

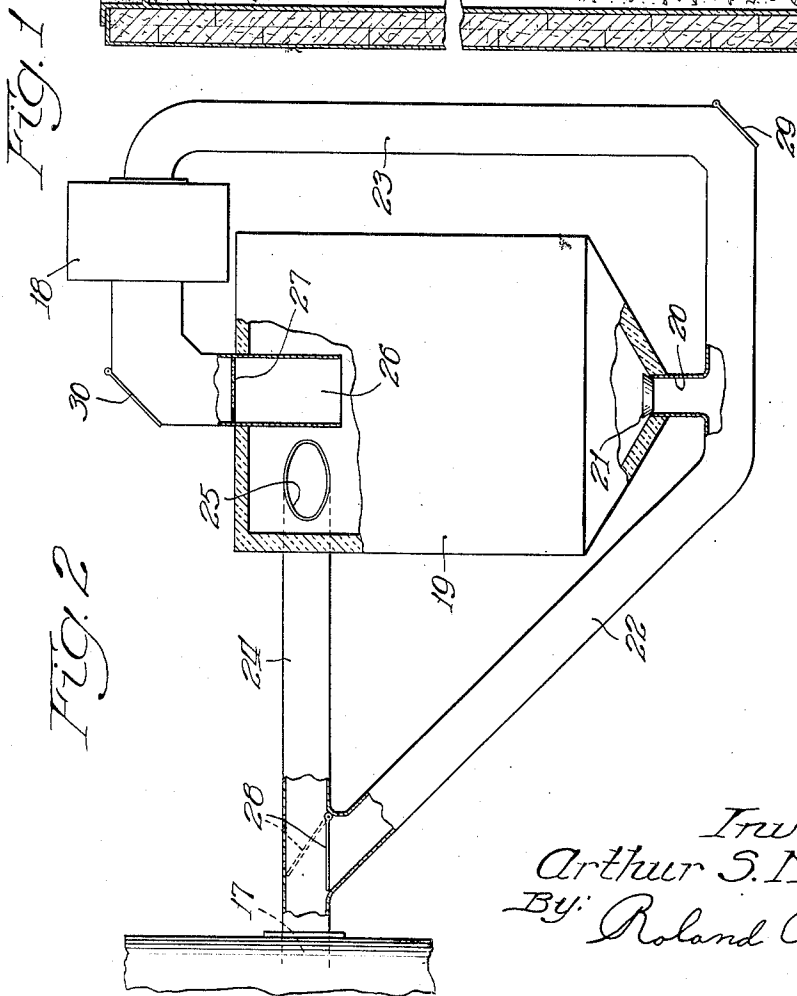
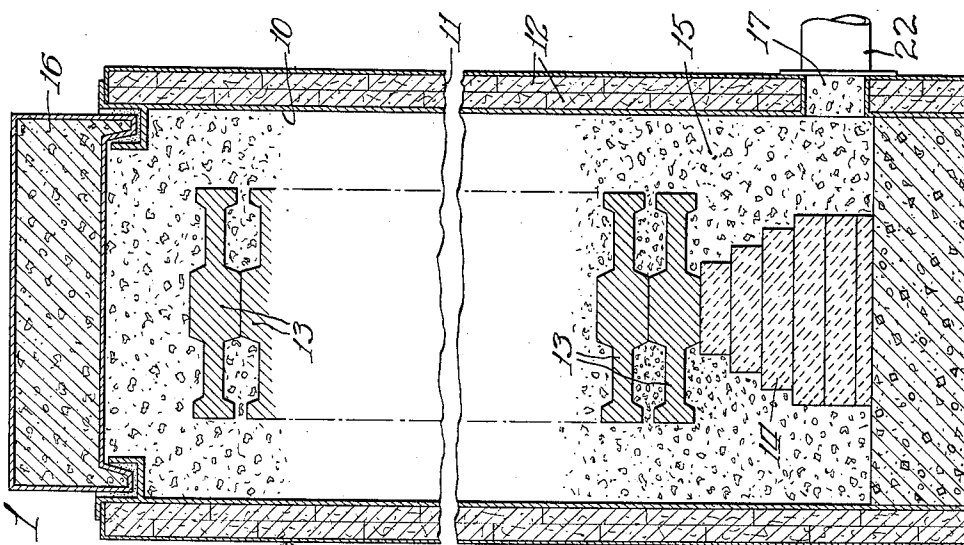
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HEAT TREATMENT OF CASTINGS AND THE LIKE

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HEAT TREATMENT OF CASTINGS AND THE LIKE

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4 Claims. (Cl. 266—2)

This invention relates to improvements in the heat treatment of iron and steel and particularly to the treatment of castings and the like, and among other objects aims to provide improved means for controlling and retarding the rate of cooling of such castings.

