Nov. 13, 1928. 1,691,645

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MECHANISM FOR PROCURING AND CONTROLLING THE BROADSIDE MOVEMENT OF METAL BARS

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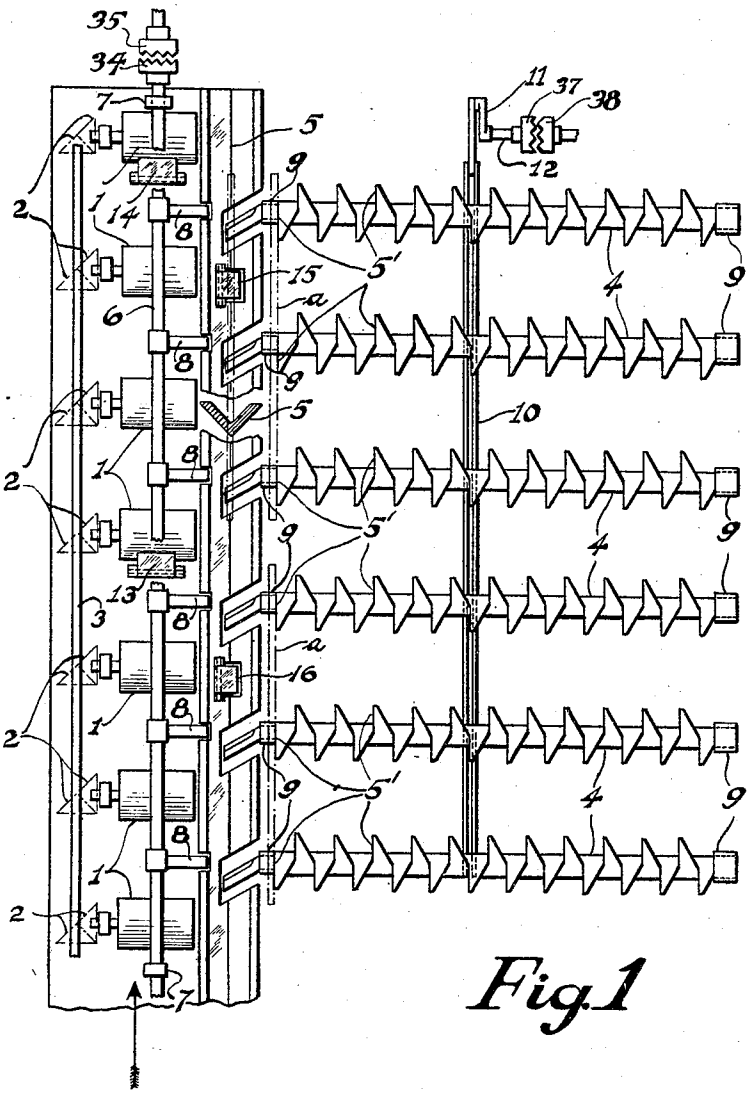


Fig. 1

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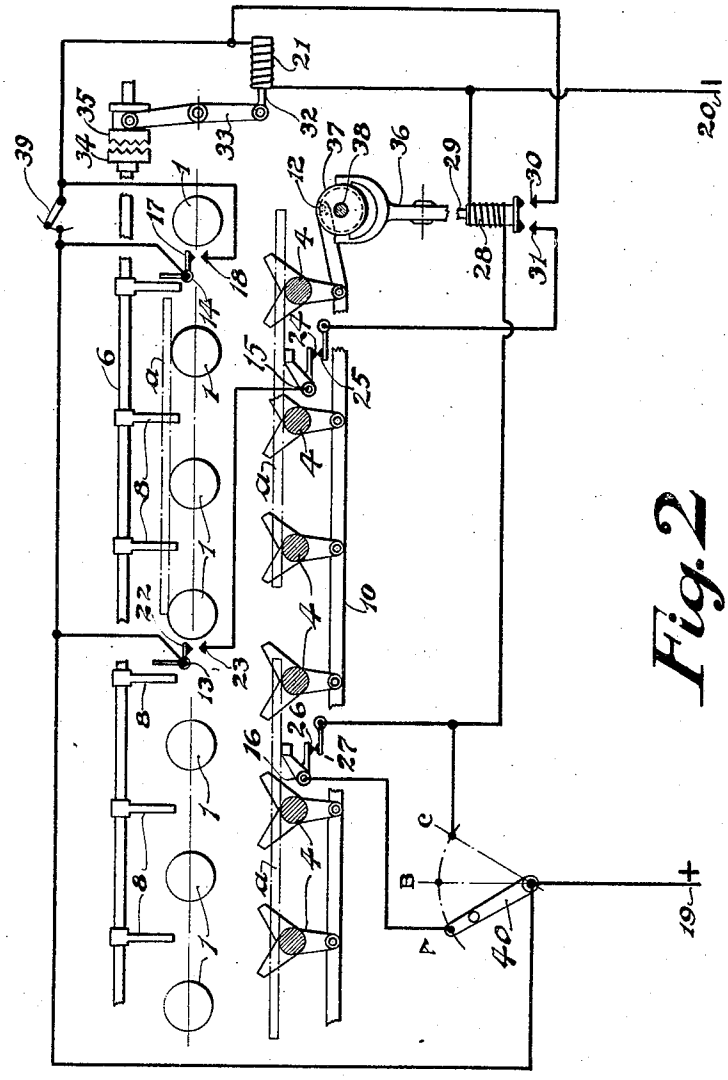


