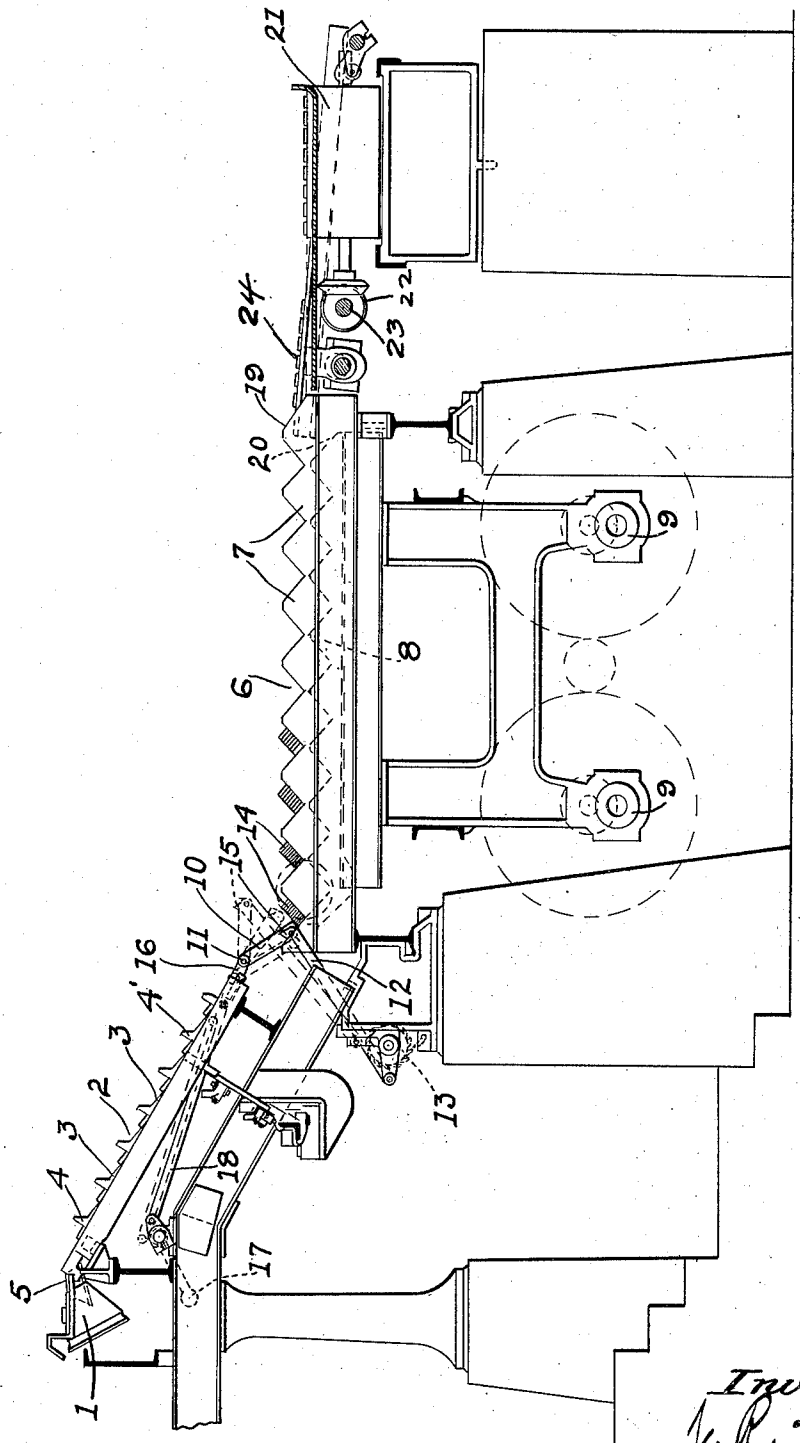
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J. R. GEORGE

METHOD OF AND APPARATUS FOR COOLING AND ANNEALING METAL BARS

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Inventor:
J. R. George
by Geo. H. Kennedy Jr.
Atty.

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JEROME R. GEORGE, OF WORCESTER, MASSACHUSETTS, ASSIGNOR TO MORGAN CONSTRUCTION COMPANY, OF WORCESTER, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

METHOD OF AND APPARATUS FOR COOLING AND ANNEALING METAL BARS.

Application filed April 8, 1920. Serial No. 372,218.