The nature of the invention may be readily understood by reference to one illustrative apparatus shown in the accompanying drawing.

10 In said drawing, Fig. 1 is a vertical section of a heat treating apparatus, and Fig. 2 is a diagrammatic elevation of auxiliary apparatus connected to the apparatus of Fig. 1 but shown separately to permit illustration on a larger scale.

15 In cooling cast articles such as car wheels, it has been the practice to stack a large number of such wheels in a deep insulated chamber or so-called pit, while still red hot, i. e., at a temperature of approximately 1,550° F. and to allow the castings to cool slowly. A pit of this character is about twenty feet deep and about five feet in diameter, and while its walls are insulated, it has not been possible within practical limits to insulate the wheels sufficiently thoroughly to retard cooling to the desired rate. For best results, the castings should not cool more rapidly than about 8° F. per hour. In other words, the temperature should not drop below 1,300° F. in from twenty-two to twenty-six hours of soaking. 20
25 Generally the annealing cycle requires about forty-four hours at the end of which the temperature of the casting should not be below 1,050° F.

30 The rate of cooling is retarded and controlled according to the present invention by surrounding the stack of hot castings in the pit by a light weight refractory insulation having a low specific heat and of such character as to flow readily around the castings. I have discovered that exfoliated vermiculite is satisfactory for this purpose. It is very light in weight (about six pounds per cubic foot), is granular in form and therefore can be made to flow readily around the castings, has a low specific heat, i. e., low heat absorbing capacity, is refractory and does not react with the hot metal, and retains its insulating efficiency at high temperatures.

35 Exfoliated vermiculite is an alteration product comprising particles of certain micaceous minerals such as biotite, which exfoliate or expand to many times their original size upon the application of heat to produce a granular material. When exfoliated, the extremely thin and polished laminae, which characterize the structure of the material are very slightly separated, their separation being responsible in part for the excellent insulating qualities of the material. The granules being roughly cubical or spherical in shape, slide and tumble freely, and therefore, notwithstanding their light weight, they will flow readily.

After the red hot castings have been stacked in the pit, they are surrounded by granules of exfoliated vermiculite which fill the space between the castings and the sides of the pit. The insulation afforded by the vermiculite effectively retards cooling to the desired rate. It is efficient in insulating the castings, both against loss of heat by convection currents and against radiation, the latter being a substantial factor at high temperatures, since transfer of heat by radiation increases tremendously when temperatures reach red heat. Furthermore, because of its low specific heat, the exfoliated vermiculite has substantially no cooling effect on the castings and when once heated, holds its temperature for long periods of time.

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45 In the drawing is illustrated one form of apparatus for thus treating castings and the like. It comprises a metal shell 10, constituting the pit, which may be wholly or partly buried in the ground, and which is provided with about six inches of insulation 11 on its exterior in the form of block 12 or the like. Such block may advantageously be formed of an aggregate of exfoliated vermiculite. The castings which are here represented by car wheels 13 are stacked upon a refractory pedestal 14 until they practically fill the pit. Thereafter, granules 15 of exfoliated vermiculite are introduced into the pit to fill the entire space between the castings and the walls of the pit. An insulated cover 16 is employed to cover the top of the pit.

50 Because of their extremely light weight, the vermiculite granules may be carried into the pit by currents of air passing into the pit through a bottom opening 17. The tremendously high natural draft caused by the stack of hot castings (when the top of the pit is uncovered) is sufficient itself to carry into the pit a substantial quantity of vermiculite granules, but the natural draft may be supplemented by a blower or fan 18 to insure complete filling of the pit with granules. During such introduction of the granules, a screen is preferably placed over the top of the pit to prevent the granules from being carried out of the pit. If a slight settling of the granules should take place after introduction in this manner, some additional granules may be

poured into the top of the pit, whereupon the cover 16 is replaced.

After the soaking and annealing period, the granules may advantageously be drawn from the bottom of the pit through the opening 17 by suction, the cover, of course, being removed to permit air to enter the top of the pit. Again the light weight and character of the granules make possible their removal by suction induced air currents passing out of the pit.