Fig. 2

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UNITED STATES PATENT OFFICE.

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MECHANISM FOR PROCURING AND CONTROLLING THE BROADSIDE MOVEMENT OF METAL BARS.

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The present invention relates in general to the automatic handling of hot metal bars or billets, such as constitute the product of a rolling mill. The invention resides in certain mechanism, operable in response to the delivery of each successive bar from the rolling mill, for automatically transferring each bar sidewise onto a cooling bed or the like, and for automatically procuring step-by-step sidewise movement of said bars on said cooling bed.

Other and further objects of the invention will appear from the following detailed description thereof, reference being had in this connection to the accompanying drawings, in which—

Fig. 1 is a plan view showing rolling mill apparatus, including a cooling bed, to which the invention is applied.

Fig. 2 is a view showing, in side elevation, certain of the mechanism of Fig. 1, and showing diagrammatically the electrical connections and the like by which the automatic control is secured.

Like reference characters refer to like parts in the different figures.

Referring to Fig. 1, a series of alined conveyor rolls 1, 1 may constitute, for example, the hot runout of a rolling mill, said rolls being driven in any suitable way as by bevel gearing 2, 2 from a common driving shaft 3. Each successive bar or billet as run out longitudinally on said rolls 1, 1 is adapted to be pushed or kicked off laterally (to the right in Fig. 1) from said rolls, onto a cooling bed or other receiving device of conventional construction; as here shown, such a cooling bed, or receiving device, may consist of a plurality of spaced parallel laterally extending racks 4, 4, having a plurality of alined sets or rows of bar-receiving notches, the first row of which, as shown, may take the form of a trough 5, constituted in part by the ends of said racks which lie in close proximity to the conveyor rolls 1, 1. Thus each bar or billet as moved sidewise off of said rolls, will drop by gravity into the first notch or trough 5 of the cooling bed.

In a manner well known in apparatus of this class, provision is made for mechanically pushing each bar or billet sidewise off the rolls 1, 1 and into the first notch 5 of the cooling bed; as here shown, a shaft 6, rotatably mounted in suitable bearings 7 above the rolls 1, 1, has extending downwardly a plurality of spaced kick-off arms 8, adapted to engage portions of the bar or billet lying intermediate of said rolls. Rotation of said shaft 6 in a counterclockwise direction carries the kick-off arms 8 against the billet and pushes the latter sidewise across the conveyor rolls 1, 1 until its drops by gravity in the first trough or notch 5, 5 of the cooling bed. Said cooling bed, in any manner well known in the art, may be operated mechanically to procure the broadside step-by-step movement of the bars, from the first row of notches 5, 5 to the second row of notches 5′, 5′, and so on across the full length of the racks 4, 4; as herein shown, said racks, to accomplish this result, are mounted for oscillatory movement in suitable bearings 9, 9 and have such movement imparted thereto in unison by their connection to a common operating link 10, which is moved back and forth by a suitable crank arm 11, secured to a crank shaft 12.

The cooling bed, constituted by the row of parallel racks 4, 4 extends, as here shown, over a length which is substantially double the length of the relatively short bars or billets *a a* that are run out on the conveyor rolls 1, 1. Thus each row of notches in said cooling bed can accommodate two of such bars or billets *a*, *a*, lying end to end, or in tandem,—and it is one of the objects of the present invention to obtain, automatically, the transfer of successively run out bars or billets *a*, *a* to the first notch of the cooling bed in this particular relation, and another object is to obtain, automatically, the step-by-step, or notch-by-notch, movement of the bars, in such multiple arrangement, across the cooling bed, all in the absence of any necessity for intervention, on the part of an operator, to control either the kick-off mechanism or the racking mechanism.

