Nov. 24, 1925. 1,563,104

O. PEDERSEN

MEANS FOR MEASURING TEMPERATURES

Filed Jan. 3, 1921

Fig. 1.

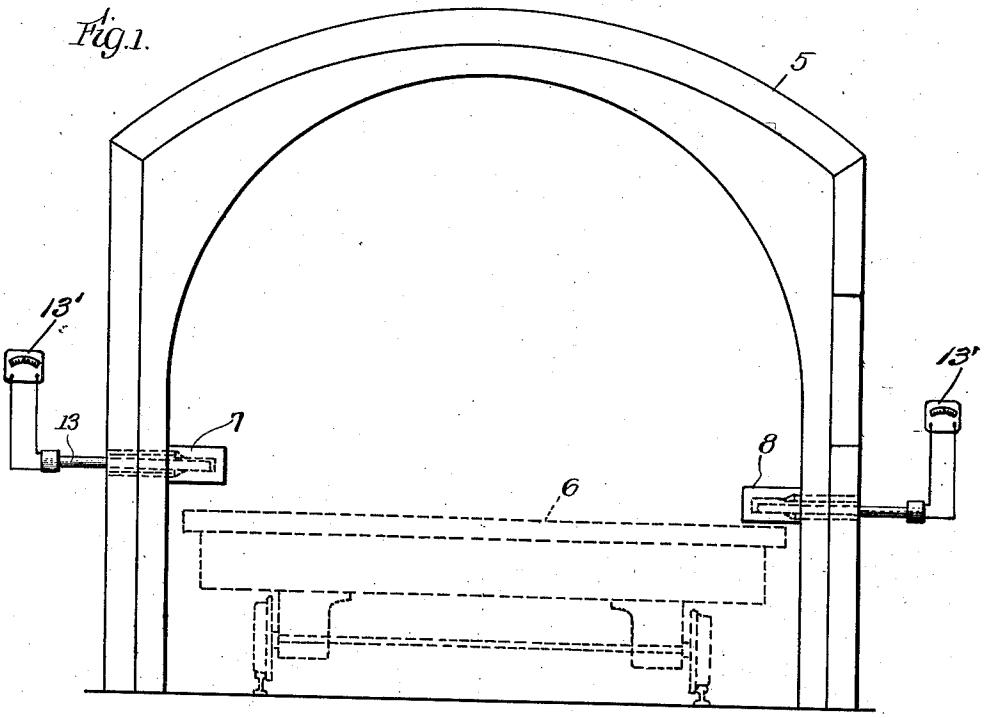


Fig. 3.

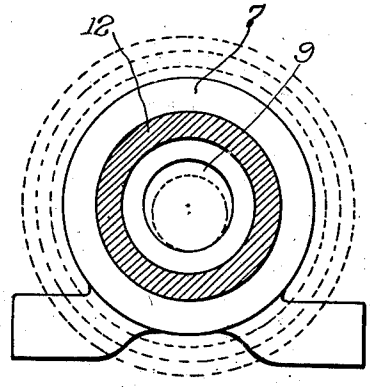
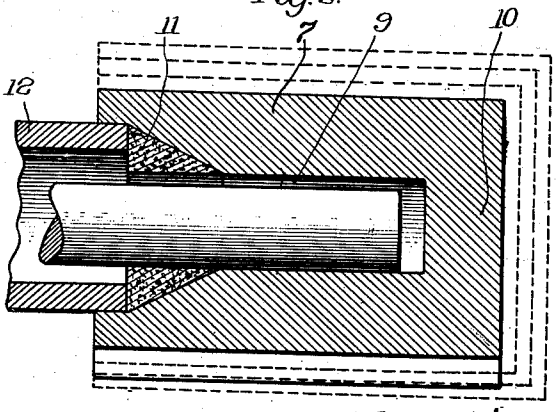


Fig. 2.



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UNITED STATES PATENT OFFICE.

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MEANS FOR MEASURING TEMPERATURES.

Application filed January 3, 1921. Serial No. 434,580.

To all whom it may concern:

Be it known that I, OTTO PEDERSEN, a citizen of the United States, residing at Chicago Heights, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Means for Measuring Temperatures, of which the following is a specification.

