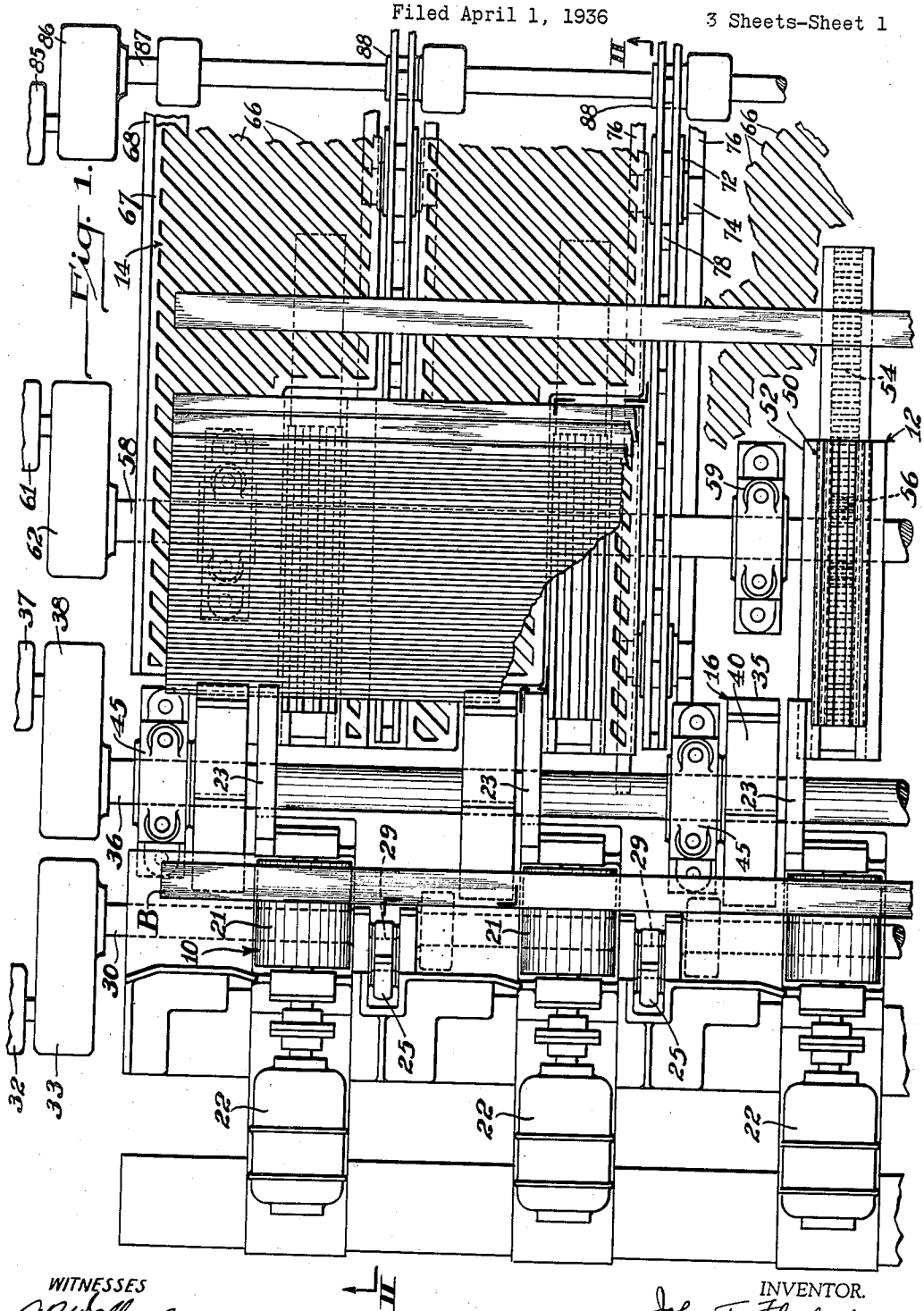
Jan. 12, 1937. J. T. FLAHERTY 2,067,525

APPARATUS FOR ANNEALING MERCHANT BARS

Filed April 1, 1936 3 Sheets-Sheet 1

Fig. 1.