To this end, trigger divices 13 and 14 are located in the path of bars run out on the rolls 1, 1, the trigger 13 being disposed about midway the length of the cooling bed, and the trigger 14 substantially in line with the far end of said bed. These triggers 13 and 14,

of any well known type, present surfaces which are adapted to be struck and depressed by the front ends of bars or billets carried forward by the conveyor rolls 1, 1, such operation of the triggers, in the manner hereinafter described, causing the actuation of the kick-off 8, 8 to move the material sidewise off said rolls; the triggers 13 and 14, either by gravity or by spring action, thereupon resume their normal positions, in readiness to be struck and depressed by subsequent bars or billets that are run out on the rolls 1, 1. Other trigger devices 15 and 16, of substantially the same type, are disposed so as to project slightly above the bottom or supporting surface provided by the first trough or notch 5, 5 of the cooling bed, the trigger 15 adapted to be struck and depressed when a bar or billet *a* is delivered sidewise off the rolls 1, 1 into the far end of the first row of cooling bed notches, and the trigger 16 adapted to be struck and depressed when a bar or billet *a* is delivered sidewise off the rolls 1, 1 into the other end of said first row of notches.

The wiring diagram, Fig. 2, indicates the way in which various electrical circuits, controlling the actuation of the kick-off and racking mechanisms, are completed, by the depression of the several triggers 13, 14, 15 and 16. For example, the trigger 14, when depressed, electrically connects the contacts 17 and 18, causing current to flow across the supply leads 19 and 20, by way of a solenoid coil 21. Another electrical circuit adapted to energize the solenoid coil 21 is completed when the two triggers 13 and 15 are depressed, the respective pairs of contacts 22, 23, and 24, 25, which are connected by said triggers, being, as shown, in series. The depression of trigger 16 electrically connects the contacts 26 and 27 and establishes an electrical circuit through solenoid coil 28; whenever the coil 28 is thus energized, depression of the two triggers 13 and 15 which would ordinarily, as above described, energize the solenoid coil 21, is rendered ineffective; this by reason of the fact that the movable core 29 of solenoid coil 28, which normally electrically connects the two contacts 30 and 31 in the particular circuit controlled by triggers 13 and 15, is drawn away from said contacts by the energization of coil 28.

The operation of the mechanism as thus far described is as follows:—Assume that no bars or billets are on the conveyor rolls 1, 1 or in the first row of notches 5, 5 of the cooling bed, all the triggers 13, 14, 15 and 16 being undepressed. The first bar *a* that is then run out on rolls 1, 1 strikes, by its front end, against trigger 13 and depresses said trigger, but such depression has no effect on the solenoid coil 21, because no circuit is completed at this time by said trigger's connection of the contacts 22 and 23,—the contacts 24 and 25 in series therewith being unconnected. Consequently, said first bar *a* continues to be advanced by the rolls 1, 1 until its front end strikes and depresses the trigger 14; with the contacts 17 and 18 thus connected, current flows through the solenoid coil 21 and causes sufficient movement of a core member 32 of said solenoid to clutch together, through suitable connections 33, the clutching elements 34 and 35, the former on shaft 6 and the latter constantly driven from any suitable source of power, not shown. This clutching of the elements 34 and 35 secures a single actuation of the kick-off arms 8, 8 and the return of said arms to their normal inoperative position; in consequence of this actuation, the first bar or billet *a* is pushed off the rolls 1, 1 and drops into the first notch of the cooling bed at the far end thereof and, in so doing, depresses the trigger 15.

The next succeeding bar or billet *a* carried forward by the rolls 1, 1 strikes, by its first end, against the trigger 13, and this time the depression of said trigger, connecting the contacts 22 and 23, is effective to energize the solenoid coil 21 because the preceding bar or billet, now in the first notch of the cooling bed, keeps the trigger 15 depressed, so as to connect the contacts 24 and 25. Thus this second bar or billet only travels on the rolls 1, 1 as far as the trigger 13; as soon as it strikes said trigger, the solenoid coil 21 is energized, and this causes an immediate actuation of the kick-off arms 8, 8 in the manner above described, to discharge said second bar sidewise off the rolls and into the first notch of the cooling bed, at the portion thereof unoccupied by the first bar or billet *a*.

