UNITED STATES PATENT OFFICE.

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METHOD OF CASTING ALUMINIUM ALLOYS.

SPECIFICATION forming part of Letters Patent No. 634,904, dated October 17, 1899.

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To all whom it may concern:

Be it known that I, WILLIAM A. McADAMS, a citizen of the United States, and a resident of New York, in the county of Kings and State of New York, have invented a new and useful Improvement in Methods of Casting Aluminium Alloys, of which the following is a specification.

My invention relates to an improvement in the method of casting aluminium alloys composed of aluminium, zinc, and copper, with or without a small percentage of nickel, and in which the metal aluminium predominates.

Aluminium when melted cools slowly, so slowly that other metals which are present in molten state in the molten aluminium are permitted to segregate and form large crystals before the slowly-cooling aluminium checks to any considerable degree their segregation and crystallization, thereby materially reducing the strength of the casting. Furthermore, the zinc and copper, because of their greater specific gravity, have a tendency to fall toward the bottom of the molten mass, and thus render the casting non-homogeneous.

The object of my present invention is to prevent such segregation, crystallization, and stratification of the mixture during the process of the cooling, and thereby add material strength to the casting.

In an alloy composed of seventy-two per cent. aluminium, twenty-four per cent. zinc, and four per cent. copper, or similar alloys in which the aluminium forms a greater part of the alloy, the hereinbefore-described segregation, crystallization, and stratification of the commingled metals will be liable to take place unless the molten mass is cooled so rapidly after pouring as to check the segregation and stratification before it can have proceeded to any great extent. By means of numerous experiments I have found that the cooling should take place rapidly within certain well-defined practical limits and that the heat should be taken from the molten mass at as nearly a uniform rate as possible. This may be accomplished where the casting is thin or small by using a metal mold of sufficient thickness to quickly remove the heat from the casting, and when the casting is to be thick or large the mold may be surrounded by a cooling medium to assist it in removing the heat with the required speed and uniformity.

To carry out my process successfully, the heat should be removed from the casting as rapidly as at the rate of one-fifth of a calory per second, and, on the other hand, it should not be removed more rapidly than at the rate of two calories per second, as when removed more rapidly than this rate the sudden chill is found to produce the same weak structure that is produced when the heat is removed at a rate less than one-fifth of a calory per second. The best results are obtained by removing the heat at the rate of from one to one and one-tenth calories per second—a rate much more rapid than is common in the ordinary use of metallic molds. I found that this treatment of aluminium alloys in which the aluminium forms the greater part of the alloy will increase the strength of the casting from eighty to one hundred per cent.

I have found by careful experiment that a bar composed of aluminium, zinc, and copper, combined in substantially the proportions hereinabove mentioned, (viz., seventy-two per cent. aluminium, twenty-four per cent. zinc, and four per cent. copper,) .968 of a square inch area in cross-section, cast by the process hereinabove set forth, supported upon inverted-V edges twelve inches apart and with the weight applied by a V edge midway of its point of support, showed a transverse stress of three thousand two hundred pounds, with a deflection of .21 of an inch under a load of three thousand two hundred pounds, the same bar showing a tensile strength of thirty-nine thousand pounds. A two-inch length of the bar standing on end supported a load of seventy thousand pounds without visible deformation and actually sustained over ninety-eight thousand pounds before breaking with a shearing crack. I have further found by careful experiment that a similar bar of metal, composed of the same material and in the same proportions, cast in the ordinary manner and allowed to cool at a rate not greater than one-fifth of a calory per second showed a transverse stress, under the same conditions as before, of only two thousand and fifty pounds, a deflection of .13 of an inch under

a load of nineteen hundred pounds, and a tensile strength of twenty-two thousand pounds.

What I claim is—

The method of casting alloys containing aluminium, zinc and copper, in which the aluminium predominates, consisting in rapidly removing the heat from the molten mass at a rate not less than one-fifth of a calory per second—viz., more rapidly than has heretofore been common in the ordinary use of molds, thereby preventing the segregation of the metals and the formation of large crystals, substantially as set forth.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 4th day of May, 1898.

WILLIAM A. McADAMS.

Witnesses:
FREDK. HAYNES,
EDWARD VIESER.