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APPARATUS FOR ANNEALING MERCHANT BARS

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Fig. 2.

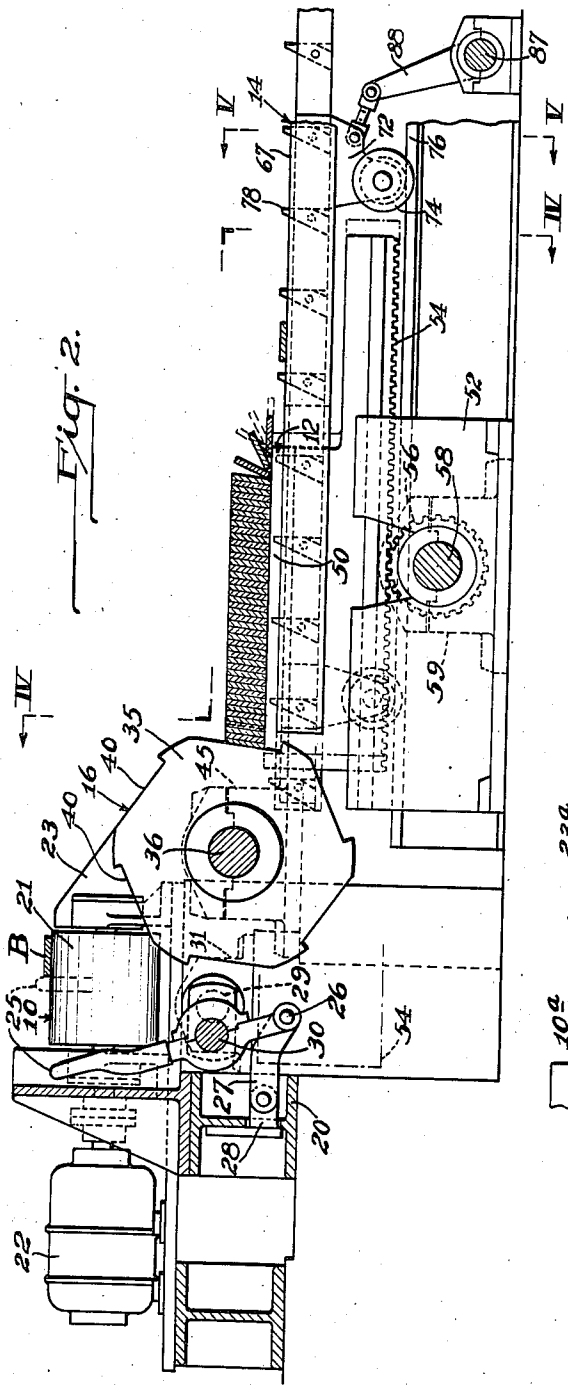
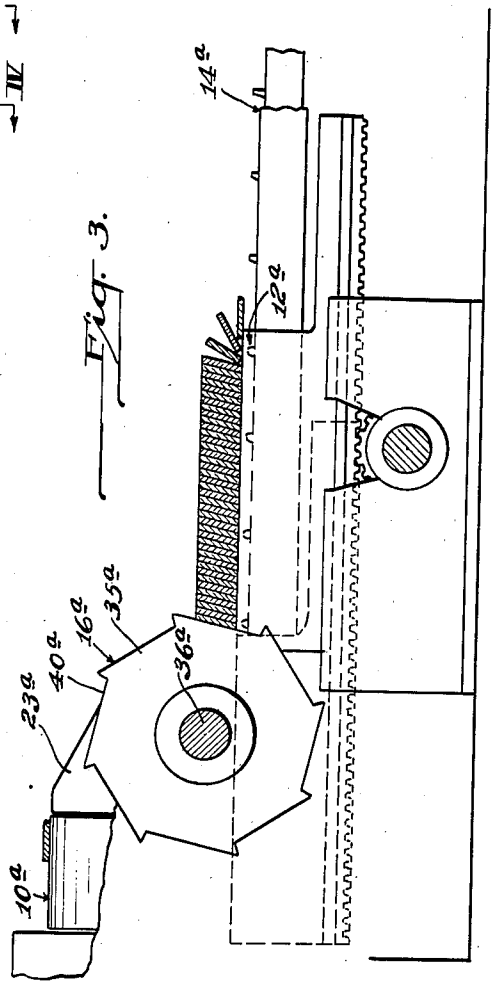


Fig. 3.