To all whom it may concern:

Be it known that I, JEROME R. GEORGE, a citizen of the United States, residing at Worcester, in the county of Worcester and Commonwealth of Massachusetts, have invented a new and useful Improvement in a Method of and Apparatus for Cooling and Annealing Metal Bars, of which the following, together with the accompanying drawing, is a specification.

The present invention relates to the art of handling hot metal bars as they emerge from a rolling mill, preparatory to the delivery of the same to shearing devices, or other mechanism, for operating on said bars. The invention resides in certain novel features connected with the treatment of said bars, with particular reference to the cooling and annealing of flat stock, as used in the manufacture of springs. The invention further resides in the novel combination and arrangement of mechanisms that are employed in this connection, the same constituting an improved type of cooling bed that is practically universal in its application to miscellaneous kinds and shapes of hot stock, in addition to the special use for spring stock, above specified.

The several features of the invention, involving the novel mode of handling the metal, as well as the novel combination of instrumentalities employed, are fully set forth in the following description, reference being had to the accompanying drawing, wherein the single figure is a diagrammatic view in side elevation of one form of mechanism embodying the present invention.

At the left hand side of the drawing is depicted a conical conveyor roll 1, the same being one of a series of similar alined rolls forming the hot run-out of a rolling mill, not shown. The bars, which are successively carried out from the mill on the rolls 1, 1, are adapted to be moved broadside on a suitable conveying and cooling mechanism, here shown diagrammatically by way of example as a cooling bed of the type fully described in United States Letters Patent to Edwards, No. 701,024, dated May 27, 1902. Briefly referring to said cooling bed, here designated as a whole by the numeral 2, the same consists of a series of inclined oscillatory skids 3, 3, provided on opposite sides with spaced staggered projections 4, 4'. Said skids terminate in oblique wings 5, 5, over which the bars are supported by the rolls 1, 1; when the skids are rocked, the wings 5, 5, lift the bar from the run-out, and said bar thereupon slides by gravity, broadside, into contact with the first row of alined projections 4, 4'. The continued oscillation or rocking of the skids, effected in any well known manner, will alternately raise and lower the projections 4 and 4' respectively, thereby allowing each bar to slide from one row of projections 4 or 4' to the next lower row. Thus the broadside traverse of a bar across the bed 2 in a series of step-by-step movements is effected.

Obviously, other and different types of cooling beds may be used for this initial step-by-step broadside movement of the individual bars; for instance, a cooling bed, such as shown and described in the United States reissued Letters Patent to Edwards, No. 12,520, dated August 14, 1906, may be employed. With reference to the subsequent assemblage of the hot bars into packs or piles, as contemplated by the invention, the preliminary cooling afforded by passage over a bed of the type designated is advantageous in preventing the burning in of scale on the surfaces of the packed bars, which is apt to occur if they are too hot. Furthermore, the use of a cooling bed 2 of the general type designated allows the time occupied in the preliminary cooling to be varied at will, so as to suit the particular requirements of the stock that is being handled; the bars may occupy every notch of the bed, or they may be disposed one, two, or more notches apart.

The invention, particularly as applied to bars or flats for manufacture into springs, contemplates the assemblage of the bars leaving the cooling bed 2 in a succession of packs or piles for self-annealing by the well known pack method; in this arrangement, the bars are conveyed in multiple for a sufficient distance so that the time consumed in their transit suffices to anneal them, due to the relatively slow cooling that ensues as a result of the piling thereof. As a means of carrying out this second step in the cooling of the bars, there is shown a cooling bed 6 of the general construction illustrated and described in United States Letters Patent to George, No. 863,841, dated August 20,

1907, this construction being particularly adapted for the broadside transfer of piles or packs of flat stock. Briefly referring to said cooling bed 6, the same consists of a series of stationary notched racks 7, 7, alternating with a similar series of movable notched racks 8, 8. The latter are connected at each end to eccentrics 9, 9, and move bodily in a circular path, all the time maintaining their parallelism with the stationary racks, and performing half their movement above and the other half below the plane of said stationary racks. The throw of the eccentrics 9, 9, is calculated to carry the alined notches of the movable racks 8, 8, out of registration with one set of notches in the stationary racks 7, 7, and into registration with the next set of notches in said stationary racks, so that at each cycle of operations the stock is lifted out of the notches of the stationary racks and carried forward and deposited in the next succeeding notches; thereupon, the movable racks move below the stationary racks, and return to original position for repeating the above operation.

