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DIE-CASTING METAL.

No Drawing.

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To all whom it may concern:

Be it known that I, CHARLES PACK, a citizen of the United States, residing at Elmhurst, in the county of Queens and State of New York, have invented certain new and useful Improvements in Die-Casting Metals, of which the following is a full, clear, and exact description.

While zinc has many properties which are desirable for die-castings, being relatively inexpensive and substantially non-corrosive, and having strength and wearing qualities which adapt it for many uses within the possibilities of die-casting, it has other properties which, in its pure or unalloyed state render it more or less unsuitable for die-casting, although it may readily be extruded or rolled under pressure at the proper temperature. The extruding or rolling processes evidently change its crystalline structure, and zinc articles so formed have such lasting qualities and comparative immunity from deterioration as to render the material preeminently desirable for the uses to which the articles are put. There are, however, many articles which, by reason of their shape, are not susceptible of being extruded or made from rolled zinc, but which might readily be die-cast. The advantages of die-casting zinc have long been recognized and considerable effort has in the past been expended in that direction, but up until the present at least, it has not been possible to die-cast zinc commercially. One of the reasons for this is the fact that the metal is what is known as "hot short". Its crystals are comparatively large and in cooling the walls of the castings tend to check or crack in irregular lines along the crystalline boundaries.

For this reason attention was early directed to altering the nature of the metal by alloying it with various other metals to adapt it for die-casting, and now zinc-base alloys are extensively used in the die-casting industry. It is appreciated, however, that while the alloying of zinc apparently improves it for use in die-casting, as a matter of fact, the known alloys are materially inferior to pure zinc in lasting quality and in many other respects. While many reasons may be assigned for this, a paramount reason is the fact that zinc is highly electro-positive and a galvanic action results in the alloy between the zinc and any

other constituent which is either electro-negative or at least is not relatively high in the scale of electro-positive metals. The known alloys deteriorate more rapidly than pure zinc, an early evidence of deterioration being commonly the phenomenon of swelling in the presence of moisture and heat. The result is that their life is materially shorter than that of pure zinc. The metals most commonly used in zinc-base alloys are tin and copper, sometimes with a small trace of aluminum, although zinc alloys consisting of zinc, copper and aluminum, the latter in quantities as high as 18 to 20 per cent are known.

My invention resides in a novel treatment of the zinc which adapts it for die-casting without impairing its qualities in any way. I have found, for example, that if the pure zinc is treated with a comparatively very small quantity of chromium, nickel and iron in the presence of a suitable flux, the nature and crystalline structure of the zinc are materially changed, the crystals being substantially reduced in size, with the result that the zinc casts much better, and shrinks much less in cooling and has no tendency to check or crack. Furthermore, the tensile strength of the metal is increased substantially twenty-five per cent.

In practice I have found it very satisfactory to use for the treatment of the zinc a nickel-chromium-iron alloy which is known in the market under the trade-name "nichrome." The particular alloy containing approximately 60% nickel, 20% chromium and 20% iron gives excellent results. For a flux I have obtained the best results with ammonium chloride.

In carrying out my process I reduce the zinc to a molten state at substantially 1000° to 1100° F. and then dissolve the "nichrome" in comminuted form in the zinc, fluxing with ammonium chloride. The comminuted "nichrome" is about 1% by weight to that of the zinc, and the ammonium chloride used as a fluxing agent may be of substantially double the volume of the comminuted "nichrome" with which it is mixed. These ingredients are stirred in the molten zinc, and after the metal is thoroughly cleansed and the scum which rises to the top is skimmed off, it may be poured.

A substantial portion of the nickel and iron combines with the zinc but some of the

nickel and iron rises to the top in the form of oxides, together with all or substantially all of the chromium which acts in the capacity of a catalytic agent.

- 5 The result is an alloy containing substantially .3% of nickel, .4% of iron, and the rest zinc. While the iron is not absolutely essential I have found that up to .5% it is very desirable. It will be understood that
10 cobalt, having many properties in common with nickel, will have substantially the same effect as nickel on zinc, and I therefore deem cobalt an equivalent of nickel and a substitute therefor both in the above description
15 and in the appended claims.

I claim:

1. The method consisting in mixing a small quantity of chromium and nickel in molten zinc together with a suitable flux.
- 20 2. The method of treating zinc consisting in dissolving a nickel-chromium alloy in zinc and fluxing with a suitable flux.
3. The method of treating zinc consisting in dissolving a nickel-chromium-iron alloy
25 in molten zinc and fluxing with ammonium chloride.

4. The method of treating zinc consisting in reducing the zinc to a molten condition and then dissolving a small quantity of another metal therein in the presence of chromium as a catalytic agent. 30

5. The method of treating zinc consisting in reducing the zinc to a molten condition and then dissolving a small quantity of nickel and iron therein in the presence of chromium as a catalytic agent. 35

6. The method of treating zinc consisting in reducing the zinc to a molten condition and then dissolving a small quantity of another metal therein in the presence of chromium as a catalytic agent, and then fluxing off the chromium. 40

7. An alloy containing not less than 99% of zinc, not more than .5% of iron and the remainder nickel. 45

8. An alloy containing not less than 99% zinc, substantially .3% nickel and substantially .4% iron.

In witness whereof, I hereunto subscribe my signature.

CHARLES PACK.