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UNITED STATES PATENT OFFICE.

GEORGE THOMSON, OF ELIZABETH, NEW JERSEY.

METALLIC INGOT OR CASTING.

SPECIFICATION forming part of Letters Patent No. 734,286, dated July 21, 1903.

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To all whom it may concern:

Be it known that I, GEORGE THOMSON, a citizen of the United States, residing in Elizabeth, Union county, New Jersey, have invented certain new and useful Improvements in Metallic Ingots or Castings, of which the following is a specification.

This invention relates to steel plates or castings having a face hardened by the addition of nickel and copper. Ordinary nickel-steel contains only about three per cent. of nickel, the nickel being distributed with substantial homogeneity throughout the mass.

The object of my invention is to provide plates or castings which on one face present an alloy of nickel, copper, and steel, this portion constituting a layer of suitable thickness beyond which and on the other side of the plate or casting the latter is formed of pure or nearly pure steel. An important utility of plates thus made is for the sheathing of ships, the nickel alloy being placed upon the exterior, where it serves to efficiently resist the corrosion of salt water.

I have found that ordinary Bessemer steel will not alloy with nickel because of containing too large a proportion of oxygen or oxids. Such steel also will not make a perfect union with an alloy of nickel and copper by reason of its contained oxygen forming suboxids of copper which would render the whole mass brittle and unsuitable for hammering or rolling. For these reasons in working with Bessemer steel my invention requires that it be specially treated. To this end I subject it to fine subdivision and then resmelt it with an additional proportion of carbon. For subdividing it I prefer to run the steel in its molten condition into water, letting it fall from a sufficient height to form nodules resembling shot, whereby it is very effectively and very cheaply subdivided. The steel in this form, which I will refer to as "shot," is then resmelted with about two to four per cent. of carbon, preferably in the form of charcoal with the addition of a little silica or sand. While in a molten condition I keep this surface covered with charcoal to protect it from the air. By this means the steel is deoxidized and when cast will be free from air-holes or sponginess and will form a close, compact, and homogeneous casting.

When the steel to be employed consists of Siemens-Martin or open-hearth steel, I treat it as follows: When it has been brought up to its usual standard and is ready to be run out, I cover its surface with charcoal and pole it in a manner similar to that in which copper is poled, and I do this either with wood or with carbon blocks. At present I prefer the latter, as they are freer from moisture and contain some silica. The carbon in the said blocks gives carbon to the steel and combines with any free oxygen that may be present, while the silica combines with any metallic oxids that may be present and brings such to the surface in the form of slag.

If it should happen that steel poled as aforesaid is not sufficiently refined by this method, I may run it into shot and resmelt it after the manner hereinbefore described with reference to the treatment of Bessemer steel.

I will now describe a specific mode of preparing a plate or casting of my invention. For this purpose as the desideratum is to concentrate the nickel-copper alloy on the lower face of the plate or casting I take advantage of the greater specific gravity of nickel and copper. To prepare the nickel-copper alloy, I mix copper and nickel, preferably in the proportion of sixty-five parts of copper to thirty-five parts of nickel, and I thus obtain an alloy having a conductivity equal to about ten per cent. of pure copper on Mathieson's scale. This alloy has a specific gravity about twelve per cent. greater than that of steel. I may use a greater or less amount of this nickel-copper alloy in proportion to the amount of steel employed. I pour the nickel-copper alloy into the mold together with the steel, the latter having been prepared as hereinbefore described or being otherwise of suitable quality. The greater specific gravity of the nickel-copper alloy causes it to spread itself over the bottom of the mold, so that the lower face of the casting affords the maximum richness of nickel-copper alloy with the minimum proportion of steel, while the upper portion of the casting consists of the steel with little or no nickel or copper alloyed with it. The nickel-copper alloy may be poured first into the mold, and the steel may be poured immediately thereafter, or the nickel-copper alloy and the steel