The delivery of bars from the cooling bed 2 to the cooling bed 6 is accomplished by gravity, the bars sliding broadside across the inclined face of a shelf or plate 10, whose upper end is pivoted at 11, and whose lower end lies in proximity to the bottom of the first set of alined notches in the stationary racks 7, 7. The shelf 10 receives a bar as it is released from the last row of projections of the skids 3, 3, and the angle of said shelf is such that it supports and guides the bar in the gravity descent of the latter, said bar reaching the bottom of the first notch provided by stationary racks 7, 7, with its edge against the far side of said notch and its lower surface against the near side of said notch. Before another bar passes across the shelf 10, said shelf swings through a small arc about its pivot 11 so as to raise the free end of said shelf into such a position as to superpose the next descending bar upon the first bar. Any suitable automatic means for raising the shelf 10 may be employed; as here shown, said shelf is connected by a link 12 with a pawl and ratchet mechanism 13, the latter being operated in synchronism with the oscillations of the skids 3, 3. In other words, every time a bar is caused to pass over the shelf 10, by delivery from the first cooling bed 2, such operation is followed by a slight lifting of the shelf so as to guide the next bar into a position above the preceding bar. In this way the continued operation of the cooling bed 2 results in the formation of a pack or pile of bars in the first notch of the cooling bed 6, the latter, while this assemblage of bars is progressing, remaining inoperative. When a pack or pile, as indicated at 14, has been completed, the shelf 10 may be swung up into a substantially horizontal position, so as to give room for the movement of the pack on the cooling bed 6. A single operation of the latter procures the transfer of the entire pack from the first notch to the second notch of the stationary racks 7, 7, said pack, as will be well understood, being supported and carried during this transfer by the alined notches of the moving racks 8, 8.

During this operation of the cooling bed 6, the shelf 10 is maintained in elevated position, and any bars that might be delivered from the cooling bed 2 in this period are held and supported on the horizontal surface of said shelf. To prevent any bars from being accidentally pushed off the end of said shelf while it is in horizontal position, the operating link 12 provides a projection 15, which normally lies below the surface of shelf 10, but which, when said shelf 10 is raised into horizontal position, projects above the surface thereof and acts as a stop for the bars thereon. The pivotal shaft 11 of plate 10 is supported in sliding members 16, the latter being movable to shift the free end of plate 10 relative to the far side of the first set of notches in the stationary racks 7, 7, of cooling bed 6. In this way the gravity delivering mechanism, operable between the two cooling beds 2 and 6, is made adjustable for different breadths of bars. When handling narrow bars, the plate 10 is positioned with its free end only slightly more than the width of a bar removed from the far edge of the first set of notches, but when wider bars are being handled, this distance is increased proportionately by means, for instance, of a crank 17 that operates through links 18 on the sliding members 16.

This adjustability of the shelf 10 permits of the assemblage, if desired, of two packs of narrow bars, side by side, in a single notch of the bed 6, thus increasing under certain conditions, the capacity of the bed 6, or at least enabling said bed to operate at normal capacity if for any reason the character of the material precludes a pack or pile of the usual height.

The relatively slow broadside traverse of the successively formed packs or piles on cooling bed 6 gives time for the self annealing of the several bars in each pack, in a manner well understood. When a pack occupies the final notch of the stationary racks 7, 7, of cooling bed 6, the annealing is completed, and the bars are in readiness for further operation thereon, such as shearing. In order to procure the separation of the packs or piles, so that the individual bars can be operated upon in any way desired, the ends of the stationary racks 7, 7, provide inclined surfaces 19, 19, for the gravity descent of the bars, when the pack or pile

in the final notch is elevated by contact with the extreme end surfaces 20, 20, of movable racks 8, 8. Consequently, as each pile undergoes its final lifting movement by racks 8, 8, the bars reach the top of incline 19 and successively slide down said incline one after another, with their flat surfaces in contact therewith. The inclined surfaces 19 deliver the several separate bars one by one to any suitable mechanism adapted to procure their conveyance longitudinally, to a shear or other device for operating on the bars. As here shown, by way of example, the longitudinal movement of the bars is procured by means of an ordinary set of conveyor rolls, one of which is shown at 21, said roll, and the other similar alined rolls of the series being driven by suitable gearing 22 from a common shaft 23. The deposit of the individual bars on this longitudinal conveying mechanism is accomplished by any suitable broadside transfer device, here shown by way of example, as a conveyor 24 of the well known shuffle-bar type; but obviously any other transferring mechanism for this purpose might be employed, or the bars might be delivered direct from the cooling bed 6 to the rolls 21.

