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METHODS AND APPARATUS FOR HANDLING WIRE ROD

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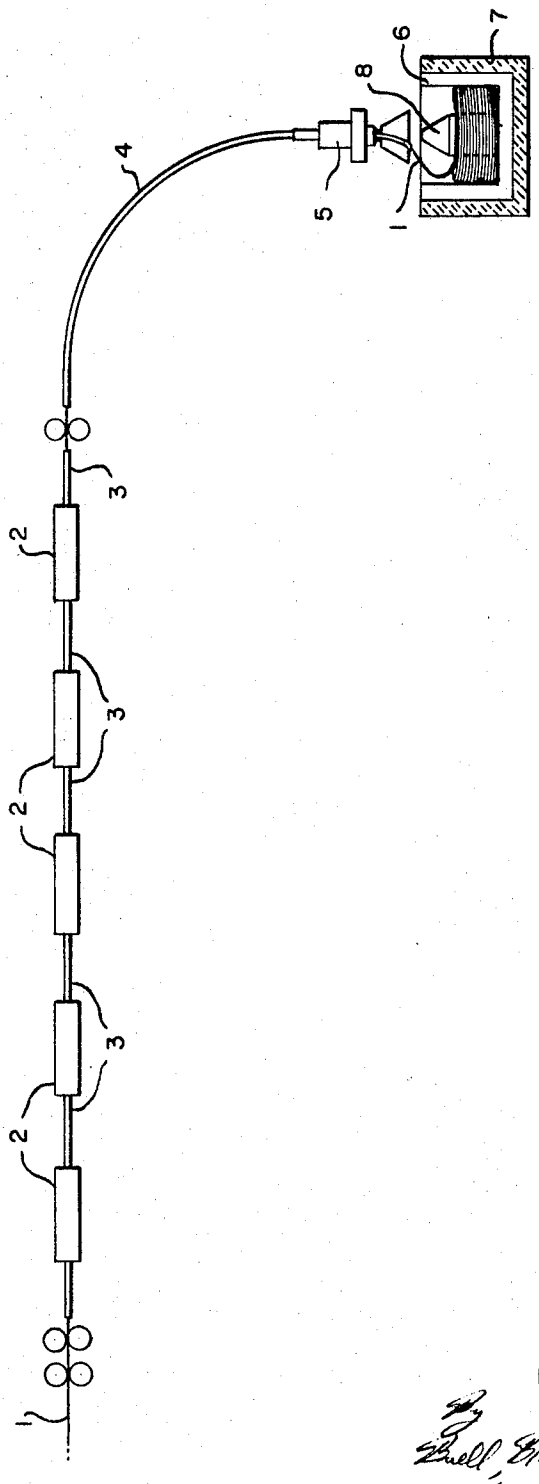

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METHODS AND APPARATUS FOR HANDLING WIRE ROD

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ABSTRACT OF THE DISCLOSURE

A method and apparatus are provided for controlled cooling of wire rod from a hot rolling mill to provide grain structure suitable for subsequent drawing by the steps of cooling said rod to a temperature between 930° F. and 1110° F. on a cooling line and holding said cooled rod on a preheated reel at about 930° F. until the temperature of the rod has stabilized.

This invention relates to methods and apparatus for handling wire rod and particularly to a method and a device for the controlled cooling of wire rod coming out of a hot rolling mill and transporting same over a cooling line.

It has long been recognized that it is necessary, in order to make the rod more suitable for cold drawing, to achieve in the rod a special grain structure. This can be achieved by a controlled cooling of the wire rod leaving the hot rolling mill or by a reheating process.

Various practices have been heretofore used for accomplishing the controlled cooling of the wire rod leaving the hot rolling mill. For example, it has been the practice for some time to use a lead bath for this purpose. This practice has however been less than satisfactory because of its uneconomical small production rates, high cost and small through-put rate.

Another method which has been used to accomplish controlled cooling of wire rod is to lay the wire rod, coming out of the hot rolling mill without any previous cooling, with the help of a laying device in sprial loops on a moving transport conveyor, where the wire rod can be cooled by using cooling devices with water or air cooling. This method, however, has certain disadvantages, since the spiral wire rod loops partly overlap, and come in contact with each other, which is unavoidable and causes non-uniform cooling and, therefore, different grain structures. Wobbling or vibrating devices used to avoid this undesired overlapping did not produce satisfactory results, and did not solve the problems of this method.

According to still another well-known method, the wire rod is collected and coiled in reels and after this coiling operation, immediately moved to an apron or hook conveyor, which is, however, also very disadvantageous and can result in a non-uniform grain structure of the rod. It is therefore not advisable to form such a compact wire rod coil, which cannot be cooled uniformly because of its large mass.

Previously mentioned and other disadvantages and shortcomings are not only eliminated by this invention, but additional advantages are gained. The rod coming out of the hot rolling mill is first cooled down to a suitable temperature range and only thereafter transported to other devices which are free of disadvantageous temperatures for further treatment.

The method according to this invention for controlled cooling preferably comprises the steps of cooling the wire rod on a cooling conveyor down to 930° F. to 1110° F., and feeding the rod afterwards into a reel preheated to

approximately 930° F. where the wire rod is held to permit temperature stabilization (about 10 to 30 seconds), and which is enough time for a grain structure transformation. Thus, it is assured that the wire rod does not come into contact with cooling areas of a temperature below 930° F. The provided holding time for the wire rod in the reel allows for a compensation in the wire rod temperature which shows a difference of about 210° F. between core and outside of the wire rod before entering the reel, and accordingly, makes possible the formation of a uniform grain structure over the entire coil.