may be poured together, so that their streams shall enter the mold together, preferably through the same passage, so that they may mix together as they flow. By reason of the greater specific gravity of the nickel-copper alloy it will settle almost wholly to the bottom of the mold, while the steel in a condition almost or quite pure will occupy the upper portion of the mold, except that the two layers are not superposed with any sharp line of separation, but are merged gradually the one into the other. The plate or casting is found to present on its bottom a layer of copper-nickel alloy of substantially the proportions in which this alloy was prepared before pouring, only commingled or alloyed with a small proportion of steel. The upper part of the plate—in fact, the entire body of the plate down to a layer or zone just above that of the copper-nickel alloy—is composed of steel with little or no nickel, while the intermediate zone or layer is composed of varying proportions of steel and nickel-copper alloy, so that from the layer of nearly pure nickel-copper alloy there is a gradual merger, the copper and nickel diminishing upwardly into the body of pure steel. The steel may be a steel varying from the nature of ordinary nickel-steel of approximately three per cent. nickel to a steel substantially pure or free from nickel.

It is desirable that the plates or ingots thus cast shall after being rolled down to the desired thickness have a thickness of about one-quarter inch of the nickel-copper alloy, the remaining portion or approximately pure steel body of the plate being of variable thickness, according to the strength of plate required. Accordingly I contemplate using about five pounds of the nickel-copper alloy per square foot of the finished plate, or the quantity of nickel-copper alloy should be sufficient to form a layer of nickel-copper-steel alloy about two inches thick on the bottom of the mold, above which the mold may be filled with pure steel to any suitable thickness—say, for example, about six inches—forming thereby, for example, an eight-inch ingot, which may be rolled down to a plate of one inch thickness; but the thickness of the ingot and of the rolled plate may be greater or less, as desired.

A composite nickel-copper-steel plate as thus prepared is advantageous for use for the sheathing of ships or as armor-plating, for which latter purpose the mass of the plate instead of being of pure steel may be of the ordinary proportion of nickel-steel. In either case the surface exposed to the action of sea-water is of nearly pure nickel-copper alloy. A plate having an exposed surface of such nickel-copper alloy is found when immersed in salt water to have very little, if any, galvanic action and is not liable to the attachment of barnacles.

It is found that by having a higher percentage of nickel alloyed with the copper and the steel the alloy obtained can be heated to a much higher temperature and therefore be better adapted for hammering and rolling purposes than when the percentage of nickel is low.

The bolts or rivets for use in such plates are preferably made in a similar manner, but with a larger proportion of copper-nickel alloy to allow for the hammering and flattening of the heads.

Plates obtained as herein described are malleable and may be rolled or hammered into sheets for the purpose of manufacturing various articles—such, for example, as cooking utensils and the like.

The ingot or casting of my invention has its nickel-copper face of such extreme hardness that it resists the action of metallic cutting-tools. This quality of surface hardness, combined with malleability, renders the plate produced by my invention of value for armor-plating and kindred uses. Castings of my invention are valuable wherever the surface of nickel-copper alloy can be presented to resist wear or receive blows.

I desire it to be understood that this invention is not to be taken as limited to the precise details set forth, as such details may be varied within considerable limits without departing from the spirit of the invention as set forth in my claims.

Wherever in this specification I have referred to "steel" or "pure steel" it is to be understood that any of the well-known forms of steel may be employed—such as chrome-steel, manganese steel, nickel-steel of the ordinary proportions, or other forms.

I claim as my invention—

1. The described product consisting of a casting the body of which is of steel and the lower face of which is mainly of a nickel-copper alloy of greater specific gravity.

2. The described product consisting of a casting the body of which is of steel and the lower face is of a nickel-copper alloy of greater specific gravity, merging gradually into the homogeneous steel body.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

GEORGE THOMSON.

Witnesses:
BELLA BROWN THOMSON,
JENNIE MAGIE.