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APPARATUS FOR ANNEALING MERCHANT BARS

Filed April 1, 1936 3 Sheets-Sheet 3

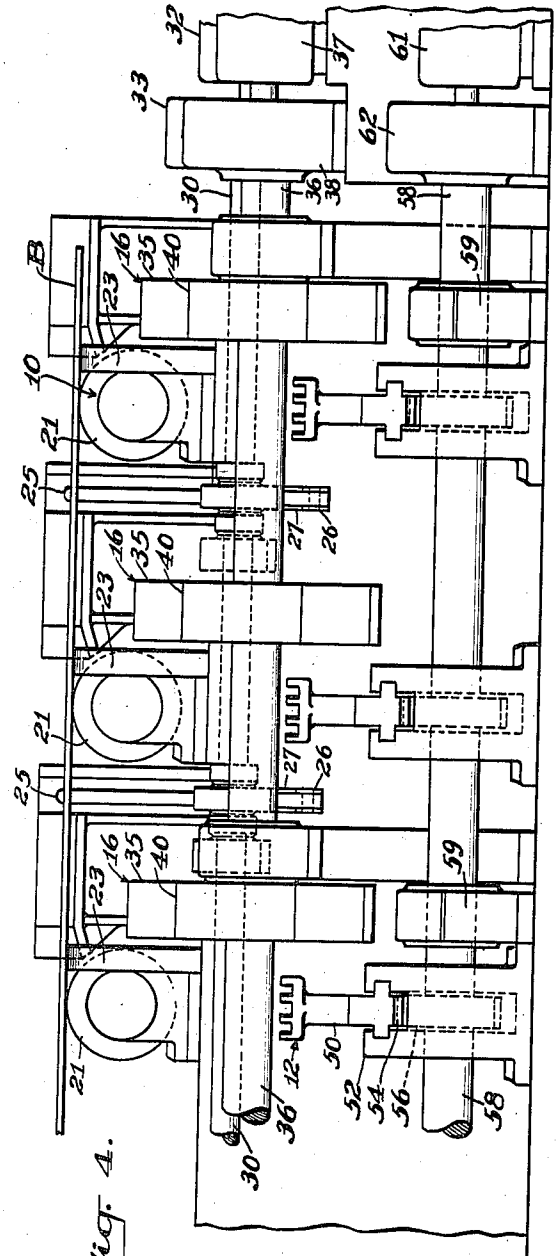


Fig. 4.

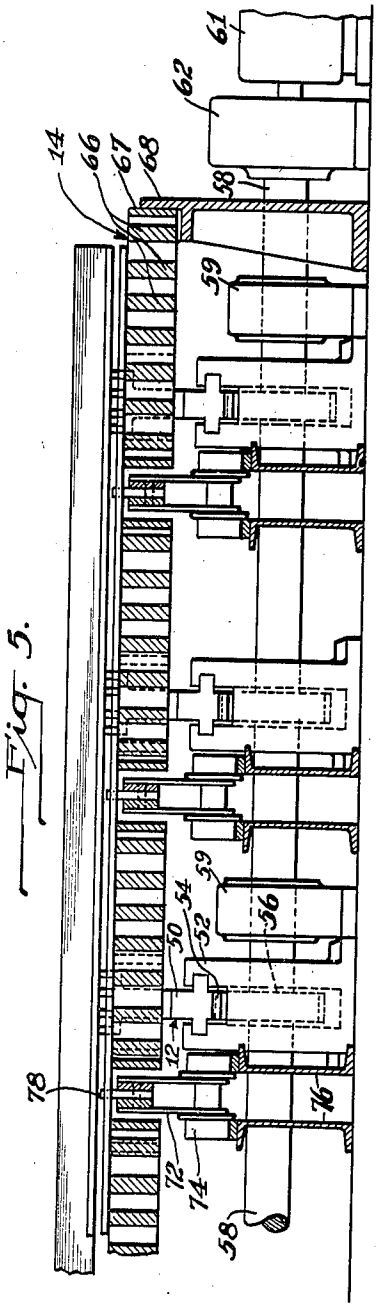


Fig. 5.

