

# United States Patent Office.

CHARLES MOTIER NES, OF YORK, PENNSYLVANIA.

Letters Patent No. 104,873, dated June 28, 1870.

## IMPROVEMENT IN THE MANUFACTURE OF STEEL.

The Schedule referred to in these Letters Patent and making part of the same.

### To whom it may concern:

Be it known that I, CHARLES MOTIER NES, of York, in the county of York and State of Pennsylvania, have invented certain new and useful Improvements in the Manufacture of Steel, of which the following is a specification.

My invention relates to the reworking of ingots, rails, and scrap of Bessemer steel, into cast-steel; but it is also applicable to the production of steel from wrought iron.

In Letters Patent No. 102,960, granted me on 10th May, 1870, I have indicated some of the difficulties which attend the reworking of Bessemer metal, and have described a mode by which cast metal can be produced from the same by first decarbonizing and then recarbonizing the metal.

My invention differs from the above, in that it enables me to produce steel from Bessemer metal by one operation, or at one heating, without necessitating first the elimination of the carbon from the metal, and afterward the recarbonization of the same, it being my present object now to retain the carbon in the metal.

To this end, I melt the Bessemer metal which I desire to rework, in a puddling or heating-furnace, in a bath of titaniferous ore, or other ore containing titanium, silica, and alumina, or either of these substances, mingled or not, as preferred, with cinder, the bath being of sufficient size to cover the metal. The silica of the ore is converted by the melting into a glass coating, which excludes the oxygen and prevents the carbon from escaping, and the melted metal will soon become a homogeneous mass of steel, which can be run off in the usual way.

Another mode I employ of excluding the oxygen and keeping in the carbon is to first cast the metal with a mortar, composed of fire-clay and plumbago, or fire-clay, soapstone, and asbestos, or other suitable refractory mortar, to the thickness of an inch or more, and then place the metal, thus inclosed in its air-tight casing, in a cupola or heating-furnace, where it is kept until melted, after which the refractory outer shell or casing can be broken or tapped, and the melted metal run out. This latter mode is also applicable to the manufacture of steel from wrought iron, the latter, together with the requisite quantity of pig to carbouize it, being coated, as above described, with the refractory mortar.

With either of the above-stated processes I can employ electricity, substantially in the manner described in my patent No. 102,146, dated April 19, 1870, to improve the quality of the steel and render it more homogeneous.

To enable others skilled in the art to understand and use my invention, I will now proceed to describe more particularly the manner in which the same is or may be carried into effect.

### First. To rework old Bessemer steel rails.

I cut and pile the rails in the usual way, and bind the piles with wire. These piles are placed in a puddling or heating-furnace, which is charged with titaniferous ore and ordinary mill-cinder, taken, say, in equal parts, sufficient to make a bath which will cover the piles. Instead of titaniferous ore, any ore containing titanium, alumina, and silica, or either of these properties, can be employed. When the silica is melted it is converted into a glass coating, which excludes the oxygen and keeps the carbon in the metal, and also keeps in the alumina and titanium, which serve to increase the steely nature of the metal. By excluding the oxygen the welding process will take place at once, and the melted metal will become a homogeneous mass of cast steel. If it is deemed desirable, I can insulate the furnace, and apply a galvanic battery to the same, as described in my patent of April 19, 1870, above referred to. The currents of electricity which are thus caused to pass through the melted steel, magnetize every particle of the mass, and the attraction of one particle for another, causes the whole to become homogeneous and weld quickly, a finer quality of steel, both in fiber and strength, of material, being the result. After the piles have been melted, and the mass welded together, the metal or cast-steel is run off in the usual manner into molds of any desired form and size.

Second. To rework ingots or scraps of Bessemer steel.

I use from fifteen to twenty per cent. of titaniferous ore, as above specified, to one hundred per cent. of Bessemer steel, and puddle in the same manner as for ordinary iron. The action of the silica in the ore is the same as above described, and the titanium and alumina increase the steely nature of the metal. The battery may also be used in this process for producing a finer quality of steel.

Third. I also make use of another mode of reworking Bessemer steel, piles, ingots, or scrap, which is similar to that above mentioned, in that it provides for the exclusion of oxygen from the metal.

I make a mortar by mixing a refractory composition, such as fire-clay, soapstone, and asbestos, with water, so as to give it the proper consistency. I then apply this mortar to the metal, so as to give it a coating of about an inch in thickness on all sides. After drying this coating over a fire, I again apply a second coat of about half an inch in thickness, which is dried in the same manner, thus, in effect, inclosing the metal in an air-tight crucible. As many of these coated ingots as desired are placed in a cupola, where they are heated in the usual manner until the metal is melted. As the metal cannot be seen, the time required for its melting must be ascertained by experiment. I have found that when heated in the cupola under ordinary conditions, the metal will melt in about one hour.

When this takes place, I insert a proper instrument through a door in the cupola, and tap or puncture the refractory air-tight shell, thus letting the metal run out into any-shaped mold or receptacle which is to contain it. By adding to the above-described mortar, plumbago, or by making a refractory mortar of fire-clay and plumbago, or of other suitable refractory material, I can produce cast-steel from wrought iron, by bundling up the iron with a sufficient quantity of pig to carbonize it, and then coating it with the mortar and heating it in a cupola, as above described. I can thus produce a fine quality of cast-steel cheaply and quickly.

Having thus described the manner in which my invention is or may be carried into effect,

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

1. The method herein described of reworking Bessemer steel into cast-steel, by melting the same and excluding air or oxygen from it, and preventing the escape of its carbon during the said melting operation, substantially as set forth.

2. The reworking of ingots and other suitable pieces

of Bessemer steel, by puddling the same with titanite ores or other ores, substantially as herein specified.

3. The reworking or welding of rails and other pieces of Bessemer steel, by heating the same in a furnace under a bath of titanite or suitable ore and cinder, substantially as and for the purposes set forth.

4. The manufacture of cast-steel by inclosing the Bessemer steel or wrought iron and pig, or other metal from which the cast steel is to be produced, in a refractory air-tight shell or casing, substantially as herein described, and then heating the same in a cupola, or other suitable furnace, so that the metal shall be melted within the shell or casing by which it is inclosed, substantially as set forth.

5. The application of electricity, in combination with the processes herein described, substantially in the manner set forth.

In testimony whereof I have signed my name to this specification before two subscribing witnesses.

CHARLES MOTIER NES.

Witnesses:

JOHN A. WILSON,  
CHARLES MCNAIR.