As said second bar or billet *a* drops sidewise into said first notch, it strikes and depresses the trigger 16, thereby connecting the two contacts 26 and 27 and causing current to flow through the solenoid coil 28. The energization of this coil 28 effects sufficient movement of core member 29 to shift, through suitable connections 36, a clutching element 37 on crank shaft 12 into clutching engagement with a constantly rotating element 38, driven from any suitable source of power, not shown. This produces a single rotation of said crank shaft 12, thereby oscillating the racks 4, 4 in unison, so that, in a manner well known in cooling beds of this class, the two bars or billets *a*, *a* in the first row of notches 5, 5 are transferred to the second row of notches 5′, 5′, whereupon the triggers 15 and 16 resume their normal positions.

The next or third bar or billet *a* run out on the rolls 1, 1 is handled automatically in precisely the same manner as the first bar or billet above described, running past the trigger 13 and engaging the trigger 14 so as to be kicked off, in response to such engagement, into the far end of the first notch of the cooling bed. The fourth bar or billet produces in the same way as the second bar or billet the completion

of another complete cycle of operations of the mechanism,—by which, each time, two successive bars are kicked off successively into the first notch of the cooling bed and then are transferred together into the second notch of the cooling bed.

It is to be noted that the electrical circuits containing triggers 13 and 16, respectively, are so interrelated that it is impossible for the continuity of these successive cycles of operation to be broken or disturbed. For example, if two bars or billets have just been kicked off successively into the first notch of the cooling bed, let it be assumed that a third bar follows so closely on the heels of the preceding one that the racking mechanism, set in operation by the energization of solenoid coil 28, has not had time to function completely, in consequence of which the trigger 15 is still depressed. Notwithstanding this, the engagement and depression of trigger 13 by the front end of this closely following bar or billet will be ineffective to energize the kick-off solenoid coil 21, because the movement of solenoid core 29 has broken the normally existing connection between contacts 30 and 31. Thus such a closely following bar or billet will continue along the rolls 1, 1 until it strikes and depresses the trigger 14.

If desired, provision may be made for the operation of the kick-off arms 8, 8 at any time at the will of the operator, who has merely to close the normally open switch 39, thereby to energize the solenoid coil 21. In addition, another switch 40 may be provided for the control of the racking mechanism of the cooling bed, said switch having an arm 41 which is movable selectively into any one of three positions, A, B or C. In the A position, said arm is in circuit with the contacts 26 and 27 of trigger 16, thereby to make possible the automatic racking operation above fully described. An operator may move said arm to the B position, in order to discontinue, for as long as desired, all rocking or oscillation of the cooling bed racks, or he may move it to the C position in order to effect, whenever desired, a single cycle of operations of the racking drive. Thus the apparatus affords means for readily varying the normal automatic cycle of operations, as for instance, where it is desired to delay, for any reason, the operation of the cooling bed, for the accumulation of additional bars or billets in the first notch, or to divert one or more of said bars or billets, at intervals, for purposes of testing the size thereof.

I claim,

1. In mechanism of the class described, longitudinal delivery means for successively delivered bars, a cooling bed alongside said delivery means, and automatic means, responsive to the travel of said bars on said delivery means, for procuring individual broadside transfers of successively delivered bars to said cooling bed, thereby to deposit on said bed a succession of sets of said bars in longitudinal alinement.

2. In mechanism of the class described, longitudinal conveying means for successively delivered bars, bar-receiving means alongside said conveying means, means for transferring each bar broadside from said conveying means to said receiving means, and mechanism operable on said transfer means to procure thereby the longitudinal alinement of a plurality of successive bars on said receiving means.

3. In mechanism of the class described, longitudinal conveying means for successively delivered bars, a cooling bed onto which said bars are successively moved broadside from said conveying means, and automatic means, responsive to the travel of said bars on said conveying means for securing said successive broadside movements at different distances from the end of said conveying means, whereby to deposit a plurality of said bars in longitudinal alinement on said cooling bed.

4. In mechanism of the class described, a series of conveyor rolls for the longitudinal movement of successively delivered bars, a cooling bed onto which said bars are successively moved broadside from said conveying means, and automatic means, responsive to the travel of said bars on said conveyor rolls, for procuring said successive broadside movements at progressively increasing distances from the last conveyor roll of said series, whereby to aline a plurality of said bars on said cooling bed.

5. In mechanism of the class described, longitudinal conveying means for successively delivered bars, a cooling bed alongside said conveying means, mechanism operable on each bar to transfer it broadside from said conveying means to said cooling bed, and automatic means, responsive to the travel of said bars on said conveying means, for procuring the operations of said transfer mechanism on successive bars at a plurality of points in the length of said conveying means.

