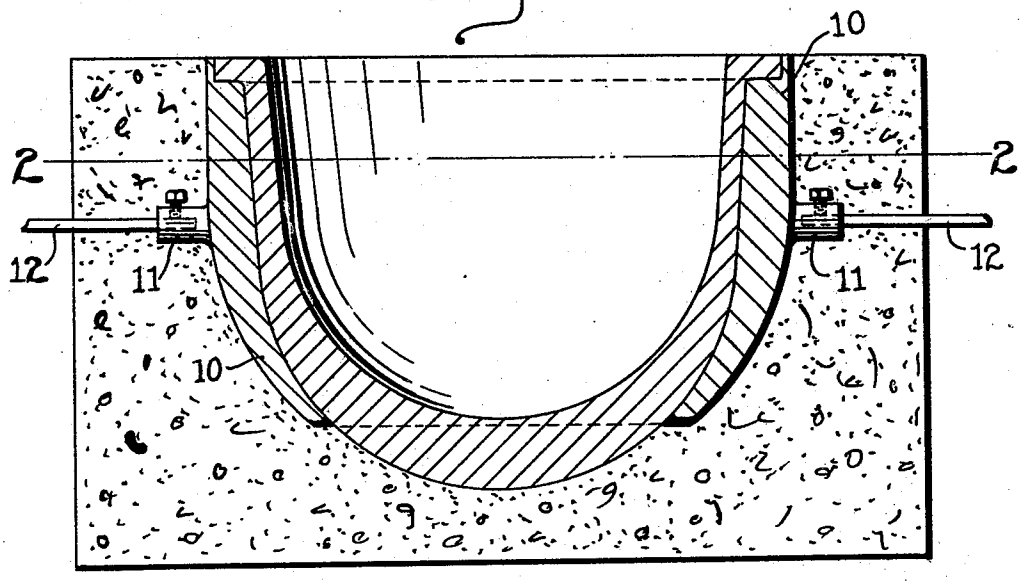
O. SOWERS.

METHOD OF CONTROLLING THE CONDITION OF CASTINGS.

APPLICATION FILED APR. 6, 1921.

1,417,638. Patented May 30, 1922.

Fig. 1.



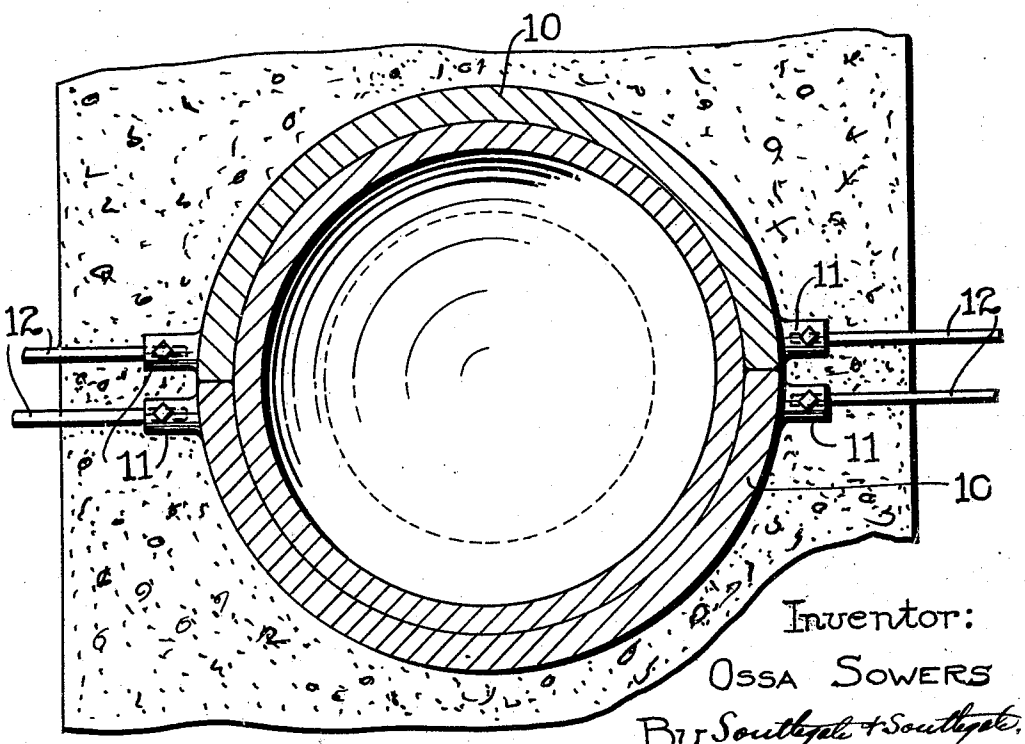


Fig. 2.

Inventor:
OSSA SOWERS
By Southgate & Southgate,
Attorneys

UNITED STATES PATENT OFFICE.

OSSA SOWERS, OF NEW YORK, N. Y.

METHOD OF CONTROLLING THE CONDITION OF CASTINGS.

1,417,638. Specification of Letters Patent. Patented May 30, 1922.

Application filed April 6, 1921. Serial No. 459,022.