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UNITED STATES PATENT OFFICE

2,067,525

APPARATUS FOR ANNEALING MERCHANT BARS

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Application April 1, 1936, Serial No. 72,093

17 Claims. (Cl. 80—42)

This invention relates to mechanism for handling metal bars or the like, and is more particularly concerned with apparatus for the pack annealing or controlled cooling of merchant bar.

In the manufacture of metal bar such as merchant bar it is often desirable to pack or self-anneal them as by stacking a plurality of the hot bars together so that the heat of the metal is retained in the pack for a considerable time to effect the desired annealing action. Ordinarily merchant bar is annealed in this manner directly after it leaves the hot rolling mill, and the process is capable of being used with bars of various sizes and shapes.

Prior to my invention apparatus has been provided for pack annealing the relatively heavy and hot merchant bar. However, these former apparatus have been quite complicated in nature and necessitate considerable initial and maintenance costs. Likewise they are not adapted to readily provide for a controlled cooling or a varying amount of annealing of the bar.

It is the object of the present invention to avoid and overcome the difficulties of known apparatus for pack annealing merchant bar by the provision of simple, rugged and durable mechanism which is relatively inexpensive but adapted to rapidly handle hot merchant bar of various sizes as it comes from the hot rolling mill, and to form the bar into the desired annealing packs or to effect controlled cooling thereof.

Another object of the invention is to provide pack-annealing mechanism wherein the annealing operation is substantially continuous with bars being constantly added to one end and removed from the other end of the pack.

Another object of the invention is the provision of pack-annealing apparatus which is easily operated to pack anneal merchant bar without scratching or other injury to the bar.

Another object of the invention is to provide apparatus which can be operated to effect substantially any desired extent of pack annealing or controlled cooling of merchant bar.

A further object of my invention is the provision of apparatus of the character described which can be operated to clear the annealing bed of bars one at a time when no more bars are added to the pack.

The foregoing and other objects of the invention are achieved by providing apparatus which includes a hot run-out table, a bar-annealing bed positioned adjacent the table, a transfer means positioned between the bed and the table for receiving the bars from the table and standing them on edge on the bed, and a cooling table for receiving the bars from the annealing bed. The annealing bed is mounted for movement to and from or completely below the transfer means, and means are provided for effecting reciprocating movement of the bed. Thus in the practice of the invention the bars and the annealing bed are moved away from the transfer means as a new bar is added to the bed but are moved back below the transfer means to engage the bars with the transfer means thereby to place the added bar on end of the pack and to force one or more bars off the other end of the bed onto the cooling table.

In a modified form of the invention the transfer means is adapted to hold one or more bars for individual cooling before they are added to the pack whereby the desired annealing action can be obtained as well as increasing the capacity of the apparatus.

In practicing the invention in either form it is possible to adjust the reciprocating movement of the annealing bed so as to allow the bars to pack anneal to any desired extent or to cause the transfer means to place the bars directly upon the cooling table.

The present invention comprises a continuation-in-part of my copending application, Serial No. 29,701, filed July 3, 1935, and entitled Apparatus for handling and annealing metal bar and the like.

In the drawings, Fig. 1 is a plan view partly broken away of one embodiment of my invention; Fig. 2 is a longitudinal vertical cross-sectional view taken on line II—II of Fig. 1; Fig. 3 is a view similar to Fig. 2 but of a modified form of the invention; Fig. 4 is a transverse vertical cross-sectional view taken on line IV—IV of Fig. 2 and with the cooling bed eliminated to better illustrate the feature of construction of the remaining apparatus; and Fig. 5 is a transverse vertical cross-sectional view taken on line V—V of Fig. 2 and illustrating the construction of the cooling table.

