

UNITED STATES PATENT OFFICE.

LEWIS CAMERON, OF PITTSBURG, PENNSYLVANIA.

PROCESS OF MANUFACTURING CAST-STEEL.

SPECIFICATION forming part of Letters Patent No. 464,920, dated December 8, 1891.

Application filed January 20, 1891. Serial No. 378,470. (No specimens.)

To all whom it may concern:

Be it known that I, LEWIS CAMERON, a subject of the Queen of Great Britain, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in the Process of Manufacturing Cast-Steel; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use the same.

My invention relates to an improvement in the manufacture of cast-steel; and it consists in the peculiar combination or mixture of the various ingredients and the manner of treating the same, as will be hereinafter specified.

When cast-steel manufactured from muck iron, puddled iron, steel scrap, Swedish iron, or scrap-iron, &c., is made in the usual way with charcoal, lamp-black, spiegeleisen, or other carbonaceous matter when melted to produce cast-steel and poured into ingot-molds ready for the hammer or rolls to be wrought upon, the said cast-steel, when forged into bars or rods, is more or less defective, and when the said bars or rods are manufactured into tools the same are liable to crack in the tempering, and when they do not crack in the hardening they are sometimes found to be brittle and coarse in the fiber. The degree of hardness in the said cast-steel cannot be regulated with uniformity or certainty, and it is often the case that the said cast-steel is hard in temper, brittle, or short when it was intended to be of a mild temper, soft, and tough, or just the reverse. The said cast-steel, when rolled into sheets for the manufacture of common saws, will often crack when tempering the same, and at the same time the saw will often warp or buckle and not retain an even or uniform surface. Circular or other saws manufactured from this cast-steel often crack or break in tothing or swaging, and when ground and polished show black spots and do not have a clean bright surface. To remedy and overcome these defects partly or wholly, and thereby improve the quality and increase the tensile strength of the steel and produce the same partly or wholly without the use of ferro-manganese or spiegeleisen, is the object of my invention.

In the manufacture of my improved cast-steel I have found the following ingredients mixed in substantially the proportions stated to give good results; but I do not limit myself to the exact proportions or materials specified: steel scrap, twenty pounds; Bessemer steel or iron scrap, twenty pounds; muck or puddle iron, fifty pounds; steatite, commonly known as "French chalk," fourteen ounces; charcoal or lamp-black, ten ounces; oil of camphor, six ounces; oxide of manganese, three ounces.

The above mixture, for convenience in describing, I will designate as "example No. 1" and the following mixture as "example No. 2:" muck or puddle iron, seventy pounds; scrap-steel, twenty pounds; steatite, fourteen ounces; lamp-black or charcoal, fourteen ounces; oil of camphor, six ounces; oxide of manganese, four ounces. These are but two examples, and I could multiply or give others, if deemed necessary.

I wish it to be observed that the hardness of the cast-steel obtained at the termination of the melting operation may be regulated by increasing or diminishing the carbonaceous matter added to the mixture, and the greater the relative proportions of carbonaceous matter the harder will be the cast-steel finally obtained. In every instance the hardness of cast-steel produced can be regulated, since the carbonaceous matter, charcoal, or lamp-black may be increased or diminished for all grades and temper required.

To adapt my invention to a Bessemer converter or open-hearth furnace, I proceed in the following manner: Pig-iron or refined iron broken in small pieces is put into the melting-pot, crucible, or any furnace so constructed as to exclude the air from the said granulated or broken pig-iron, &c. I introduce into the crucible or furnace a mixture of steatite and oil of camphor, charcoal, and lamp-black to produce when melted a metal or alloy suitable for my purpose. To one hundred pounds of pig-iron, broken or granulated, I add one pound of steatite or oil of camphor with about sixty pounds of carbon. When this mixture is melted, I pour it into molds or other receptacles prepared to receive the same. When pig-iron, refined iron, or cast-iron, broken or granulated and highly car-

burized and well melted, is used, I call this "mixture No. 1." When broken or granulated pig-iron, cast or refined iron, mixed or melted in the manner I have described and not so highly carburized, is used, I call this "mixture No. 2," and when these mixtures—namely, Nos. 1 and 2—are ready for use in my process I preferably also add a small amount of alumina for the purpose of liberating certain gases and to produce more solid ingots or castings; but the alumina may be dispensed with, if desired, and a steel of a superior quality produced.

