UNITED STATES PATENT OFFICE.

WESLEY G. NICHOLS, OF CHICAGO, ILLINOIS, ASSIGNOR TO AMERICAN MANGANESE STEEL COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF MAINE.

HEAT TREATMENT OF MANGANESE STEEL.

1,427,121. Specification of Letters Patent. Patented Aug. 29, 1922.

No Drawing. Application filed September 13, 1920. Serial No. 411,250.

To all whom it may concern:

Be it known that I, WESLEY G. NICHOLS, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Heat Treatment of Manganese Steel, of which the following is a specification.

My invention relates to the heat treatment of manganese steel.

The most important step in the manufacture of manganese steel is the heat treatment thereof. This is especially true as to castings, as manganese castings are worthless as commercial products, unless properly heat treated. The structure of manganese steel in the cast state is austenitic, but around the grain boundaries is found a heavy separation of carbide which causes brittleness, the object of the heat treatment being to dissolve this carbide, and the application of heat is continued until all of the carbide is dissolved.

There are two methods generally used at the present time for heat treating manganese steel castings. One is the employment of a coal fired furnace, and the other an oil or gas fired furnace. In each of these furnaces the same fundamental arrangement prevails, in the case of coal a grate extends usually the entire depth of the furnace and has several firing doors. Between the grate and the portion of the furnace in which the castings are placed is constructed a bridge or fire wall, for the purpose of preventing the flame from playing directly on the casting. In the oil or gas fired furnace, burners are substituted in place of grates and are directed so that the flames of combustion play against the bridge wall similar to the coal fired furnaces. A great objection to such types of furnaces is that the side of the chamber opposite the wall will heat much more quickly than that portion directly behind the bridge wall. Furthermore, the castings on the top of the pile are heated more quickly than the castings nearer the bottom. This uneven heating is one of the main causes for cracked castings. Where coal is used, proper operation of the furnace depends on the ability of the man doing the firing. Often times the fire at one end of the grate is hotter than at the other, which means that one part of the furnace will be heated to proper temperature ahead of another part, and in the case of very large castings, undue strains are set up. Because of this uneven heating, cracks develop and the castings are rejected. With oil fired furnaces, trouble is experienced because of the variation in the quality of oil. Another objection to any type where the successful operation of the furnace depends on the operator is that the furnace tender may crowd his furnace too much, especially is this true in bringing the castings from atmosphereic temperature to red heat. Many castings have been rejected because the furnace operator has crowded his furnace too much during the early stages of heat treatment.

Another objection to the coal and oil and gas fired furnaces is that because of the smoke in the furnace, it is impossible for the operator to judge the temperature correctly. This is especially true during the latter portion of the heat treatment, as the castings may be within a few degrees of the correct temperature and the operator applies more fuel to raise the temperature these few degrees and very often overheats the castings.

A further objection to the present type of furnace is that of oxidization, as oxygen is essential to proper combustion of coal, gas, or oil, and in certain classes of castings, the outer surfaces thereof are oxidized to such an extent as to permit exceedingly great wear after being placed in service. This feature is especially noticeable in railroad work such as crossings and frogs.

Another objection to the present method of heat treatment is the tendency to overheat the thin sections in order to thoroughly heat the thick sections. This is especially true where larger castings are undergoing treatment, or where castings are of uneven sections. In the present practice, these sections vary from three-fourths of an inch to five and one-half inches in thickness.

My invention consists in the use of a furnace wherein an inert atmosphere is maintained so that oxidization is prevented.

In carrying out my invention, I prefer to employ an electric furnace of the resistance type, as I have found this to be more economical for heat treatment of manganese castings.

I practice my invention by inserting manganese castings in an electric furnace

of the resistance type and heating the furnace. The amount of heat delivered to the furnace is at all times no higher than that necessary to dissolve the carbon about the grain boundaries. I have found that it is possible to put thin, thick, large, and small castings in the same furnace, and have treated these successfully, securing complete dissolution of the carbide without harming any of the castings. When the castings are put in the furnace, the same is hot from the previous heat treatment, let it be assumed about 1400° F. As soon as the lot is put in the furnace, the temperature thereof will drop quickly, due to the heat absorption by the castings. The smaller castings and the thin sections tend to come to the temperature of the furnace faster than the thick sections, but before a critical temperature is reached, the entire furnace temperature would be very low, so that no harm is done to any of the castings. Then the furnace temperature would rise slowly, bringing the temperature of the casting with it, the light and heavy sections absorbing the increased heat. In practicing my invention, I provide suitable means for cutting off the electric current as soon as the desired temperature within the furnace is obtained. In this manner no damage whatsoever can be caused to the castings. By my invention it is possible also to eliminate constant attention by an attendant, make a cleaner shop, and better working conditions. With my invention it is possible, as before stated, to put small, large, thin, and thick castings into a single furance without any fear of damage to the same. Whereas in the coal, gas, or oil fired furnaces, it is necessary to separate the castings so as to put those of substantially the same thickness of section in a single furnace. This is possible in my invention by reason of the fact that the small casting can not absorb more heat than is in the furnace, as the temperature of the furnace at no time is more than the required temperature, and even if the small castings are held at the required temperature for a longer time, no harm can be done as no oxidization takes place.

I claim:

1. An improvement in the art of heat treating manganese steel castings, which consists in subjecting such castings to heat, the maximum temperature of which never exceeds the critical temperature for such castings.

2. An improvement in the art of heat treating manganese steel castings which consists in heating the same in a non-oxidizing atmosphere by maintaining the temperature below the critical temperature of said castings.

3. An improvement in the art of heat treating manganese steel castings which consists in subjecting the same to heat in a non-oxidizing atmosphere in which the heat is maintained below the critical temperature for such castings but up to a degree sufficient to dissolve the carbides in the steel.

4. An improvement in the art of heat treating manganese steel castings which consists in subjecting the same to the heat of an electric furnace, in which the maximum temperature never exceeds the critical temperature for such castings.

5. An improvement in the art of heat treating manganese steel castings which consists in heating the same in an electric resistance furnace and maintaining the same below the critical temperature of said castings.

Signed at Chicago, Cook Co., Ill., this eleventh day of September, 1920.

WESLEY G. NICHOLS.