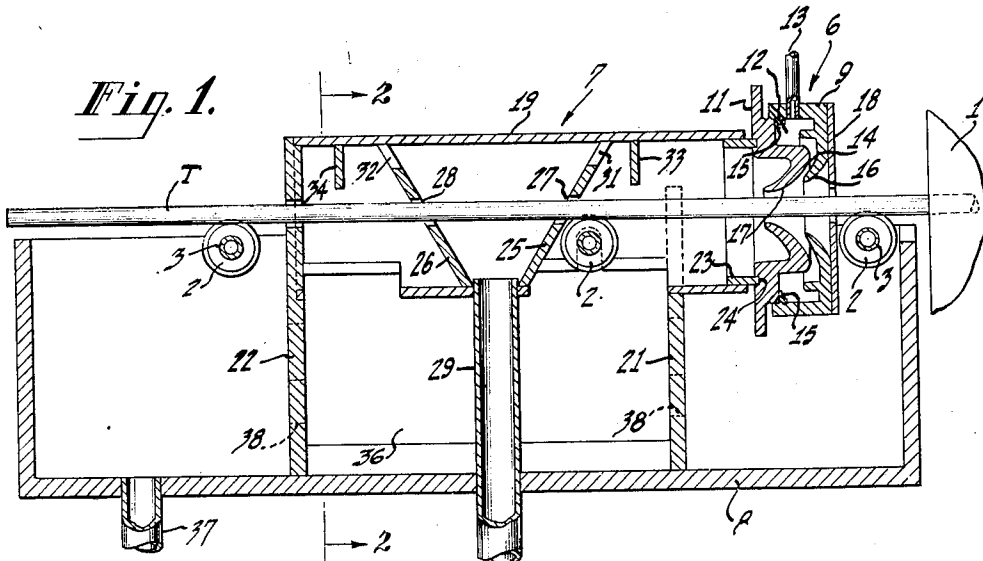
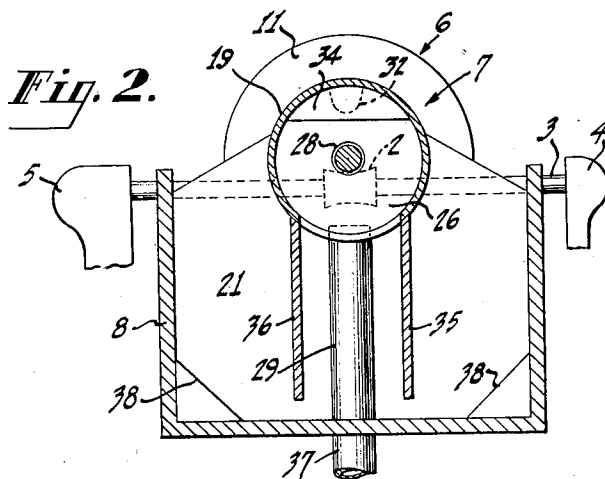


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PLURAL STATION QUENCHING DEVICE
FOR ELONGATED OBJECTS
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PLURAL STATION QUENCHING DEVICE FOR
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2 Claims. (Cl. 134-64)

1

2

The present invention relates to metal treating apparatus, and more particularly to the quenching of bar, tube or sheet stock as it issues from a furnace in which it has been heated.

It is an object of the invention to provide a method and apparatus for quenching heated metal, as it emerges from a furnace, in such a manner that the quenching medium is applied uniformly over the entire surface of the metal.

It is a further object of the invention to apply a spray quench and immediately thereafter to apply a flood quench to a piece of metal as it issues from a furnace.

It is a further object of the invention to provide a new and improved type of flood quench apparatus by means of which a quenching medium may be applied to heated metal. With this quench the metal is completely immersed in the quenching medium as it is being moved from the furnace to the point of use. The apparatus operates without impeding the progress of the metal and with a minimum of loss of the quenching medium.

