

UNITED STATES PATENT OFFICE.

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PROCESS OF MAKING MANGANESE STEEL.

1,060,078.

Specification of Letters Patent.

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No Drawing.

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To all whom it may concern:

Be it known that I, ALBERT E. GREENE, citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Processes of Making Manganese Steel, of which the following is a full, clear, concise, and exact description.

My invention relates to processes of incorporating alloying metals with other metals, and particularly to a process of making manganese steel from ferro-manganese and molten soft steel.

My invention is based on facts relative to alloys in general:—namely, that an alloy usually melts at a lower temperature than its constituent metals; and second, that an alloying metal may be more or less melted from the cold by pouring over it the metal, in a molten condition, with which it is to be incorporated, thereby producing a metal mixture having a lower melting point than said molten metal used.

It is well known that manganese steel has a very considerably lower melting point than has the soft steel with which the ferro-manganese is incorporated to make the manganese steel, and it is a fact that by pouring molten soft steel on solid ferro-manganese, a large part of the ferro-manganese can thereby be melted, but such a process is not practical for the reason that neither the melting nor the mixing are complete or uniform, and the composition of the steel so made is variable and almost always far too low in manganese.

My invention is an improvement over such a process as the one just outlined, rendering such a process both practical and useful, and my process is, as far as I am aware, more economical than any other process for making manganese steel from the materials I have referred to, including the crucible and electric furnace processes already well known.

My invention consists in the use of electric heat in combination with the heat in molten metal for the purpose of melting an alloying metal and of obtaining uniform composition in the mixture and proper temperature control. It consists, in other words, in charging the molten metal with which the alloy is to be incorporated, upon the alloy-

ing metal, to partially melt said alloying metal, and then, in the same vessel, finish- 55 ing the melting by means of electric heat.

In the manufacture of manganese steel, it is customary to melt the ferro-manganese in crucibles, pour the melted alloy into a large ladle, and then pour on top of it the molten 60 soft steel, thereby producing the manganese-steel. In this process there is a considerable waste in melting the ferro-manganese in the crucibles and also in the mixing of the alloy and the soft steel in the ladle, the losses 65 being due to both oxidation and to vaporization. Furthermore, the handling of the crucibles is difficult and the process is uneconomical in many ways.

Another process which has been used to 70 make manganese steel is to charge ferro-manganese into a bath of hot steel in an electric furnace and melt the ferro by means of electric heat. One of the difficulties involved in this procedure, namely, the heating 75 of the soft steel to a temperature above its melting point, in an electric furnace into which the molten metal has been poured, so that the manganese can be thrown into the bath without remaining on the top of it, is 80 just the difficulty it is very desirable to avoid and which I do avoid by my process. When molten soft steel is charged into an electric furnace it very quickly cools and requires considerable electrical energy to re- 85 heat it again and especially, to superheat it. This difficulty is especially likely to be met with in using an induction furnace, for the reason that the metal chills quickly on the top and therefore prevents the ferro-manga- 90 nese from entering into the molten metal and lowering its melting point. Furthermore, when cold ferro-manganese or manganese steel scrap is thrown into a bath of molten metal in an electric furnace there is 95 almost invariably a loss of metal in the slag. This may occur from the admission of air during charging the alloys, or from the presence of rust on the surface of the scrap, but the effect is almost invariably present 100 unless special precautions are observed to prevent it, such as the use of a reducing gas. My invention avoids, practically entirely, these difficulties met with in the ordinary methods of procedure. 105

I am aware that it has been proposed to

superheat a bath of molten iron in an electric furnace and then charge manganese-containing metal into the bath, (see Howe, U. S. Patent No. 954,188,) but my invention
5 is a marked improvement over such a process. It is well known that it becomes increasingly more expensive to heat a bath of steel in an electric furnace as the temperature desired increases. It is very much
10 easier and cheaper to highly superheat a bath of steel in an open-hearth furnace than to do so in an electric furnace, and by so doing and then pouring the superheated steel on the ferro-manganese in an electric
15 furnace, the melting of the alloy will be greatly facilitated and then the melting and heating may be completed in a most satisfactory manner by means of electric heat.

I will now describe how my process may
20 be carried out.

I prefer to use an induction furnace, but may use any suitable vessel, such as a ladle, heated electrically or any other kind of an
25 electric furnace. The furnace having been previously heated, the proper weight of ferro-manganese, which would give the desired composition when incorporated with the weight of molten metal to be used, is thrown
30 into the heated induction furnace. It is preferable to heat this ferro-manganese by oil or in any other way as high as possible without incurring undesirable oxidation. The molten soft steel, suitably low in carbon
35 to give the proper amount of carbon in the product, is taken from any suitable source, such as an open-hearth furnace, and is poured on top of the ferro-manganese in the electric furnace. This largely melts the
40 ferro-manganese. The electric current is

pleted and the temperature regulated to the desired degree.

In carrying out the process, I prefer to use a lime slag and also to use reducing gas to minimize oxidation. I prefer also to
45 heat the alloy before pouring the molten metal on it and also to superheat the molten metal where this is convenient.

My process is applicable to all manner of metals, such as tool steel which is to be made
50 with high content of alloy metals like tungsten; and the process is also applicable to the making of brass and other alloy metals.

I claim—

1. The process of making manganese steel
55 which consists in charging solid ferro-manganese into a suitable vessel, then pouring on top of the ferro-manganese enough molten soft steel of proper composition to give the desired composition of product, thereby
60 partially melting the ferro-manganese, and completing the melting and heating in a reducing atmosphere by means of electric heating.

2. The process of making alloy steels, con-
65 sisting in charging the alloying metal into an electric furnace, then pouring on top of said alloying metal the metal with which it is to be incorporated together with a basic flux, said latter metal and flux being in a
70 molten condition, and finishing the melting and heating in a reducing atmosphere by means of electric heating.

In witness whereof, I hereunto subscribe my name this 12th day of August, A. D.,
75 1911.

ALBERT E. GREENE.

Witnesses:

McCLELLAND YOUNG,
GEORGE P. BARTON.