6. In mechanism of the class described, longitudinal conveying means for successively delivered bars, a cooling bed onto which said bars are successively moved broadside from said conveying means, and means for procuring said broadside movements in response to the travel of each of a given number of bars on said conveying means through a distance less than that travelled by the preceding bar.

7. In mechanism of the class described, longitudinal conveying means for successively delivered bars, a cooling bed onto which said bars are successively transferred broadside from said conveying means, means for procuring the broadside movement of the first bar of a given series when it reaches the end of said conveying means, and means for

procuring the broadside movements of each succeeding bar of said series before it reaches the broadside transfer position on said conveying means of the next preceding bar.

8. In mechanism of the class described, longitudinal conveying means for successively delivered bars a cooling bed onto which said bars are successively moved broadside from said conveying means, a plurality of trigger devices in the path of the bars on said conveying means, said trigger devices being spaced apart by approximately the length of one of said bars, and mechanism, responsive to the engagement of said trigger devices by the bars, for procuring said broadside movements on a series of successive bars in regular order, beginning with the engagement of the first bar of the series with the last trigger device, and ending with the engagement of the last bar of the series with the first trigger device.

9. In mechanism of the class described, longitudinal conveying means for successively delivered bars, bar-receiving means alongside said conveying means, devices operable on each bar to transfer it broadside from said conveying means to said receiving means, and means for procuring the operation of said transfer devices, for a given series of successively delivered bars, in response to each bar's travel on said conveying means through a distance less than travelled by the bar next preceding it in the series.

10. In mechanism of the class described, longitudinal conveying means for successively delivered bars, bar-receiving means alongside said conveying means, devices operable on each bar to transfer it broadside from said conveying means to said receiving means, a series of triggers spaced apart in the path of the bars on said conveying means, means responsive to engagement of the last of said triggers by the first of a given series of bars for actuating said transfer devices, and means responsive to engagement of a preceding trigger by a succeeding bar of said series for again actuating said transfer devices.

11. In mechanism of the class described, longitudinal conveying means for successively delivered bars, bar-receiving means alongside said conveying means, devices operable on each bar to transfer it broadside from said conveying means to said receiving means, a series of triggers spaced apart in the path of the bars on said conveying means, means responsive to engagement of the last of said triggers by the first of a given series of bars for actuating said transfer devices, means responsive to engagement of a preceding trigger by a succeeding bar of said series for again actuating said transfer devices, and means for rendering ineffective on said transfer devices the engagement of said first bar with said preceding trigger.

12. In mechanism of the class described, longitudinal conveying means for successively delivered bars, bar-receiving means alongside said conveying means, devices operable on each bar to transfer it broadside from said conveying means to said receiving means, and a series of triggers spaced apart in the path of bars on said conveying means for procuring the action of said transfer devices upon engagement of the first of a series of bars with the last of said triggers, and upon the engagement in order of each trigger preceding by the next succeeding bar of said series.

13. In mechanism of the class described, longitudinal conveying means for successively delivered bars, bar-receiving means alongside said conveying means, devices operable on each bar to transfer it broadside from said conveying means to said receiving means, and means responsive to the transfer of one bar to said receiving means for causing the next succeeding bar to be transferred from a different location on said conveying means.

14. In mechanism of the class described, longitudinal conveying means for successively delivered bars, bar-receiving means alongside said conveying means, devices operable on each bar to transfer it broadside from said conveying means to said receiving means, and means, responsive to the transfer of one bar to said receiving means, for causing the next succeeding bar to be transferred before it has travelled on said conveying means to the location reached by said first-mentioned bar.

15. In mechanism of the class described, longitudinal conveying means for successively delivered bars, bar-receiving means alongside said conveying means, devices operable on each bar to transfer it broadside from said conveying means to said receiving means, a trigger device on said receiving means, and means, responsive to engagement of a bar with said trigger device for causing actuation of said transfer devices on the next succeeding bar before it reaches on said conveying means the point from which the first-mentioned bar was transferred.

16. In mechanism of the class described, longitudinal conveying means for successively delivered bars, bar-receiving means alongside said conveying means, devices operable on each bar to transfer it broadside from said conveying means to said receiving means, a series of triggers spaced apart in the path of bars on said conveying means, means responsive to engagement of the last of said triggers by the first of a given series of bars for actuating said transfer devices, and a trigger device on said receiving means, adapted, when engaged by said bar to render operative the preceding trigger on said conveying means, thereby to actuate said transfer devices when said last-mentioned trigger

is engaged by the next succeeding bar of said series.