Although the apparatus is adapted to handle and anneal various strip and bar materials within relatively wide limits, it is particularly designed for the pack or self-annealing of metal merchant bar which is ordinarily rectangular in cross section, and accordingly the apparatus is illustrated and described as handling bar of this type. The rectangular bar is, for example, from 2 to 12 inches wide and from $\frac{1}{8}$ up to 2 inches thick. Its length varies considerably, as, for example, from 100 to 300 feet. However, it should be appreciated that bar of other cross sections, such

as rounds, squares, angles, etc., can be handled, and that ordinarily the present apparatus, when made commercially, is constructed to handle the largest sizes as it then is capable of handling the smaller sizes.

As will be recognized, due to the size of the bar handled, the apparatus of the present invention is quite wide and long, but since its construction comprises a substantial duplication at laterally spaced areas, the drawings have been broken away after illustrating several of the duplicate means.

Referring to Figs. 1 and 2, the invention includes a hot run-out table 10, a pack-annealing bed 12, and a cooling bed 14. Positioned between the hot run-out table and the annealing bed are transfer means shown generally at 16 for receiving the merchant bar from the hot run-out table and standing it on edge on the annealing bed.

The hot run-out table 10, which usually receives the hot merchant bar directly from the rolling mill, may take a plurality of forms, but preferably comprises a base 20 having rollers 21 journaled thereon and driven by suitable means such as individual motors 22. Associated with the side of the hot run-out table 10 are laterally extending inclined skids 23 which function to receive the merchant bar, marked B, from the hot run-out table.

Means are provided for laterally moving the bar B from the run-out table 10 onto the skids 23, and this means may include pusher arms 25 each having its lower end pivotally connected, as at 26, to a link 27 which is pivotally secured to a bracket 28 fixed to the base 20. The arms 25 are oscillated by a crank shaft 29 journaled in the base 20 and having crank portions 30 received in bearings 31 formed on the pusher arms. The crank-shaft 29 is driven in any preferred manner as, for example, by a motor 32 through a gear box 33. Thus when the motor 32 is driven to turn crank-shaft 29 each pusher arm 25 moves from its retarded full-line position seen in Fig. 2 up to and past the dotted-line position in the same figure to push the merchant bar B onto the inclined skids 23.

Positioned adjacent the lower end of the skids 23 is the transfer means, indicated generally at 16, which includes a plurality of rotatable means 35 preferably mounted upon a common shaft 36 at laterally or more strictly axially spaced points thereon and driven by means, such as a motor 37, through a gear box 38. The shaft 36 carrying the rotatable means 35 is journaled in suitable axially spaced bearings 45. Each of the rotatable means 35, as best seen in Fig. 2, comprises a wheel or drum having one or more bar-receiving notches or recesses 40 formed on its outer surface. The notches 40 in the several rotatable means 35 are aligned to form groups each of which is adapted to receive a bar B. The position of the skids 23 and the rotatable means 35 is such that merchant bar sliding laterally off the hot run-out table and down the skids 23 moves into the notches 40 in a substantially tangential direction. The bar is received in the notches when they are near the uppermost point in their arcuate movement. As evident from the arrangement of parts shown in Fig. 2, the notches 40 illustrated in position to receive a merchant bar from the skids 23 are slightly beyond their uppermost position so that the bottom of each notch is in substantial alignment with the surface of the skids 23.

Rotation of the rotatable means 35 through an arc of about 60° deposits the bar carried in a group of notches 40 upon the annealing bed 12. The rotatable means 35, as best seen in Fig. 1, are positioned along the shaft 36 so that the distance between them is somewhat less than the shortest bar to be handled so that in transferring the bar more than one of the means carry it regardless of its length.

The annealing bed 12 for receiving the merchant bar B from the transfer means 16 comprises a plurality of laterally spaced relatively narrow bed-forming members 50 which, as best seen in Fig. 4, are gibbed to bases 52 so as to have longitudinal sliding movement thereon. Suitable means are provided for effecting reciprocating movement of the bed-forming members 50 toward and from or completely under the transfer means 16, and in the form of the invention illustrated this means comprises racks 54 secured to the bottom of the bed-forming members 50 and engaged with gears 56 secured to a shaft 58 carried in bearings 59 and operable by a motor 61 through a gear box 62.