The drawing shows one diagrammatic means for introducing and removing the granules. The latter may be stored in a circular insulated bin 19 having a hopper bottom and discharge opening 20 which is controlled by a gate 21. The discharge opening 20 is connected with a conduit 22 leading to the opening 17 in the pit. The pressure side of the blower 18 is connected by conduit 23 with conduit 22. When introducing the granules, gate 21 is opened, allowing a stream of granules to fall into the current of air passing into the pit. This current may be supplemented if and when necessary by the blower. For withdrawing the granules after the soaking and annealing cycle, gate 21 is closed and the suction side of the blower is connected to opening 17. In the present instance a conduit 24 joins conduit 22 adjacent opening 17 and discharges tangentially at 25 into bin 19, thereby creating a cyclone or whirling action by which the granules of vermiculite may be retained in the bin and the air withdrawn. The current of air is withdrawn from the bin through a conduit 26, located centrally of whirling currents, which passes out of the top of the bin and is connected with the blower intake. A screen 27 across the conduit prevents the removal of stray granules of vermiculite. When withdrawing granules from the pit, a gate valve 28 is moved to close conduit 22, at the same time connecting conduit 24 with the opening 17. Gate 29 is also opened to provide an outlet for the fan. When introducing granules into the pit, gate 29 is closed and gate 28 operated to close conduit 24. Gate 30 is opened to provide a direct inlet to fan. At other times, gate 30 is closed.

It will be understood that the foregoing means for handling the granules is merely illustrative and that the method of handling the granules is not limited to the specific means shown.

Obviously the invention is not limited to the illustrative apparatus and methods, since these may be variously modified. Moreover, it is not indispensable that all features of the invention be used conjointly since various features may be used to advantage in different combinations and sub-combinations.

Having described my invention, I claim:

1. The method of retarding the rate of cooling of castings and the like which is characterized by stacking the castings while in highly heated condition in a relatively deep chamber, creating a current of air through said chamber with the aid of the upward currents induced in said chamber by the stack of hot castings, carrying granules of lightweight exfoliated vermiculite into said chamber with said current of air, allowing the current of air to pass out of said chamber but

preventing the escape of the granules, and after said chamber is filled with said vermiculite, closing the same to arrest said air currents.

2. The method of heat treating castings and the like by retarding their rate of cooling to a predetermined slow rate which is characterized by placing in a chamber castings heated to such high temperatures as to develop substantial radiant heat, said chamber providing a substantial space between its walls and the castings, creating a current of air through said chamber, conveying granules of exfoliated vermiculite into said chamber with said air current until the space around the castings is substantially filled with vermiculite, allowing the air current carrying the vermiculite to escape from said chamber but preventing the escape of the granules therewith, maintaining the vermiculite around said castings to minimize loss of radiant heat and thereby cooling said castings slowly at a predetermined rate, and after completion of the treatment withdrawing said granules.

3. The method of heat treating castings and the like by retarding their rate of cooling to a predetermined slow rate which is characterized by placing in a chamber castings heated to such high temperatures as to develop substantial radiant heat, said chamber providing a substantial space between its walls and the castings, creating a current of air through said chamber, feeding granules of exfoliated vermiculite from a bin into said air current until the said space around said castings is substantially filled with vermiculite, allowing the air current carrying said vermiculite to escape from said chamber but preventing the escape of the granules with the air, allowing the vermiculite to remain in said chamber to cause the castings to cool at a slow rate to the desired temperature, and after completion of the treatment withdrawing said granules from said chamber by suction induced air currents and discharging them tangentially into said bin to create a vortex to separate the granules from the suction induced current of air.

4. Apparatus for retarding the cooling of castings and the like to a predetermined rate comprising in combination, a chamber having an opening adjacent its bottom, a bin in the form of a cyclone separator for holding lightweight insulating material and having at its lower end a discharge opening and adjacent its upper end a tangential inlet opening, a discharge conduit connecting the discharge opening of said bin with the opening into said chamber, an inlet conduit connecting said tangential inlet opening with the opening into said chamber, valve means for selectively opening and closing said conduits, a blower or the like for creating air currents and suction, means for delivering air currents from said blower to said discharge conduit to convey the insulating material from said bin into said chamber, and means for applying the suction of said blower to said inlet conduit to withdraw the insulating material from said chamber and return the same to said bin.

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