17. In mechanism of the class described, longitudinal conveying means for successively delivered bars, a cooling bed alongside said conveying means, devices operable to transfer each bar broadside from said conveying means to said cooling bed, and means made operable on said cooling bed by the transfer of a given number of bars thereto, for procuring the further broadside movement of said bars in unison.

18. In mechanism of the class described, longitudinal conveying means for successively delivered bars, a cooling bed onto which said bars are successively moved broadside from said conveying means, and means set in operation by the deposit of the last of a given number of bars on said cooling bed for actuating said bed, to cause the broadside movement of bars thereon.

19. In mechanism of the class described, longitudinal conveying means for successively delivered bars, a cooling bed onto which are deposited successive sets of said bars in longitudinal alinement, and means set in operation by deposit of the last bar of each set for actuating said bed to move all the bars thereon broadside in unison.

20. In mechanism of the class described, longitudinal conveying means for successively delivered bars, a cooling bed providing rows of bar-receiving notches running lengthwise of said conveying means, means for depositing a series of successive bars, in alinement, in the first row of notches of said bed, and means set in operation by the deposit of the last bar of said series for actuating said bed, thereby to transfer said series of bars to the second row of notches of said bed.

21. In mechanism of the class described, longitudinal conveying means for successively delivered bars, a cooling bed alongside said conveying means, devices operable to transfer each bar broadside from said conveying means to said cooling bed, a series of spaced triggers in the path of the bars on said conveying means for the operation of said transfer devices, a second series of triggers on said cooling bed, each adapted to be engaged by one of the bars transferred to said bed, and means for alternately rendering operative and inoperative a trigger of the first series, in response to successive engagements of bars with two different triggers of the second series.

22. In mechanism of the class described, longitudinal conveying means for successively delivered bars, a cooling bed alongside said conveying means, devices operable to transfer each bar broadside from said conveying means to said cooling bed, a pair of triggers spaced apart on said conveying means by substantially the length of a bar, the last one for operative engagement by the first of two successive bars, and the first one for operative engagement by the last of two successive bars, means for actuating said transfer devices in response to the operative engagements of said triggers, and means responsive to the transfer to said bed of the first of said bars for rendering said first trigger operative, when engaged by the second bar.

23. In mechanism of the class described, longitudinal conveying means for successively delivered bars, a cooling bed alongside said conveying means, devices operable to transfer each bar broadside from said conveying means to said cooling bed, a pair of triggers spaced apart on said conveying means by substantially the length of a bar, the last one for operative engagement by the first of two successive bars, and the first one for operative engagement by the last of two successive bars, means for actuating said transfer devices in response to the operative engagements of said triggers, means responsive to the transfer to said bed of the first of said bars for rendering said first trigger operative, when engaged by the second bar, and means responsive to the transfer to said bed of the second of said bars for rendering said first trigger inoperative, when engaged by the first of two more successive bars.

24. In mechanism of the class described, longitudinal conveying means for successively delivered bars, a cooling bed alongside said conveying means, devices operable to transfer each bar broadside from said conveying means to said cooling bed, a pair of triggers spaced apart on said conveying means by substantially the length of a bar, the last one for operative engagement by the first of two successive bars, and the first one for operative engagement by the last of two successive bars, means for actuating said transfer devices in response to the operative engagements of said triggers, means responsive to the transfer to said bed of the first of said bars for rendering said first trigger operative, when engaged by the second bar, and means responsive to the transfer to said bed of the second of said bars for rendering said first trigger inoperative, when engaged by the first of two more successive bars, and for procuring the actuation of said bed, to move the two bars received thereon broadside in unison.

25. In mechanism of the class described, longitudinal conveying means for successively delivered bars, bar-receiving means alongside said conveying means, devices operable to transfer each bar broadside from said conveying means to said receiving means, automatic means operable normally on said transfer devices to procure thereby the longitudinal alinement of a plurality of successive bars on said receiving means, and means for further procuring the operation of

said transfer devices at the will of an operator.

26. In mechanism of the class described, longitudinal conveying means for successively delivered bars, a cooling bed onto which are deposited successive sets of said bars in longitudinal alinement, automatic means set in operation by deposit of the last bar of each set for actuating said bed to move all the bars thereon broadside in unison, and means for further securing the actuation of said bed, for broadside movement of the bars thereon, at the will of an operator.

Dated March 17, 1927.

FRANK P. DAHLSTROM.