As will be evident from Figs. 1 and 4, the bed-forming members 50 being relatively narrow can be easily moved in between or completely under the rotatable means 35 of the transfer mechanism which is necessary in the operation of the apparatus as will be evident as this description proceeds.

The cooling table shown generally at 14 comprises a plurality of grill bars 66 carried in frames 67 and mounted on bases 68. The cooling table extends between the bed-forming members 50 of the annealing bed to a point adjacent the transfer means 16 but is suitably recessed to allow for free reciprocating movement of the bed-forming members and, as best evident from Fig. 2, the cooling table is slightly below the surface of the bed-forming members 50 so that the bar carried on the annealing bed can move above the surface of the cooling table without touching it.

At transversely spaced positions, the cooling table 14 is formed with bar-moving means for carrying the merchant bar along the cooling table in spaced relation. Mechanism for this purpose, in the form of the invention illustrated, comprises carriages 72 having wheels 74 engaging with and supported by tracks 76. The carriages 72 mount a plurality of counter-balanced fingers 78 which are called "ducking dogs" in the trade, inasmuch as in movement of the carriages in one direction the dogs duck or tilt to pass beneath the merchant bar on the cooling table, but when the carriages are moved in the other direction the dogs can not duck and thus move the bar along the cooling table for the stroke of the carriage. The carriages 72 are reciprocated in any suitable manner, as for example, by the provision of a motor 85 operating through a reversing gear box 86 to oscillate a crank shaft 87 connected by cranks 88 to each carriage.

The modified form of the apparatus, illustrated in Fig. 3, comprises a hot run-out table 10*a*, laterally positioned inclined skids 23*a*, an annealing bed 12*a*, and a cooling 14*a*. Positioned between the annealing bed and the inclined skids are transfer means 16*a* which comprise a plurality of rotatable means 35*a* spaced axially of the shaft 36*a* and comprising wheels or drums having notches 40*a* formed on their peripheries. Substantially the only difference between the apparatus illustrated in Fig. 3 and that shown in Fig. 2 is that each rotatable means 35*a* has a greater number of bar-receiving notches formed on its

periphery. This is for the purpose of providing a mid-station between the skids and the annealing bed so that the capacity of the apparatus is increased and so that each bar has a certain amount of cooling after it leaves the hot run-out table and before it is added to the pack of bars on the annealing bed. In order to provide the mid-point or dwell in the operation of the transfer means 16*a*, the skids 23*a* are positioned to feed the merchant bar into a group of aligned notches 40*a* when they are substantially at the top of their rotary movement. Accordingly the arc of movement of each bar from the skids to the annealing bed is approximately 90° so that stepped rotary movement of the rotatable means 35*a* in arcs of about 45° effects the desired operation as hereafter more fully explained.

The invention likewise contemplates providing more than a single mid-point for each merchant bar between the skids 23*a* of the annealing bed 12*a*, and this can be accomplished by increasing the number of notches 40*a* in the rotatable means 35*a* and correspondingly decreasing the stepped arcuate movement thereof. Ordinarily if this is to be done the cross-sectional size of bar handled must be relatively small.

In the operation of the apparatus shown in Figs. 1, 2, 4 and 5, the merchant bar B is received on the hot run-out table 10 which is controlled by the operator so as to stop the bar in the desired position on the table. The operation of the push-off arms 25, whose position is controlled by motor 32, is likewise under the care of the operator, and the bar B, when desired, is moved laterally off the hot run-off table 10 and onto the inclined skids 23. The bar slides down the skids 23 by gravity and into notches 40 of the rotatable means 35 which have been stopped in the position shown in Fig. 2 so that the notches are in aligned relation with the skids 23. The movement of each bar down the inclined skids and the sudden stopping of the bar in the notches 40 serve to straighten the bars to remove curves or kinks formed in rolling and this operation likewise effects removal of any loose scale on the bars. The angle and length of the skids 23 determine the effective straightening action obtained. It will be recognized that the bar thus moves onto the rotatable means 35 in a substantially tangential direction and with the notches 40 near their highest point of arcuate movement.