The apparatus, as described above, lends itself especially to a solution of the difficulties of handling spring stock, in the operation of annealing same by the pack method. As previously set forth the duration of the preliminary cooling period, as applied to the individual bars, as well as the duration of the self-annealing period, with the bars in pack formation, can be varied over a wide range, to suit the precise conditions in every case, as affected by the material, composition, thickness, or breadth of the stock that is being handled. Aside from its applicability to the particular uses above set forth, it will readily be seen that the apparatus is quite as well adapted as a cooling bed for miscellaneous stock of nearly all descriptions, in its ability to handle the same either singly or in multiple, as desired.

The separate handling of individual bars on the first cooling bed 2 operates to straighten them before they cool enough to take a permanent set; thereafter, said bars will remain straight on the bed 6, notwithstanding the possibility of uneven piling, which ordinarily would cause the projecting ends of some of the bars to sag.

I claim,

1. The improvement in the art of handling hot metal bars, which consists in moving the bars, individually, across a cooling bed, whereby to obtain a preliminary cooling, and then assembling said bars in stacked formation, in piles or packs for further cooling.

2. The improvement in the art of handling hot metal bars, which consists in imparting an initial broadside movement in a plurality of steps to individual bars to straighten same, and then assembling said bars in stacked formation, in piles or packs for further broadside movement.

3. The improvement in the art of handling hot metal bars, which consists in imparting broadside step-by-step movement to the individual bars as they emerge successively from the mill, in order to cool the same, and then imparting further broadside movement to said bars, when stacked in packs or piles, in order to anneal the same.

4. The improvement in the art of handling hot metal bars, which consists in moving the bars, individually, across a cooling bed, whereby to subject them to a preliminary cooling, and then causing said bars to be moved broadside in stacked formation, in a succession of packs or piles.

5. The improvement in the art of handling hot metal bars, which consists in imparting broadside step-by-step movements to the individual bars, whereby to subject them as they emerge from the mill to a preliminary cooling, assembling said bars in stack formation in packs or piles, and procuring a further cooling of said bars in said packs or piles.

6. The improvement in the art of handling hot metal bars, which consists in imparting broadside step-by-step movement to the individual bars as they emerge from the mill, in order to straighten and cool the same, procuring the assemblage of said bars in stacked formation in successive packs or piles at the end of said individual broadside movement, and then imparting broadside movement to the successive packs or piles of bars.

7. The improvement in the art of handling hot metal bars, which consists in imparting step-by-step straightening movement to successive individual bars, assembling said bars, at the end of said straightening movement, in a succession of stacks, moving the successive stacks broadside step by step, and then procuring the spreading of the bars contained in said stacks.

8. The improvement in the art of handling hot metal bars, which consists in moving successive bars individually across a cooling bed, procuring the assemblage of said bars in successive packs or piles, by gravity discharge from said bed subjecting said packs or piles to cooling, to anneal the bars therein, and then procuring the spreading of the bars in said packs or piles by gravity, after annealing of the bars therein.

9. The improvement in the art of handling hot metal bars, which consists in moving successive bars individually across a cooling bed in a plurality of steps, procuring the assemblage of said bars in stacked formation in successive packs or piles on a second

cooling bed, and moving said packs or piles across said second bed, to anneal the bars therein.

10. The improvement in the art of handling hot metal bars, which consists in moving successive bars individually across a cooling bed, procuring the assemblage of said bars in a succession of stacks on a second cooling bed, moving said stacks across said second bed, and procuring the spreading of each stack at the end of its movement across said second bed.

11. The improvement in the art of handling hot metal bars which consists in exposing individual bars to a preliminary cooling, by step-by-step broadside movement across a cooling bed, varying the duration of said preliminary cooling in accordance with the requirements of different kinds of stock and assembling said bars in packs or piles for further cooling.

12. The improvement in the art of handling hot metal bars which consists in exposing individual bars to a preliminary cooling, by step-by-step broadside movement across a cooling bed, varying the duration of said preliminary cooling in accordance with the requirements of different kinds of stock, assembling said bars in packs or piles, and procuring further cooling of same in said packs or piles by step-by-step broadside movement across a second cooling bed.

