FLUIDIZED BED APPARATUS FOR QUENCHING HOT ROD

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ABSTRACT OF THE DISCLOSURE

Apparatus for quenching hot rod received directly from a hot rod rolling mill comprising a fluidised bed vessel, a conveyor arranged to move through the vessel, a coil er arranged over one end of the vessel above the conveyor and so positioned that rod received by the coiler is fed directly onto the conveyor in overlapping looped form, and means for maintaining in the vessel a fluidised bed.

This invention relates to the heat treatment of rod, particularly rod in continuous strands. The invention is particularly advantageous when applied to steel rod having a carbon content between 0.40% and 0.85%, which rod should have a closely specified metallurgical structure, if it is to be subsequently reduced, such as by being drawn into wire. In that case the structure of the rod is, ideally, fine pearlite.

In one aspect the invention provides a method of heat treating rod, in which the rod is laid in overlapping looped form on a moving conveyor, which passes continuously through a fluidised bed maintained at a controlled temperature.

Preferably steel rod, having a carbon content between 0.40% and 0.85%, coming directly from a rolling mill is collected onto the conveyor, and the fluidised bed is maintained in such a temperature range that the rod forms a fine pearlitic structure as it cools.

In another aspect the invention provides apparatus for heat treating rod comprising a fluidised bed vessel, means for maintaining a fluidised bed in the vessel, a conveyor arranged to move through the fluidised bed, and means for forming rod into overlapping loops on the conveyor.

One embodiment of heat treating apparatus, in accordance with the invention, will now be described, by way of example only, with reference to the accompanying drawings of which:

FIGURE 1 is a side view of apparatus for heat treating continuous rod.

FIGURE 2 is a sectional view through the fluidised bed vessel of FIGURE 1.

FIGURE 3 is an enlarged plan view of part of the conveyor part of the apparatus.

FIGURE 4 is an enlarged view of part of the conveyor, as viewed in the direction of arrow IV of FIGURE 2, and

FIGURE 5 is an enlarged view of part of the conveyor as seen in the direction of arrow V of FIGURE 2.

A fluidised bed vessel 12, about 50 feet long, is supported on beams 13 and uprights 14. The fluidised bed container 12 is formed from a number of sections connected by brackets and has a base 16 in which are located a plurality of nozzles supplied with the fluidising gas through a conical supply pipe located below the container in known manner. On either side of the fluidised bed vessel 12 are parallel rails 21 and directly below the rails 21. On either side of the container and at each end, a pair of driven wheels 26 in the plane of the rails 21, 25 carry a pair of endless chains 27, 28 which pass round the wheels and along the rails 21, 25. As seen in FIGURE 3 each chain comprises a series of links 30 pivoting at connections 31, each connection 31 having a central portion 32 which rides on the rails.

A continuous conveyor mechanism is carried between the two chains so that the conveyor surface 33, which is in the plane of the chains by which it is supported, passes through the fluidised bed vessel and is then returned to the entrance to the fluidised bed vessel by passing underneath that vessel on rails 25. Each side of the conveyor mechanism comprises a series of upright brackets 34 connected to the inside link parts 35 of the chain and extending upwards from the chain between the uprights 20 and the side wall 12 of the vessel, the upper end of each bracket 34 being secured to a horizontally extending panel 36 projecting inwardly through a slit 37 in the wall 18 into the vessel 12. The slits 37 are located above the level 38 of the fluidised bed material in its fluidised condition and are sealed by flexible seals 40. A series of brackets 41 extend downwardly from each panel 36 and form the side walls of the trough shaped conveyor within the fluidised bed vessel. A series of tubes 42 extend across the fluidised bed between the lower ends of the brackets 41 and carry five bars 43 normal thereto, the upper serrated surfaces of which form the conveying surface 33. Further bars 45 are connected between the outer bars 43 and the brackets 41 so that their upper surfaces are the same level as the serrated surfaces.

The level of the chain and the conveying surface 33 at the ends of the vessel 12 are raised above the level 38 of the fluidised bed so that the conveyor does not carry material out of the bed. At the exit end of the bed is located a scrubber 46 driven through a chain 47 from the wheel 26. A laying reel 48 is adapted to receive hot rod directly from the finishing stand of a rolling mill and lays it into the conveyor.

In operation the bed is fluidised by supplying a fluidising gas, e.g. air or a non-oxygenising gas, to fluidise the bed material, e.g. sand, and the wheels 26 are driven to drive the chain and endless conveyor at a speed of about 50 feet per minute. Hot rod which preferably comes directly from a rolling mill enters the laying reel 48 and is formed into loops which are deposited on the moving conveyor so that the centre of each loop is displaced from the preceding loop along the conveyor path. The loops are shown at 50 in FIGURE 3 supported on the bars 43 and tubes 45 which owing to their open nature do not hinder the fluidisation of the bed and the contact of the fluidising gas and sand with the rod so that effective rapid cooling is achieved. For example the rod may enter the bed at approximately 950° C. and leave the bed at approximately 400° C.; in this case, where the rod has a carbon content between 0.40% and 0.85%, a fine pearlitic structure will be formed.

What is claimed is:
1. Apparatus for quenching hot rod received directly from a hot rod rolling mill comprising a fluidised bed vessel;

a conveyor arranged to move through the vessel;

coil er arranged over one end of the vessel above the conveyor and so positioned that rod received by the coiler is fed directly onto the conveyor in overlapping looped form, and

means for maintaining in the vessel a fluidised bed hav-
ing a surface above the conveyor and composed of finely divided material having a temperature lower than that of the rod entering the bed.

2. Apparatus for quenching hot steel rod having a carbon content between 0.4 and 0.85% received directly from a hot rod rolling mill comprising
a conveyer of open construction arranged to move through the vessel,
a coiler positioned to receive hot rod directly from the mill and so located over one end of the vessel above the conveyor that rod received by the coiler is fed directly onto the conveyor in overlapping looped form, and
means for maintaining in the vessel a fluidised bed of the surface of which is above the conveyor, and composed of finely divided material having a temperature range such that all the rod forms a fine pearlitic structure as it is quenched.

3. Apparatus for quenching hot rod received directly from a hot rod rolling mill comprising
an elongate fluidised bed vessel arranged with its longitudinal axis substantially horizontal,
a conveyor arranged to move through the vessel said conveyor comprising
a pair of rails extending parallel to and along the length of the vessel and positioned outside of the vessel on opposite sides thereof,
two endless chains with a part of each chain supported on the respective rails,
means for continuously driving the chains,
a pair of bracket members secured one to each of the chains with each member having a part which projects into the vessel through an opening in the adjacent side wall thereof,
endless support means of open construction suspended in the vessel from said projecting parts,
a coiler positioned to receive hot rod directly from said mill and so located over one end of the vessel above the support means that rod received by the coiler is fed directly onto the support means in overlapping looped form, and
means for maintaining in the vessel a fluidised bed of finely divided material having a temperature lower than that of the rod entering the bed, with the surface of the bed above the support means and below the openings in said side walls.

4. Apparatus as claimed in claim 3 in which said support means comprise a plurality of first elongate members arranged in spaced apart side-by-side relation and extending in a direction normal to the direction of conveyance and a plurality of second elongate members supported in spaced apart relation on said first members.

5. Apparatus according to claim 3 in which the level of the pair of rails is raised at the exit end of the vessel above the level of the bed when fluidised.

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