My invention relates to heat treatment, and particularly to a method of and apparatus for measuring heat in the interior of castings or other pieces of metal subjected to heat treatment.

At the present time many and various materials are subjected to heat treatment and the present practice is to heat these materials up to what is termed the "critical" temperature, which temperature varies with the different materials and with the chemical qualities thereof. In many cases and especially with castings of manganese steel, it is necessary that the critical temperature be uniform throughout the mass treated, that is, that the interior of the heaviest piece of material under treatment must be brought up the critical temperature as well as the outside. In view of the fact that the heat is applied to the outside of the material under treatment, it follows that the outside heats up first and reaches the critical temperature long before the heat has sufficiently penetrated the piece to bring the interior thereof up to the critical temperature. The lagging of the heat penetration varies with different materials, and is due, among other reasons, to the intensity of the application of the heat and the cross-section area of the pieces under treatment.

There is no method or means at the present time whereby it is possible to ascertain the temperature in the interior of a piece under treatment; the ascertainment being made solely by reason of the skill and experience of the attendant, which, at the best, is but a matter of guess work. Often it so happens that the material being heat treated consists of many pieces of different cross-section and so piled in the furnace as to be affected in different manners by the application of the heat. Experience has shown that when a measuring instrument such as a pyrometer indicates that the critical temperature within the heat treating furnace has been obtained, it is necessary to hold the heat at such point until in the judgment of the attendant the heat has penetrated the heavy sections. This operation is called "soaking", and the time of soaking depends entirely on the skill and judgment of the attendant, who by reason of the fact that there are many chances for error is often at fault, withdrawing the materials from the furnace long before the interior of the pieces has received sufficient heat. Some of the factors which affect heat treatment are intensity of the application of the heat, variation in the cross-sections of the pieces being treated, the operation of the furnace, amount of fuel used, leakage, and the like. When material is removed before the critical heat has penetrated the heavier sections, the interiors of these sections are under-treated, resulting in the setting up of invisible internal strains and weaknesses which cause failure when the various materials are put into service. The natural tendency therefore, of the attendant in operating a heat-treatment furnace is to overheat the material, which overheating is as detrimental in many cases as under-heating. Furthermore, overheating in all cases causes waste of fuel, of time, with a consequent increase in the cost of such treatment.

My invention is directed to a method of and means for overcoming the above-recited and other well known objections to heat treatment, and its main object is the provision of means for measuring heat supplied to the interior of materials being heat treated.

A further object is to provide an improved method for measuring the temperature at the interior of a casting being heat treated.

A further object is to provide means for measuring the temperature at the interior of a casting being heat treated, said means comprising a test piece of substantially the same material and having substantially the same cross sectional dimensions as said casting.

A further object is to provide a test block for indicating the temperature of castings being subjected to heat treatment, which test block will simulate the heat conveying features of said casting.

A further object is to provide convenient temperature indicating means suitable for indicating the temperature at the interiors of a plurality of castings.

A further object is to provide improved furnace construction whereby the temperature at the interiors of articles under heat treatment may be conveniently measured.

Generally speaking, I carry out the preferred form of my invention by providing a plurality of hollow test blocks closed at one end and open at the other, the cross-sectional area of which blocks being substantially the same as the materials being treated, and which blocks are made of the same material. These blocks are then positioned in the heat treatment furnace in such manner as to receive the same heat applied to the articles under treatment and so arranged as to permit the application of a thermo-couple, or other instrument, to the interior of the blocks, whereupon the heat applied to the interior of the blocks may be measured by means of a pyrometer scale or other heat-measuring instrument.

The various novel features of my invention will be understood from the following description and drawings and will be particularly pointed out in the appended claims.

In the drawings:

Figure 1 is a vertical transverse section through a heating furnace with the test blocks of my invention in operative position;

Figure 2 is an enlarged longitudinal section showing one form of test block and indicating in dotted lines the different sizes that such blocks may assume; and

Figure 3 is an end view of Figure 2.

