UNITED STATES PATENT OFFICE.

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ALLOY FOR COATING METALS.

SPECIFICATION forming part of Letters Patent No. 328,239, dated October 13, 1885.

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To all whom it may concern:

Be it known that I, CHARLES E. MANBY, of McKeesport, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Alloys for Coating Metals; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to alloys for coating metals, its object being to provide a coating-alloy which will efficiently protect the surfaces of sheet metal, pipes, wire, and other metallic articles from rusting or oxidation, and one which overcomes many of the difficulties heretofore experienced in the use of zinc or alloys containing zinc.

The zinc employed in galvanizing is so crystalline that it often breaks off in flakes, and so leaves the surface of the iron exposed. The most effective coating heretofore employed is the calamine alloy, which penetrates into the surface-pores of the iron as though it had in turn entered into an alloy with the iron. The calamine alloy is, however, found to be soft, and will not resist much friction, and though it has a bright surface it will in a short time tarnish and lose its bright luster, and while it is still effective to protect the metal coated from oxidation, yet this tarnished or leadened appearance of its surface renders it less marketable. The galvanizing process requires an exceedingly high temperature of the coating-bath, and while calamine requires much less, still, as it contains zinc, the temperature of the coating-bath is high; and it is most essential to have the lowest possible temperature when using the wet process, for the reason that a high temperature causes too rapid volatilization of the prepared solution of soluble chlorides to separate it from the iron at the time it is being dipped into the metal, and consequently there is formed on the iron a thin film of oxide sufficient to prevent perfect success and the penetration of the alloy into the metal to produce the required effect. A high temperature of the coating-bath also in many cases blisters the metal coated.

By my invention these objections are entirely overcome, and dipping can be done with the greatest economy. My coating-alloy is an entirely new combination, being formed of tin, antimony, lead, and bismuth, and the proportions preferred by me in producing the alloy are: tin, from twenty-three (23) to thirty-six (36) per cent. of the entire alloy; antimony, from one-half (½) of one (1) per cent. to eight (8) per cent.; lead, from fifty (50) to seventy (70) per cent.; and bismuth, from one-fourth (¼) of one (1) per cent. to five (5) per cent. I find the alloy more efficient for coating purposes when the above proportions are used, though they may be varied to some extent within these limits.

In preparing the alloy no greater heat is required than that necessary for alloying antimony with tin, and I have found the most advantageous manner of mixing to be as follows: The tin required is first melted in a crucible, and heated to a dull red heat, and the antimony is then added either in a hot or cold state, the two metals being afterward stirred until they alloy. The lead is then added in a molten state and stirring continued, and when these metals appear thoroughly incorporated with each other the fire is withdrawn, so as to lower the temperature, after which the bismuth is added and the metals restirred, so forming the coating-alloy. I find, when the metals are mixed as described, the result is most satisfactory in that the four (4) metals have a strong union one with another to form a perfect alloy.

In coating iron or steel with this alloy the articles to be coated—such as pipes, sheets, wire, &c.—are first scaled by the usual pickling process, and then subjected to the neutralizing or reducing bath, consisting of a saturated solution of chloride of zinc or chloride of tin. The articles are then removed to the metal bath and immersed therein, remaining until raised approximately to the temperature of the metal bath, and afterward they are drawn out and allowed to drain. The tin and lead, forming the principal part of the alloy, prevent oxidation; but it is essential to bind these two metals more strongly together, and this I find can be accomplished by the aid of

antimony in presence of bismuth. Antimony also imparts to the alloy a hardness which properly enables it to withstand much severe wear and tear or unusual friction. Antimony also imparts to it and causes it to retain a silver-like luster, much more handsome than galvanizing. Antimony is also very electro-negative, and it aids in the presence of bismuth in neutralizing or reducing to a minimum galvanic action between the remaining heterogeneous metals, iron, tin, and lead. The bismuth promotes fluidity of the alloy, and lowers the temperature of the coating-bath, which condition is of the greatest importance, the low temperature being exceedingly desirable for reasons hereinbefore explained. The temperature of the bath is from 150° Fahrenheit to 250° Fahrenheit below that required for galvanizing, and about 100° Fahrenheit below that required in coating with calamine alloy. The temperature of the alloy is indicated by its surface, so that it can be kept under complete control with a very little experience. When the proper temperature is observed, there is no loss either by skimmings or oxidation. The coating formed by this alloy on iron or steel affords a superior protection to any heretofore known to me, as it forms a firm union with the metal coated and precludes oxidation or rusting of the article coated, and the alloy will not oxidize or tarnish, so that it retains its bright silvery luster when subjected to all natural waters for some considerable time. The coating is also remarkably ductile on account of the combination of these metals possessing properties of non-crystallization.

I am aware that the metals contained in my improved alloy have been heretofore alloyed for different purposes, such as for imitation silver-ware, printing-blocks, and piston-packing; but the proportions of the several metals employed in these alloys differ widely from mine, and on account of their cost none of them could be economically employed for coating purposes, and even that most nearly approaching my alloy in proportions could not be employed for the same purpose, for the reason that the metal would waste or dross in coating and the surface formed be entirely too hard and brittle to give proper protection to the metal coated, being liable to scale off and leave the metal unprotected.

What I claim as my invention, and desire to secure by Letters Patent, is—

The alloy for coating metals herein described, containing tin, antimony, lead, and bismuth in substantially the following proportions: tin, from twenty-three to thirty-six per cent.; antimony, from one-half of one per cent. to eight per cent.; lead, from fifty to seventy per cent., and bismuth from one-fourth of one per cent. to five per cent.

In testimony whereof I, the said CHARLES E. MANBY, have hereunto set my hand.

CHARLES E. MANBY.

Witnesses:

JAMES I. KAY,

J. N. COOKE.