13. The improvement in the art of handling hot metal bars which consists in exposing individual bars to a preliminary cooling, by step-by-step broadside movement across a cooling bed, assembling said bars in packs or piles, procuring the further cooling of same in said packs or piles, by step-by-step broadside movement across a second cooling bed, and varying the duration of the last named cooling in accordance with the requirements of different kinds of stock.

14. The improvement in the art of handling hot metal bars which consists in exposing individual bars to a preliminary cooling, by step-by-step broadside movement across a cooling bed, varying the duration of said preliminary cooling in accordance with the requirements of different kinds of stock, assembling said bars in packs or piles, procuring further cooling of same in said packs or piles, by step-by-step broadside movement across a second cooling bed and varying the duration of the last named cooling in accordance with the requirements of different kinds of stock.

15. The improvement in the art of handling hot metal bars, which consists in moving successive bars individually across a cooling bed, and procuring the assemblage of said bars in successive packs or piles, on a second cooling bed, by gravity discharge from said first cooling bed.

16. The improvement in the art of handling hot metal bars which consists in annealing said bars while in stacked formation, and procuring by gravity the separation of the bars in the successive stacks.

17. The improvement in the art of handling hot metal bars which consists in moving said bars in stacked formation across a cooling bed, to anneal the same, and procuring the separation of successive stacks by gravity discharge from said bed.

18. The improvement in the art of handling hot metal bars, which consists in moving successive bars individually across a cooling bed, procuring the assemblage of said bars on a second cooling bed by gravity discharge from said first bed, moving said bars in pack formation across said second bed, and procuring the separation of the bars in successive packs by gravity discharge from said second bed.

19. In apparatus of the class described, a support for the broadside gravity movement of successively delivered bars, and means for elevating said support after each passage of a bar thereacross, whereby to form said bars in a pack or pile.

20. In apparatus of the class described, a cooling bed providing a series of alined bar receiving notches, a support for the broadside gravity movement of successive bars toward said notches, and means for elevating, at intervals on said support to procure the deposit of bars, one above the other, in said notches.

21. In apparatus of the class described, the combination with means for moving broadside a succession of individual bars, to cool the same, of means for thereafter continuing the broadside movement of said bars in a succession of stacks, to anneal the same.

22. In apparatus of the class described, the combination with means for moving broadside a succession of individual bars, to cool the same, of means for thereafter continuing the broadside movement of said bars in a succession of packs or piles, to anneal the same, and means for controlling the gravity movement of said bars from said first moving means to said second moving means.

23. In apparatus of the class described, the combination with means for moving broadside a succession of individual bars, to cool the same, of means for thereafter continuing the broadside movement of said bars in a succession of packs or piles, to anneal the same, a bar supporting device providing for gravity movement of said bars from said first moving means to said second moving means, and means for elevating said device after each passage of a bar across the same.

24. In apparatus of the class described, the combination with means for moving

broadside a succession of individual bars, to cool the same, of means for thereafter continuing the broadside movement of said bars in a succession of packs or piles, to anneal the same, and a bar assembling and piling mechanism interposed between said first moving means and said second moving means.

25. In apparatus of the class described, the combination with means for moving broadside a succession of individual bars, to cool the same, of means for thereafter continuing the broadside movement of said bars in a succession of packs or piles, to anneal the same, a pile forming mechanism interposed between said first moving means and said second moving means, and means for adjusting the position of said mechanism in accordance with the breadth of the bars to be piled.

26. In apparatus of the class described, the combination with a cooling bed for the broadside movement of successive individual bars, of a second cooling bed to which said bars pass by gravity from said first cooling bed.

27. In apparatus of the class described, the combination with a cooling bed for the broadside movement of successive individual bars, of a second cooling bed to which said bars pass by gravity from said first cooling bed, and means for varying the time of a bar on said first cooling bed.

28. In apparatus of the class described, the combination with a cooling bed for the broadside movement of successive individual bars, of a second cooling bed to which said bars pass by gravity from said first cooling bed, and means operable at will to interrupt the gravity passage of bars to said second bed.

29. In apparatus of the class described, the combination with a cooling bed for the broadside movement of successive individual bars, of a second cooling bed to which said bars pass by gravity from said first cooling bed, and means for procuring the assemblage of said bars on said second bed in a succession of packs or piles.

30. In apparatus of the class described, the combination with a cooling bed for the broadside movement of successive individual bars, of a second cooling bed to which said bars pass by gravity from said first cooling bed, and means operable to change the plane of gravity delivery of certain bars, whereby to procure the deposit of said bars, one above the other, on said second cooling bed.