The main advantage of a lower entering temperature of the wire rod into the reel is that the wire rod already possess a certain stiffness and can therefore, be fed in through a vertical laying pipe or similar equipment without any interruptions so that the loop is formed automatically. A mandrel pin or similar equipment can be provided under the vertical laying pipe to make sure that the loop is always formed in the same direction.

It is preferred to cool the wire rod down to the range 930° F. to 1110° F. on a cooling line consisting of several sections intermittently arranged for intensive heat dissipation on the one hand, and for heat compensation on the other hand, and to feed the rod afterwards into the preheated reel. The complete cooling line, therefore, can consist for example of a cooling line provided with water, air or other cooling medium, arranged behind the rolling mill, and of an adjoining uncooled equalization line provided for temperature compensation of the wire rod. According to the prevailing requirements, the cooling line for temperature equalization can be of a length equal to a multiple of the length of the cooling line for intensive heat dissipation. It is preferred also to arrange another cooling line or cooling section supplied with a cooling medium in such a way that the wire rod is cooled down to a certain temperature before entering the preheated reel.

It is of advantage to build the cooling section designated for temperature equalization by using guide pipes or the like consisting of materials with a low thermal conductivity. However, any other suitable shape or material can be used according to this invention. An apparatus for the execution of this method preferably comprises a reel completely or partially heated for the takeup of the incoming wire rod and built and arranged in such a way, that the wire rod is only touched and held by parts of the reel having an anticipated temperature of approximately 930° F. For this purpose, it is preferred that the reel be preheated and always held at the required temperature during operations. After the rolling mill is in operation for a certain period of time, and a certain temperature balance has been established in the reel through heat radiation of the wire loops remaining therefor a short time, additional heating is not required anymore. It is however necessary to hold the reel during operations always at the required temperature.

According to the invention, it is provided that bottom, shell, pin, and/or other reel parts can be heated to the required temperature and held there by using specially suited heating elements. The reel or individual reel parts can be heated electrically, or by devices using gaseous, liquid or solid heating materials. It is of advantage, of course, to use heating devices already provided or required for other purposes for heating of the reel. The reel parts designated to be heated can be provided with some insulation against undesired temperature losses. It is also of advantage to provide the inside of the reel with a lining of a material having a low thermal conductivity. Refractory materials or heat storing metals can be used for example. The invention is further characterized that completely or partially automatically working control, regulating, and/or measuring devices or the like are pro-

vided for holding and controlling of the required temperatures and time intervals. It is also possible according to the prevailing conditions to execute the required functions manually.

I have set out certain objects, purposes and advantages of my invention in the foregoing statement of my invention. Other objects, purposes and advantages of my invention will be evident from a consideration of the following description and the accompanying drawing which is a side elevation partly in section of an apparatus for carrying out my invention.

Referring to the drawing I have illustrated a rod **1** travelling on a pass line and emerging from the mill through successive cooling sections **2** and temperature equalization sections **3** in which the rod is cooled from rolling temperature to approximately 500° to 600° C. The cooled rod then passes through pinch rolls into guide pipe **4** where it is delivered to laying head **5** from which it is coiled into a refractory tub **7** having an inner heated liner **6** around a central post or mandrel **8**. The mandrel **8** may, like the liner **6**, be heated. Preferably the temperature within the tub is held at about 500° C. This heating may be accomplished by heating with gas or electricity by any of a variety of well known and conventional systems.

While I have described a presently preferred practice and embodiment of my invention in the foregoing specification, it will be understood that the invention may be otherwise embodied within the scope of the following claims.

I claim:

1. A method for controlled cooling of wire rod from a hot rolling mill to provide grain structure suitable for subsequent drawing comprising the steps of

(a) cooling said rod leaving the mill to a temperature in the range 930° F. to 1110° F.;

(b) delivering said cooled rod to a reel preheated to about 930° F.;

(c) holding said rod on said reel until the temperature of said rod has stabilized; and

(d) withdrawing said rod from said reel.

2. A method as claimed in claim **1** wherein the rod is held on the preheated reel for a time between of about 10 seconds to 30 seconds.

3. A method as claimed in claim **1** wherein the rod is cooled in consecutively arranged areas of intensive heat dissipation followed by temperature equalization.

4. An apparatus for controlled cooling of wire rod from a hot rolling mill to provide grain structure suitable for subsequent drawing comprising a cooling line receiving said rod from said hot rolling mill, means at said cooling line reducing the temperature of the rod to a point within the range 930° F. to 1110° F., a heated reel adjacent the cooling line receiving the rod from said cooling line, and heating means maintaining the reel at a temperature of about 930° F.

5. An apparatus as claimed in claim **4** wherein the reel is insulated against heat loss.

6. An apparatus as claimed in claim **4** wherein the cooling line includes an area of intensive heat dissipation followed by an area of temperature equalization preceding the heated reel.

7. An apparatus as claimed in claim **6** wherein the area of intensive heat dissipation includes means for directing cooling fluid onto said rod.

8. An apparatus as claimed in claim **6** wherein the area of heat stabilization includes elongated pipe means of a material of low thermal conductivity through which the rod passes.

9. An apparatus as claimed in claim **4** wherein the reel is provided with a lining of a material having a low heat transfer factor.

10. An apparatus as claimed in claim **4** wherein means are provided holding the rod on said reel for a period of between 10 and 30 seconds.

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