The quenching of bar, tube or sheet stock as it emerges from a furnace has been a serious problem in the heat treating industry. This problem has been largely overcome by the recent introduction of a device that sprays a sheet of water or other quenching medium simultaneously over the entire surface of the piece of stock, as it is moving through a path from a furnace to a point of use. Such apparatus, in some cases, must be supplemented by immersing the stock in the quenching medium, and the sooner that this can take place the better the metallurgical properties that are obtained.

The present invention provides apparatus by means of which the stock may be immersed in the quenching medium immediately after it has been spray quenched and without having any effect on the movement of the stock. This is accomplished by building a housing through which the stock is passed, and filling this housing with the quenching medium under pressure. Suitable baffles are provided so that the quenching medium will be retained within the housing.

In the following description the quenching medium that is used will be described as water, since this is most commonly used. It will be understood, however, that any other material may be used in order to obtain the desired metallurgical qualities. By way of example, the metal worked upon will be described as bar stock, although it will be appreciated that rod, tubes or other shapes may be treated equally as well.

The various features of novelty which characterize my invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, however, its advantages and specific objects attained with its use, reference should be had to the accompanying drawings and descriptive matter in which I have shown and described a preferred embodiment of the invention.

In the drawings:

Figure 1 is a sectional view of the quenching apparatus of the invention; and

Figure 2 is a view taken on line 2-2 of Figure 1.

There is shown in Figure 1 a fragment of a furnace 1 in which the bars T to be quenched are heated. This furnace may be of any suitable type in which bars may be continually heated, but it is preferably of the type disclosed in Hess application Serial Number 602,323, filed June 29, 1945, and now U. S. Patent No. 2,529,690. The bars are heated and moved to the left from the furnace by a series of driven rolls 2 which serve to forward them to the point of use. These rolls are preferably of the water cooled type and are mounted, as shown in Figure 2, on a hollow shaft 3 through which water may be circulated. The shafts are supported on one end by suitable bearings 4 and on the other end by bearings 5 which also incorporate in them suitable gears to drive the rolls. As the bar leaves the furnace, it is passed successively through a spray quench device 6 and through a flood quench device 7. It will be noted that the spray quench is mounted immediately adjacent the exit of the furnace so that the bar is not subjected to the action of the atmosphere for a sufficiently long time for any appreciable scaling to take place. The flood quench is located immediately following the spray quench so that the bar passes from one directly to the other. A tank 8 to collect the quench water is located below the quenching devices.

The spray quench is of the type shown in Garrett application Serial Number 770,785, filed August 27, 1947, and includes a casting 9 which is suitably supported, by means not shown, so that an opening in its center is concentric with the path of the bar. Threadedly fastened in the casting 9 is a second casting 11, which together form a chamber 12 into which the quenching water is supplied by means of an inlet pipe 13. The water for the spray quench leaves the chamber 12 through an exit slot 14 that is conical in shape and which is formed between the lip portions 16 of the casting 9 and 17 of casting 11.

3

With the arrangement shown, the water is ejected from chamber 12 in a solid conical spray which completely surrounds the bar and which engages the bar on a line perpendicular to its axis along the path of travel thereof. Because of the shape of the lip 17 of casting 11, the water as it leaves slot 14 will hug the surface of the dip and encircle the bar to form a cylindrical sleeve thereon which quenches the bar evenly around its circumference. Since the bar is quenched along a line that is perpendicular to the axis thereof there is no tendency for the bar to warp. Depending upon the diameter and the temperature to which the bar is heated and the qualities desired, more or less water will be needed to effect the proper quenching. In order to accomplish this adjustment, casting 11 can be rotated with respect to casting 9 to vary the width of slot 14 and therefore to vary the amount of quenching water that is supplied. A washer 15 is attached to casting 11 and engages casting 9 to provide a water tight joint between the two. There is also provided a baffle 18 to reduce the backwardly directed spray produced when the quench water strikes the end of a bar or rod.