When pig-iron is used and melted in a cupola or furnace, or is produced by the direct process and conveyed to the Bessemer converter for the purpose of blowing, after the said blowing I have mixture No. 1 or No. 2 melted in a cupola or other furnace and add the same to the contents of the converter—one in seven or one in ten, as the case may be, according to the grade of steel that may be required. In a ten-ton converter I add one ton of mixture No. 1 or No. 2. When steel of high carbon is required, I use mixture No. 1. For low carbon I use mixture No. 2. The hardness of the steel may be regulated by increasing or diminishing the amount of said mixtures, as above stated, and spiegeleisen may be partly or wholly dispensed with.

In the open hearth I proceed as in the Bessemer converter by adding mixture No. 1 or No. 2, either in a cold state or heated, to any degree, or it may be melted and run into said open hearth or furnace at any stage of the melting operation; but I prefer to add said mixture No. 1 or No. 2 after the molten metal has been tested for the degree of carbon contained in said mixture melted to produce steel. The said mixture No. 1, being highly carburized, will produce steel of any degree of temper or hardness that may be required high in carbon. Mixture No. 2 may be added in like manner as mixture No. 1 and in any proportion that may be desired to produce steel of a soft nature and tough or of low carbon, and I find in practice that one part in twelve produces good results.

In order to simplify and obtain accuracy of temper in the open-hearth process, and in order to remove a larger percentage of phosphorus and sulphur, I employ the same method as in crucible cast-steel—namely, adding steatite or French chalk, oil of camphor, charcoal, lamp-black, or any carbonaceous matter and any of the chalky earths or min-

erals suitable for my purpose; but prefer steatite on account of the easy manner in which it can be used and the advantages to be derived from it in the purifying of material during the operation of melting for the production of cast-steel. In order to point out more clearly the manner I operate in the last-named open hearth or furnace, I introduce into said open hearth a mixture of steatite, oil of camphor, charcoal, and lamp-black well mixed and in proportions to give from one pound to two of steatite per hundred pounds of pig-iron, cast-iron, steel scrap, iron scrap, or any mixture of said materials when melted for the production of steel.

The carbonaceous matter may be added in any proportion suitable for the production of steel of either high or low carbon, as may be desired, and in order to further improve the steel produced by the last-named process I add of mixture No. 1 or No. 2 from two to four pounds to every one hundred of pig-iron or other mixture of metal when melted to produce steel either cold or heated to any degree or melted in a cupola or other furnace and run into said open hearth or furnace at or during any stage of the melting operation, or in like manner as when mixture No. 1 or No. 2 is used alone in the above-mentioned process, and these proportions may be varied without departing from the nature of my invention.

Having thus described my invention, I claim—

1. The process herein described of manufacturing steel, consisting in melting with the muck or puddled iron or reduced or broken scraps of steel or iron a mixture containing steatite, a carbonaceous matter, and an essential oil, substantially in the manner and for the purposes specified.

2. The herein-described mixture for use in the manufacture of steel, consisting of steatite, a carbonaceous matter, and an essential oil.

3. The herein-described mixture for use in the manufacture of cast-steel, consisting of steatite, lamp-black, or charcoal, oil of camphor, and oxide of manganese in substantially the proportion stated.

In testimony that I claim the foregoing I hereunto affix my signature this 20th day of December, A. D. 1890.

LEWIS CAMERON. [L. S.]

In presence of—

CHARLES LARGE,
M. E. HARRISON.