In the drawings a conventional heat treatment furnace is represented at 5, which is of any well-known form and into which the materials to be treated are moved by means of a car 6 or other portable element. The materials to be heat treated are piled on the car outwardly of the furnace, whereupon the same is moved into the furnace and the furnace sealed. Positioned in various places within the furnace so as to be subjected to the heat therein are test blocks 7 and 8 which, as will be observed by reference to Figure 2, have a hollow interior 9 and an end wall 10. The heat conveying features of the articles to be heat treated should be approximated in the test blocks 7 and 8. The cross sectional dimensions of the blocks should preferably be made substantially the same as the cross sectional dimensions of the articles being heat treated, and the test blocks should preferably be made of the same material as said articles. Where the application of the heat to the articles varies, due to the nature of the article, the test blocks may be made in graduated sections, which graduations are in accordance with the degree of accuracy required. For instance, in certain work such as heat treating rough castings, the test blocks may vary by ¼ inch graduations in size, whereas in the test blocks for finer work, such as tool and die work, the variations should not exceed $\frac{1}{16}$ of an inch. In mounting the test blocks in the furnace, they are arranged adjacent a lateral opening therein and sealed as at 11 by means of mineral wool, fire clay or other heat resisting medium to prevent the entrance of any heat to the interior 9 of the block. A tube 12 or other like member is inserted through the opening in the furnace and so insulated as to permit no heat to reach the interior of the test block. A thermo-couple 13 is then inserted into the interior of the block and connected in any well-known manner to an indicating device such as the scale of a pyrometer 13′ for indicating the temperature in the interior of the test blocks. Blocks arranged in the position 7 may be secured in the furnace prior to the entry of the car 6 and its load, while those in the position 8 might, if desired, be secured on the car 6 and moved into register with openings through the wall of the furnace, which openings are properly sealed after the car is in position. In this way, it may be observed, the test block would be included among the articles being treated and perhaps might indicate a little more closely the actual conditions to which the articles under heat treatment are subjected. In any event, the test blocks 7 and 8 are suitably insulated to prevent the entrance of any heat to the interior thereof except that due to the penetration of the heat treatment.

The method of using these test blocks will necessarily vary with the different furnace installations and for different purposes, the essential feature of the invention being that the graduated blocks must be so positioned in the furnace as to be exposed to the same heat as the material being treated, the heat penetration of which it is desired to measure. It might be that a series of test blocks could be permanently bricked in a furnace where the articles being heat treated were of the same character for a period of time. This method would enable the furnace attendant to ascertain the temperature of the various sections of the material under treatment and permit the removal of lighter sections from the furnace as these would be ready for removal prior to the heavy pieces.

While I have described more or less precisely the details of construction of my invention, I do not wish to be understood as limiting myself thereto, as I contemplate changes in form and the proportion of parts and substitution of equivalents as circumstances may suggest or render expedient, without departing from the spirit of my invention.

I claim:

1. In combination, a furnace for enclosing articles to be heat treated, a plurality of test blocks closed at one end and being of a construction to simulate the heat con-

veying features of articles to be heat treated in said furnace, said blocks being fixed to the inside wall of said furnace to expose same to the heat of said furnace, and means communicating with the interior of said blocks and with the exterior of said furnace for measuring the temperature at the interior of said blocks.

2. In combination, a furnace for enclosing articles to be heat treated, a plurality of test blocks each closed at one end and having an opening at the other end and being of a composition and of cross sectional dimensions approximating those of articles to be heat treated in said furnace, said blocks being fixed to the inside wall of said furnace to expose same to the heat of said furnace, and means communicating with the interior of said blocks and with the exterior of said furnace for measuring the temperature at the interior of said blocks.

3. In combination, a furnace for enclosing articles to be heat treated, a plurality of test blocks each closed at one end and having an opening at the other end and being of a construction to simulate the heat conveying features of articles to be heat treated in said furnace, said blocks being fixed to the inside wall of said furnace to expose same to the heat of said furnace, and means communicating with the interior of said blocks and with the exterior of said furnace for measuring the temperature at the interior of said blocks.

Signed at Chicago Heights, Ill., this 21st day of December, 1920.

OTTO PEDERSEN.