

UNITED STATES PATENT OFFICE.

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CAST METAL.

No. 878,691.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, ROBERT C. TOTTEN, a resident of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Manufacture of Cast Metal; and I do hereby declare the following to be a full, clear, and exact description thereof.

This invention relates to a new composition of casting metal and method of producing the same. Its object is to provide a casting metal for the production of articles, such as car wheels, chilled rolls, malleable castings, gearing and the like, in whose composition what is technically called chilling iron is used, which will produce articles having greater strength and ductility and a greater resistance against wearing, especially on the faces, than when such articles are produced from ordinary chilling irons.

Chilling irons are such as will give a hard or chilled surface to the cast article when poured in a chill mold. The chilling property depends principally upon a certain percentage of combined carbon in the cast iron. These pig irons, and especially those made by the charcoal process, contain a proportion of combined carbon varying from about five-tenths (.5) of one per cent. to about three (3) per cent., and such irons are used for making car wheels, chilled rolls, malleable castings, and even soft rolls, strong gearing, etc. The ordinary commercial pig irons generally contain a very small proportion of combined carbon, but so low that when cast in a chill mold no chilling effect is apparent, and such pig irons are never known under the name of chilling irons.

My invention applies only to what is known as chilling irons, that is, cast iron having a percentage of combined carbon sufficiently large to give a chilled surface when cast in a chill mold. The invention is not limited to charcoal irons but applies to any cast iron, produced in any way or by a mixture of steel or other alloys, which contains one-half ($\frac{1}{2}$) per cent. or more of combined carbon.

The invention is based upon the discovery of a peculiar affinity of nickel for the combined carbon of chilling iron and the further discovery that by varying the percentage of nickel to combined carbon the depth of chill may be regulated.

It consists, generally stated, in a composition of casting metal consisting of chilling

cast iron and a certain percentage of nickel or alloy thereof.

It also consists in a cast metal article made from such composition, as well as to the method of making the same.

Nickel when melted and cast alone in an iron mold has no chilling properties, but I have discovered that when mixed in proper proportions with chilling cast irons, it not only does not destroy the chilling properties of the iron, but very greatly increases the strength and ductility of the metal and the wearing qualities of the chilled surface of the article.

In carrying out my invention, I make use of pig iron or scrap chilling cast iron containing a percentage of combined carbon, and nickel in proportions depending upon the amount of combined carbon in the iron, the quantity of nickel present being preferably as great as one-third ($\frac{1}{3}$) of one per cent. In general, the quantity of nickel is made to follow the proportion of combined carbon in the metal, and for ordinary purposes the proportion of nickel to combined carbon will be cent per cent.; that is, if there is one per cent. of combined carbon in the chilling iron, one per cent. of nickel is used in the mixture. The proportion, however, of both the nickel and combined carbon may be varied to produce different depths of chill in the casting. For instance, generally speaking, the nickel has a tendency to reduce the chilling properties of the combined carbon. Care should therefore be taken not to introduce an excessive amount of nickel. This same property, however, enables me to regulate the depth of the chill by merely varying the proportion of nickel. For instance, if a chilling iron containing a certain percentage of combined carbon has added thereto, say, one and one-half per cent. ($1\frac{1}{2}\%$) of nickel and produces a casting having a chill, say, one inch in thickness, then by using exactly the same iron and increasing the percentage of nickel, the depth of the chill will be decreased, or, by decreasing the quantity of nickel the depth of the chill will be increased. In this way, by merely varying the quantity of nickel added to a given chilling iron, I am enabled to regulate the depth of the chill at will. This is of especial importance in the utilization of scrap cast iron containing combined carbon, such as worn out car wheels, chilled rolls, and the like. A peculiarity of such scrap chilling irons is the fact that when

remelted and recast there is large increase in the proportion of combined carbon, giving an abnormally deep chill and rendering the article very brittle, practically without strength. Heretofore this tendency has been overcome by various expedients, such as adding silicon or the like to the metal, which, however, has a detrimental rather than a beneficial effect on the strength of the metal. With my invention, however, by using a sufficient proportion of nickel, the increase of combined carbon is entirely overcome, giving a chill of the desired depth, and furthermore very greatly increasing the strength of the metal.