The bar and its enveloping cylinder of water pass immediately into the flood quench device 7. This device is shown as including a cylindrical member 19 that is supported by members 21 and 22 in tank 8. Referring to Figure 2 of the drawing, it will be seen that member 21 is a plate-like support which is shaped in its upper portion to receive the cylindrical member 19. Support 22 is provided with a groove on its right face that receives the right end of the cylindrical member 19. These parts form a frame for the various sections of the quench and may be rigidly mounted in place. In order to prevent the water which envelopes the bar from falling into the tank prior to the time that it has reached the flood quench, and also in order to prevent the spraying of water over the surroundings of the apparatus, casting 11 has a sleeve 23 mounted in a groove 24 on its face. This sleeve is received in telescoping relation in cylindrical member 19. As casting 11 is rotated in order to vary the width of the slot 14 the axial distance between the casting and cylindrical member 19 will be changed, but because of sleeve 23 there will be no gap between the two.

Located within cylindrical member 19 is what amounts to a tank or compartment filled with water through which the bar is passed. Forming the tank or compartment are two sloping plates 25 and 26 which completely fill the cylinder as shown in Figure 2. These plates are provided, respectively, with openings 27 and 28 that are axially aligned with the path through which the bar or rod is moved. Water under pressure is supplied from a pump (not shown) through a pipe 29 to the lower portion of the cone formed by these slanting members so that the bar passing through the tank or compartment formed between these members and the cylindrical member 19 is completely enveloped in water. The water which is forced in through pipe 29 may pass out through grooves 31 and 32 respectively, which are formed in the upper portion of the sloping members. In order to prevent the water from going too far and setting up a spray that will wet the surroundings of the device, there are provided two segmental members 33 and 34 which act as baffles and which are fastened to the interior of the cylindrical member 19 in front of the openings 31 and 32. Some water, of course,

4

will escape through openings 27 and 28 around the bar. Since these openings are only slightly larger than the bar, however, the water escaping at this point will be negligible. It will be seen that by reference to Figure 2 of the drawings that the water which is supplied to the interior of the cylindrical member 19 can fall through an opening formed in the bottom of this member into the tank 8. In order to prevent any more splashing than is absolutely necessary, side pieces 35 and 36 are fastened to the ends 21 and 22 and extend as shown in Figure 2 of the drawing from each side of the opening that is formed in the bottom of the cylindrical member nearly to the floor of the tank. All of the water that is used for quenching purposes is withdrawn through a drain 37 in the bottom of tank 8. Supports 21 and 22 are cut away at their corners, as shown at 38, so that the water may flow from the right end of the tank to the drain at the left end thereof.

In the operation of the system as a whole, the bar T which is being moved from the furnace immediately enters the spray quench 6 and is enveloped in a cylindrical sheet of water moving generally in the direction of bar travel. This water completely encircles the bar and chills it to an extent which will bring it below some critical desired temperature. The bar then passes into what is, in effect, a tank that is completely filled with water. This tank comprises the space between the sloping members 25 and 26 and the water is continuously circulated so that the bar is cooled to such an extent that the temperature of the entire area thereof is completely equalized. Because of the arrangement of the parts of the quenching device the tank holding the water is elevated to a point above the path through which the bar travels. Therefore, the quenching process can take place continuously and immediately following the heating. The arrangement of the parts is such that there will be no objectionable spray over the surroundings of the apparatus and substantially all of the water used is received in a suitable tank and can be drained from the immediate location of the furnace and be re-used, if desired. Sloping plate 25 acts to strip from the bar the cylinder of water placed thereon by quench 6. Any water escaping through opening 28 with the bar is stripped therefrom by water falling from slot 32. As a result the bar is substantially dry when it passes through opening 34.