31. In apparatus of the class described, the combination with a cooling bed for the broadside movement of successive individual bars, of a second cooling bed to which said bars pass by gravity from said first cooling bed, bar delivery means between said beds, and means operable on said bar delivery means to procure the delivery of some of said bars in planes above those of preceding bars.

32. In apparatus of the class described, the combination with a cooling bed for the broadside movement of successive individual bars, of a second cooling bed to which said bars pass by gravity from said first cooling bed, and a member interposed between said beds and operable to change the plane of delivery of said bars, whereby the bars delivered to said second bed are superposed one upon the other in a plurality of packs or piles.

33. In apparatus of the class described, the combination with a cooling bed for the broadside movement of successive individual bars, of a second cooling bed to which said bars pass by gravity from said first cooling bed, a member for supporting said bars during their gravity movement, and means for causing said member to arrest the gravity movement of said bars.

34. In apparatus of the class described, the combination with a cooling bed for the broadside movement of successive individual bars, of a second cooling bed to which said bars pass by gravity from said first cooling bed, an adjustable member for supporting said bars during their gravity movement, means for moving said member into position to arrest the gravity movement of said bars, and means responsive to said movement for interposing a stop in the path of said bars.

35. In apparatus of the class described, the combination with a cooling bed for the broadside movement of successive individual bars, of a second cooling bed to which said bars pass by gravity from said first cooling bed, a member movable to change the plane of gravity delivery, whereby said bars are assembled on said second bed in packs or piles, and means for moving said member out of the path of said packs or piles.

36. In apparatus of the class described, the combination with a cooling bed for the broadside movement of successive individual bars, of a second cooling bed to which said bars pass by gravity from said first cooling bed, an assembling mechanism controlling the gravity delivery of bars to said second bed, and means for disposing said mechanism in different operative positions as determined by the width of the bars delivered thereby.

37. In apparatus of the class described, the combination with means for imparting an initial broadside movement to successive individual bars, of means for continuing the broadside movement of said bars in a succession of packs or piles, and means for varying the time occupied by said bars in said initial movement.

38. In apparatus of the class described,

the combination with means for imparting an initial broadside movement to successive individual bars, of means for continuing the broadside movement of said bars in a succession of packs or piles, and means for varying the time occupied by said bars in said final movement.

39. In apparatus of the class described, the combination with means for imparting an initial broadside step-by-step movement to successive individual bars, of means for continuing the broadside movement of said bars in a succession of packs or piles, and means operable by said last mentioned broadside movement for causing the disassemblage of said stacks.

40. In apparatus of the class described, the combination with means for imparting an initial broadside movement to successive individual bars, of means for continuing the broadside movement of said bars in a succession of packs of piles, a bar conveying mechanism to receive said bars from said last mentioned means, and means for causing the disintegration of said packs or piles, upon the transfer of the same to said conveying means.

41. In apparatus of the class described, the combination with a cooling bed for successive individual bars, of a second cooling bed on which the bars delivered by said first bed are movable in packs or piles, a conveying means at the end of said second cooling bed, and means for procuring the disintegration of said packs or piles upon the delivery of the same to said conveying means.

42. In apparatus of the class described, the combination with a cooling bed for successive individual bars, of a second cooling bed on which the bars delivered by said first bed are movable in packs or piles, means for procuring the assemblage of bars on said second cooling bed in a succession of packs or piles, a conveying means at the end of said second cooling bed, and means for procuring the disintegration of said packs or piles upon the delivery of the same to said conveying means.

43. The improvement in the art of handling hot metal bars which consists in procuring their assemblage by step-by-step movement, in stacked formation, in a succession of packs or piles on a cooling bed, and moving said packs or piles across said bed, to anneal the bars therein.

44. The improvement in the art of handling hot metal bars which consists in imparting step-by-step movement to said bars, as delivered successively from a mill, to form them in a series of stacks, and moving said stacks broadside across a cooling bed, to anneal the bars therein.

45. In apparatus of the class described, a cooling bed adapted for the broadside movement of bars in stacked formation, in combination with means, involving step-by-step movement of said bars for mechanically procuring their delivery to said bed in stacked formation.

Dated this third day of April 1920.

JEROME R. GEORGE.

Witnesses:

PENELOPE COMBERBACH,

NELLIE WHALEN.