To all whom it may concern:

Be it known that I, OSSA SOWERS, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented a new and useful Method of Controlling the Condition of Castings, of which the following is a specification.

The principal objects of this invention are to provide a method of treating castings, or other metal articles, for controlling the condition of their ingredients so as to improve the character of the metal, and, more specifically, to bring about certain changes in the state of the carbon in an iron casting which will effect annealing thereof after solidification of the metal is accomplished; also to provide a process which will permit of the production of malleable iron castings of enormous size of a great irregularity of outline and cross-section; to provide a process which will greatly shorten the time required for the change of carbon and permit a thorough and uniform change in a reasonable time; to provide castings, that would normally result in the brittle "white" iron, having higher tensile strength and finer structure than has been obtained heretofore so that they will withstand torsion and bending better than ordinary malleable iron castings and have much greater durability.

One particular use of the invention is in the manufacture of large castings such as soda pots of special mixtures which could not be cast in such form and size under the present practice.

This is owing to the fact that the rapid cooling of the thin portions of the casting allows too much of the carbon to remain in the combined state and sets up internal cooling strains which result in cracks even during the cooling of the casting, and if a perfect casting is produced, leaves the metal therein too brittle to use.

Further objects and advantages of the invention will appear hereinafter.

Reference is to be had to the accompanying drawings in which—

Fig. 1 is a sectional view of a soda pot in its mold showing how this invention can be applied thereto, and

Fig. 2 is a horizontal section of the same.

The use of malleable cast iron has been confined heretofore to small articles and articles of not too irregular a shape. It is well understood that malleable iron is a superior product for a great many purposes and extending its use into fields in which it has not heretofore been possible to employ it obviously is a valuable addition to this art.

In the usual process of producing malleable iron castings the metal is cast in a very brittle state which in itself prevents its use for many kinds of castings. After the castings are cleaned, they are subjected to an annealing process which renders the metal malleable by changing the condition of the carbon as is well understood. Although my process is not limited to the production of malleable iron, so far as I now know, its principal utility is when applied to the particular cast metals that can be made malleable, and I will describe it especially in connection therewith.

I am aware of the fact that several means have been employed to control the condition of cast iron and other metals in the mold. For example, the use of chills in the mold to chill cast iron and to harden its surfaces is well known. Furthermore, it has been proposed to use the electric current to attempt to control the solidification of molten metal or to keep the top of a steel ingot fluid after the bottom has started to set in order to provide fluid material to eliminate the formation of the top of the ingot with a large pipe. Many similar schemes have been proposed, but so far as I know these electrical heating schemes have not proved practical, and are not now in use for the purposes for which they were invented.

I accomplish the desired result by passing an electric current of low voltage and high amperage through a casting, preferably while cooling in its mold, in such a way that the cooling of the metal at all points will be uniform. The cooling of the metal having a small cross-section, in advance of the cooling of any parts having a greater cross-section, will be avoided. I do this by passing the current through the entire casting, thus holding the temperature throughout the casting. I also divert some of the current from the portions of the casting having the thinner cross-section. Otherwise these parts would be heated much higher by the current than those parts having a greater cross-section and therefore lower electrical resistance.

More specifically stated, the process preferably is carried out as follows, assuming that it is to be used to cast a soda pot such

as shown in the drawing. I might state here that the soda pot is shown only as a simple and convenient example. Numerous other kinds of castings can be made advantageously by this method, even such complicated ones as marine engine cylinders. I have shown it however, as applied to the casting of a soda pot in which, instead of the sides and bottom being of uniform thickness as usual, I use the ordinary thickness for the vertical sides but I gradually increase the thickness of the bottom until at the lowest point it is nearly twice as thick as the thinnest portion of the casting near the top. Instead of the usual grade of iron used for this purpose I employ a mixture which is capable of being converted into malleable iron. Such a soda pot will weigh 25,000 pounds in many cases and its manufacture of malleable iron is unusual. It is to be understood that by my process many other articles, as for example, marine engine cylinders can be improved in shape and made of malleable iron, where that material has not been employed commonly, and certain shapes and dimensions had to be adhered to on account of practical considerations.

When setting the pattern in the mold, for the pot shown in these drawings, I also set into it "chills" 10 on its thinnest portion. In case of a circular object like this, I find it convenient to place in the mold, two or more chills together surrounding the casting. The so-called chills consist of cast iron or other metal that will conduct electricity with the same resistance as an equal body of the cast metal. Although I call it a chill, I am aware of the fact that it does not accomplish the results of an ordinary chill but accomplishes substantially an opposite result.

I provide carbon terminals 11 on the opposite sides of the chills connected with conducting wires 12. It will be understood that the chills and the carbon terminals 11 are applied to the pattern when first set in the mold and the molding sand is introduced and tamped around them as if they were part of the pattern. But when the pattern is withdrawn, the chills and terminals are left embedded in the sand.