A spray quench of the type disclosed has the valuable characteristic of providing a rapid and even quench action on the bar. The water or other quenching medium supplied by such a quench will chill immediately the surface of the work to a depth that can be varied by varying the volume of water for a bar of a given temperature. Since the sleeve of quenching water is held around the work only by its kinetic energy it will drain away from the bar in a short time. With small diameter bars or those at low temperatures the quenching action may well be completed by the time this happens. With a large bar at high temperature the water supplied by the spray quench may drain away before its center portion has been reduced sufficiently in temperature. Heat will then flow from the center of the bar toward the surface thereof to reheat the surface and reduce the effects of the quench.

By providing a flood quench to follow immediately after the spray quench the full effect obtained by the spray quench is retained. The bar passes into the tank of the flood quench before

the water supplied by the spray quench can drain away from it. The water in the tank is being agitated due to its flow and is of sufficient volume to cool completely the bar and equalize its temperature throughout its entire area. Thus the combination of the two types of quenches gives the benefits of both and an ultimate result that cannot be obtained by either type alone. There is a sudden, controlled chilling of the bar that moves progressively along a line around its circumference perpendicular to its axis. This is followed immediately by soaking the bar to retain the benefits of the original chilling and to equalize the temperature of the bar throughout. Since the bar is cooled below a temperature at which scale is formed before it is exposed for any length of time to the atmosphere further treatment to remove scale is not necessary. In this fashion the desired metallurgical characteristics obtained from a quenching operation can be controlled and duplicated without the formation of scale on the work.

From the above description it will be seen that a heated bar or rod may be moved continuously in a straight path directly from a furnace in which it was heated to a place in which it is quenched. This quench not only cools immediately the surface of the bar but also permits what is, in effect, a soaking of the bar in the quenching medium so that complete and thorough quenching takes place. This operation is performed practically instantaneously and does not have any tendency to produce warping of the bar. No additional power is required to move the bar through the quench over that required to move the bar itself. Because of the arrangement, the spray which accompanies the use of water under pressure is completely enclosed in a housing so that no water is liable to get on any equipment which is located adjacent to the heating and quenching mechanism, and the bar leaves the device substantially dry.

While in accordance with the provisions of the statutes, I have illustrated and described the best form of embodiment of my invention now known to me, it will be apparent to those skilled in the art that changes may be made in the form of the apparatus disclosed without departing from the spirit of the invention, as set forth in the appended claims, and that in some cases certain features of my invention may be used to advantage without a corresponding use of other features.

What is claimed is:

1. Apparatus for heat treating elongated work comprising an annular device through which heated work is passed, said device being provided with an inwardly directed annular slot through which a quenching medium can be discharged on

the work, a horizontally extending cylindrical member aligned axially with said device and beyond the same in the direction of work travel, said member having openings in the ends thereof through which the work can pass in a straight line from said device, a pair of inclined plates in said member forming a chamber therein with the narrow portion toward the bottom, said plates each having an opening aligned with said previously mentioned openings and each being provided with a cut out portion adjacent to the top of said member to form a space therebetween, and means through which a quenching liquid may be forced under pressure into said chamber through the narrow portion thereof to overflow through said spaces, whereby the work is first quenched by the medium flowing from said device and then immersed in the medium in said chamber.

2. Apparatus for quenching elongated work comprising means to forward said work through a path, an annular device surrounding said work and operative to discharge quenching medium on all sides of said work, a tank below and beyond said device, an inclined wall provided with an opening through which work passes, said wall being inclined generally downwardly and away from said device and operative to strip the quenching medium from the work and direct it toward said tank, an additional and oppositely disposed inclined wall having an opening through which the work passes, wall means engaging the sides and extending across the tops of said first-mentioned inclined walls to form a chamber over said tank, means to supply quenching medium under pressure to the bottom of said chamber to form a bath of said medium through which the work travels to complete the quenching action started by said device, means cooperating with said wall means to direct the quenching medium overflowing from said chamber into said tank, and means to withdraw quenching medium for recirculation to said device and to said chamber.

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