecting phosphorus against oxidation comprising treating it with a solution of a tin salt and precipitating thereon a mixture of metallic tin and phosphide of tin.

12. As an article of commerce, a unit mass of phosphorus having an exposed surface comprising a metal phosphide.

13. As an article of commerce, a unit mass of phosphorus having an exposed surface comprising a mixture of a phosphide and a metal precipitated thereon.

14. As an article of commerce, a unit mass of phosphorus having an exposed surface comprising metal precipitated thereon.

15. As an article of commerce, a unit mass of phosphorus, the exposed surface of which is coated with a metal capable of alloying with the phosphorus.

16. As an article of commerce, a unit mass of phosphorus, the exposed surface of which comprises a mixture of a phosphide and a metal capable of alloying with the phosphorus.

In testimony whereof we affix our signatures.

WILLIAM H. WAGGAMAN.
FRIEDRICH P. KERSCHBAUM.
STAPLETON D. GOOCH.