My invention is not limited to chilling cast iron used alone, but is equally applicable to any alloy of cast iron having chilling properties, such as a mixture of chilling cast iron and steel which is commercially known as "semi-steel," being generally a mixture of about five parts of cast iron to one part of steel. Any suitable nickel alloy or metal of the nickel group may also be used in lieu of nickel, and by the term "nickel" in the claims, I intend to include not only nickel itself, but any metal of the nickel group, or alloys thereof.

In preparing my chilling composition, the iron or iron and steel and nickel may be melted together in any suitable way or any suitable furnace; but as the melting point of nickel is considerably higher than that of cast iron, it is preferred to melt the iron or the iron and steel and nickel separately, the former being melted, for instance, in an air furnace or cupola, and the latter in a cupola or crucible, and mixing these metals in their molten state, either before or after they leave the furnace or cupola, or the nickel may be dissolved in the molten cast iron, being added thereto in solid state. The mixture can then be cast in pigs for future remelting or may be immediately cast in molds.

This casting composition is of special advantage for forming chilled articles, but my invention is not limited thereto as the composition may be cast in any kind of molds and may be used for any purpose for which charcoal irons are now used; that is, for making chilled rolls, car wheels and other articles, for malleable castings, or for sand rolls, trunnions, gearing, etc., requiring strength and durable wearing surfaces.

The composition of metal described has the following advantages over ordinary chilling irons: The strength of the metal against both compressive, transverse, and tensile stress is very greatly increased, it having been demonstrated that with the proper proportion of nickel to combined carbon, the tensile strength per square inch is largely increased. Further, there is a very decided gain in the wearing qualities of castings pro-

duced from this composition, whether cast in ordinary molds or in chilled molds, but especially in the wearing surfaces of chilled articles, such as rolls, car wheels, and the like. The chilled surfaces of these articles often contain double the quantity of combined carbon that is found in the body thereof, and as the presence of the nickel increases the strength of the article in proportion to the amount of the combined carbon present, the wearing surfaces are very greatly toughened practically without reducing their hardness, and the brittleness of such surfaces is largely overcome, so doing away to great extent with the checking or fire cracks which usually develop in the surfaces of chilled rolls; and the chilled surfaces are smoother and wear longer. By the addition of the nickel it is also possible to reduce the proportion of combined carbon so that scrap metal such as chilled rolls and car wheels, can be utilized and with the effect of producing a stronger article than when new.

I am aware that it has been proposed to mix nickel with ordinary grades of cast iron containing graphitic carbon for the purpose of increasing the strength and ductility thereof. My invention is, however, entirely distinct from this use, as such cast irons do not contain any appreciable amount of combined carbon and the peculiar advantages above described are not obtained. I believe that I am the first to discover and demonstrate the special effect of nickel upon these chilling cast irons.

What I claim is:

1. A new composition of casting metal comprising chilling cast iron and nickel, the nickel and the combined carbon of the iron being present in substantially equal proportions.

2. A new composition of casting metal comprising cast iron containing at least one-half per cent. of combined carbon, and substantially a similar proportion of nickel.

3. A new composition of casting metal comprising chilling cast iron, steel, and nickel.

4. A new article of manufacture comprising chilling cast iron and nickel, the nickel and combined carbon of the iron being present in substantially equal proportions, said article having a chilled surface.

5. A new article of manufacture comprising cast iron containing at least one-half per cent. of combined carbon, and a substantially similar proportion of nickel, and having a chilled surface.

6. A new article of manufacture comprising chilling iron, steel, and nickel, and having a chilled surface.

7. The method of producing a new composition of casting metal consisting in forming a molten body containing chilling cast iron and nickel, and while forming said mixture regulating its chilling property by

increasing the quantity of nickel relatively to the quantity of combined carbon to reduce the depth of chill and decreasing the quantity of nickel relatively to the quantity of combined carbon to increase the depth of chill.

8. The method of producing a new composition of casting metal consisting in forming a mixture comprising cast iron containing combined carbon in excess of one-half of one per cent. and nickel, and while forming said mixture regulating its chilling property

by increasing the quantity of nickel relatively to the quantity of combined carbon to reduce the depth of chill and decreasing the quantity of nickel relatively to the quantity of combined carbon to increase depth of chill. 15

In testimony whereof, I the said ROBERT C. TOTTEN have hereunto set my hand.

ROBERT C. TOTTEN.

Witnesses:

J. R. KELLER,
H. M. CORWIN.