Now when the casting is poured it is allowed to cool in the usual way until it is near the point of solidification and until the temperature comes down to a point at or near the transformation point, that is, the temperature at which combined carbon is capable of changing to free carbon and temper carbon. This temperature varies in different grades of iron and may be 1400 to 1800 degrees Fahrenheit. Whether I allow the temperature to drop at this time to a point below the transformation point depends on the composition of the metal and somewhat on the use to which it is to be put. Although it is not free from other influence this depends largely on the proportion of manganese. When there is no manganese in the metal it is generally best to let it cool to the transformation point, or as near it as can be determined by the usual instruments, as for example, the pirometer. I find, however, that when manganese is present, the casting should be allowed to cool below the transformation point. The more manganese, the lower it is cooled. Then the wires 12 are connected with a source of electricity. A current of low voltage and large volume, as for example, from four to six volts and several thousand amperes, is applied. If the surface of the casting against the chills has been hardened by the action of the chills, that is due to the condition of the carbon mainly. The whole casting is now heated by the current and the full amouut of current is allowed to pass through the thickest bottom and edge portions of the pot while the current that passes around the pot on its vertical walls is divided and a part of it passes through the casting and a part through the so-called chills. The effect of this is to heat the cast metal in the thin portions of the casting substantially the same as it is heated in the thick portions, where there would otherwise be less resistance to the passage of the current.

For use with a straight casting with varying cross-sections the way to design the chill would be to give it such shape and size that the entire casting and chill from one end to the other would be of uniform cross sectional area. In that case each portion of the casting would receive a heating current proportioned to its cross section and any current not required for that would pass through the so-called chills. In that way the whole casting would be heated uniformly throughout the period of application of the electric current.

I am aware of the fact that in applying my invention to a circular article such as shown in the drawing, the problem is not quite so simple, but in that case the principle above mentioned applies with modifications such as necessary to equalize the current in the casting of the shape employed.

I keep the current constant for a period of several hours. In ordinary work two or three hours is sufficient but in some cases the current has to be left on much longer. In any event, however, the time required for the annealing process is much reduced over anything now known. It is necessary to maintain the temperature longer and at a higher temperature for some kinds of castings than for other kinds. Thus if a casting contains .35% of manganese it will require only about three hours, keeping the temperature at 1400 deg. F. Again if the manganese content is only 08% it would require

perhaps 48 hours. The manganese content varies according to the use for which the casting is intended.

The effect of the application of the current in this way is to convert nearly all of the combined carbon into temper carbon and free carbon and give the metal the structure of malleable cast iron. It is finer and of higher tensile strength and capable of withstanding torsion and bending. As an example of one application of the process, I may state that before and after annealing it contains the same amount of total carbon but the combined carbon, which before annealing may be over 3%, after annealing is found to be less than one half of 1%. This operation enables be to produce large castings like the one illustrated and various other kinds of castings of large size and complicated shape of malleable cast iron which is an entirely new result in this art as far as I am aware. The advantages of it are so obvious that no further explanation is thought to be necessary.

Although I have illustrated and described only a single embodiment of the invention, I am aware of the fact that modifications can be made therein by any person skilled in the art without departing from the scope of the invention as expressed in the claims. Therefore, I do not wish to be limited to all the details of procedure herein shown and described, but what I claim is:

1. The method of treating iron which can be converted into malleable iron which consists in passing an electric current through an iron article, and regulating the current to cause more current to pass through the thicker than the thinner portions and to keep the entire article for a period of several hours at a temperature near the point at which the combined carbon changes to temper and free carbon, whereby the iron is rendered malleable.

2. The method of annealing iron castings which consists in passing an electric current through the entire casting while it is cooling in its mold for the first time, to maintain the entire casting at or about the temperature at which the combined carbon changes to temper and free carbon and thus change the physical condition of all parts of the casting and prevent brittleness therein.

3. The method of annealing iron castings which consists in passing an electric current through the casting while it is cooling, and making more current pass through the thicker portions than the thinner portions so as to proportion it to the mass in each part of the casting, to cause the physical condition of all parts of the casting to change uniformly.

4. The method of treating castings, which consists in casting an article having varying cross sections, directing an electric current through the casting in the mold, and providing a path outside the casting but adjacent thereto for part of the current along the parts of the casting having a cross section smaller than the remainder thereof, to retard cooling and affect crystallization substantially uniformly throughout the casting.

5. The method of casting metal which consists in applying a metal chill to the mold adjacent to the mold cavity, of such shape and size as to provide a substantially uniform cross section of chill and casting, passing through the casting and chill a current of high amperage about when the casting sets and maintaining the current for a period to effect the transformation of most of the carbon.

6. The method of casting iron containing manganese which consists in pouring the metal, allowing it to cool materially below the point at which the combined carbon changes to temper or free carbon, then heating the casting substantially uniformly all over and holding it at a higher temperature than the transformation point to allow most of the combined carbon to change to free and temper carbon in the mold.

7. The method of casting iron which consists in pouring the metal, allowing it to cool below the point at which the combined carbon changes to temper or free carbon, then heating the casting and holding it at a higher temperature to allow most of the combined carbon to change to free and temper carbon.

In testimony whereof I have hereunto affixed my signature.

OSSA SOWERS.