UNITED STATES PATENT OFFICE.

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AMALGAMATING COMPOUND.

SPECIFICATION forming part of Letters Patent No. 547,824, dated October 15, 1895.

Application filed January 2, 1895. Serial No. 533,636. (No specimens.)

To all whom it may concern:

Be it known that I, CHARLES N. VIGNERON, a resident of New York city, in the county and State of New York, have invented a new and useful Improvement in Amalgamating Compounds and in Methods of Preparing the Same, which improvement is fully set forth in the following specification.

This invention has reference to the preparation of amalgams for use especially in the extraction of precious metals from their ores; and its object is chiefly to enhance the attractive and adhesive property of the mercury upon the precious metals, to prevent loss of mercury from oxidation and from the detrimental action of substances associated with gold and silver ores, and to prolong the efficiency of the amalgam. The difficulties encountered in carrying on the process of amalgamation, such as the "sickening" and "flouring" or granulation of the amalgam, the loss of mercury, and the like are well understood by those skilled in metallurgical operations and do not require to be explained at length. I have found that these difficulties can in large measure be avoided and that the desirable results above indicated can be realized by combining the mercury with aluminium in the metallic state or as an alloy or compound; and the invention consists, broadly, in an amalgamating compound containing aluminium in any of its forms. In some of its effects aluminium acts in and on the mercury similarly to sodium, which has been heretofore employed in the well-known Wurtz amalgam, described in United States Patent No. 48,499, dated June 27, 1865. For example, it produces a polaric condition of the atoms of mercury, rendering the latter more electropositive, and hence increasing their affinity for the relatively electronegative metals, such as gold and silver. Sodium, however, is so readily oxidized on exposure to air that its effects are not lasting and it must be renewed at short intervals. The presence of aluminium, moreover, keeps the mercury clean and bright and in efficient condition for a long period of time. While aluminium when combined with mercury oxidizes with great rapidity, it is capable of so much higher degrees of oxidation than sodium that its lasting power for the purposes in view is many times greater. Not only does sodium lose its power of action in a very short time, but it is quite expensive, and for these reasons its industrial use has been limited. Many of the auriferous ores contain greater or less quantities of zinc, and when this comes into contact with mercury on a copper plate an action (probably galvanic) takes place, the zinc being deposited on the copper plate and apparently oxidizing and driving off the mercury. This peeling of the mercury from the plate is one of the greatest difficulties against which miners have to contend. When, however, aluminium is employed with the mercury, this objectionable action is prevented wholly or in part, according to the amount of zinc present in the ore. The action of the aluminium in such case cannot be stated with certainty, but the result described is believed to be due to the oxidation of the zinc along with the aluminium and its consequent elimination from the mercury.

In producing the effects above described I have used aluminium in the pure metallic state, introduced into the mercury in the form of a wire or distributed through the same in granular or pulverulent form. The conditions, however, under which amalgamating plates or apparatus are used render it desirable to bind the aluminium and mercury together as firmly as possible, and for this reason I prefer to use an aluminium compound or an aluminium alloy with a high percentage of aluminium, the other metal acting as a binding agent to form a close union between the mercury and aluminium. For this purpose I have employed in my experiments alloys of copper and aluminium, zinc and aluminium, silver and aluminium, and many others, the effects upon the amalgamating properties of the mercury being always as above pointed out, though in some instances more pronounced than in others. Without, therefore, confining myself to any specific form of aluminium, or to any specific method of using it, I will explain the mode of procedure from which the best results up to the present time have been obtained. I reduce metallic aluminium to the form of powder or of granules, such as will pass through sixty-mesh screen, though the size of the particles is not a matter of importance. This pulveru-

lent or granular mass I treat by chemical reagents to facilitate its introduction into the mercury and to increase its affinity therefor. For this purpose it has been found that the action of sulphate of copper produces favorable results, though other compounds of copper (as nitrates, chlorides, and the like) or other metallic salts might be employed. Assuming that sulphate of copper be used I dissolve it with a small quantity (one to five per cent.) of common salt in water, making a very strong or even a saturated solution. This solution is now diluted by adding about two volumes of water to one of the solution. The powdered or granular aluminium is placed in a glass or earthen vessel, making a layer of about one-eighth of an inch in depth. The dilute solution of copper sulphate and salt is then poured in until the liquid forms a layer of about an inch to an inch and a half above the aluminium. These directions are given as more convenient to follow in practice than proportions indicated by weight. They may be varied according to circumstances within considerable limits. Upon mixing, a somewhat energetic chemical reaction takes place, gradually subsiding, as the result of which a precipitate, which is an aluminium-copper compound in the form of a pulpy reddish-brown mass, is found in the vessel. The solution is then poured off. The precipitated mass or residue should be thoroughly washed before using. The mercury is then added in such proportions as to form a thick paste, grayish in color, and care should be taken that it be properly mixed by any suitable kneading or stirring process. The paste thus obtained may be spread on the amalgamating plates or thrown into barrels or employed in any amalgamating apparatus in the usual and well-known manner. Instead of dissolving the common salt with the copper sulphate I have found that it will answer just as well to add it, a little at a time, to the solution after the latter has been brought in contact with the aluminium.

The described process of treating a solution of sulphate or other copper salt with aluminium is not limited in its industrial applications to the preparation of an amalgam for extraction of precious metals. It also affords a means of reducing copper from its sulphate or other compound.

I claim as my invention—

1. The described composition for amalgamation of precious metals, composed of mercury having aluminium incorporated therewith, as set forth.

2. An amalgamating composition for use in the extraction of precious metals from their ores, said composition being composed of mercury, aluminium and a binding agent, as set forth.

3. The described composition for amalgamation of precious metals, said composition being composed of mercury, aluminium and copper, as set forth.

4. The method of preparing an amalgamating composition, consisting in treating aluminium with a metallic salt (such as sulphate of copper) and common salt and mixing the aluminium compound thereby produced with mercury, substantially as described.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

CHARLES N. VIGNERON.

Witnesses:
PHILIP MAURO,
HOWARD THAYER KINGSBURY.