The operator now moves the annealing bed-forming members 50 to the dotted line position shown in Fig. 2 by operation of the motor 61 and associated mechanism. This movement of the annealing bed 12 as a whole away from the transfer means carries the bars B stacked on the bed away from the transfer means so as to provide a relatively small clearance between the last bar on the bed and the transfer means. The shaft 36 carrying the rotatable transfer means 35 is then rotated through an arc of about 60° by the operation of the motor 37. Thus the bar carried by the notches 40 is moved down until it engages with the annealing bed which receives it on edge, and the rotary movement of the means 35 is continued to bring the next group of aligned notches 40 into bar-receiving position relative to the inclined skids 23. The annealing bed 12 comprised of the bed-forming members 50 effects the removal of the bars B from the notches 40 inasmuch as the members 50 extend inwardly of the outer circumference of the rotatable means 35 as is evident from Figs. 1 and 2.

The bar B which has been deposited upon the annealing bed 12 is usually at a slight angle engaging both with the pack of bars on the bed and with the rotatable means 35. When the operator has stopped the rotary movement of the transfer means 16, he then energizes the motor 61 to move the annealing bed toward the transfer means so that the newly added bar is forced against and becomes a part of the pack on the annealing bed. In this operation the added bar of the pack engages with the inclined surfaces of the notches 40 of the transfer means which act as inclined stops to align the bar and the pack on the annealing bed. Further movement of the annealing bed toward the transfer means pushes one or more bars off the annealing bed at its opposite end and onto the cooling table 14.

The number of bars removed from the bed in this manner is dependent upon the extent of movement of the annealing bed toward and between the transfer means. Ordinarily in operating the apparatus the extent of movement is such that a single bar is removed from the annealing bed. Since no stops are provided between the cooling table and the annealing bed, the last few bars may fall over on their sides as seen in Fig. 2, and because of this, sometimes two bars fall off together and perhaps no bars at all on one particular reciprocating stroke of the bed. In all events, the resulting operation when performed rapidly in the usual commercial manner to continuously add bars at the end of the annealing bed adjacent the transfer means effects a continuous removal of one or more of the bars from the other end of the bed and onto the cooling table. The bars are fed across the cooling table 14 by the reciprocating movement of the carriages 72 and the "ducking dogs" 78 in a manner which is well understood in the art.

The operation of the modified form of the invention illustrated in Fig. 3 is substantially the same as that just described with the exception that each of the rotatable means 35*a* of the transfer means 16*a* is formed with an extra number of notches 40*a* so that movement of the merchant bar laterally of the hot run-out table 10*a* and onto the skids 23*a* causes the bar to catch in one group of aligned notches 40*a*. The first arcuate movement of the rotatable means 35*a*, generally of about 45 degrees, causes the merchant bar to move to a position between the annealing bed 12*a* and the position in which it was received from the skids. Another merchant bar is then received in the next group of aligned notches 40*a* and the next arcuate movement of the rotary means 35a causes the first bar to be moved onto the annealing table 12*a* and the second bar to move to the mid-position. In this manner the apparatus is adapted to receive an additional bar from the hot rolling mill and to provide for some preliminary cooling of each bar before it is added to the annealing pack. The remaining operation of the modified form of apparatus shown in Fig. 3 is identical with that above described.

If it is desired to employ either form of the apparatus for the purpose of handling hot metal bars, and more particularly for merely cooling the bars without pack annealing, the annealing bed 12 or 12*a* is moved completely under the transfer means 16, i. e., from the full line to the dotted line position of Fig. 3, so that the bars are received from the transfer means directly upon the cooling table 14 or 14*a*. Another important feature of the invention resides in the operation of either type of apparatus described

to effect any desired amount of annealing action. This is readily accomplished by merely varying the effective operating length of the annealing beds 12 or 12a. In other words, more or less of the annealing beds may be moved under the transfer means 16 and 16a so that the number of bars contained in the pack during annealing can be varied from none up to a full pack.

Furthermore the apparatus is self-clearing without requiring additional mechanism. In other words, when no more bars are added to the pack, those already forming the pack can readily be removed one by one by merely moving the annealing bed under the transfer means step by step.

The stated objects of the invention are achieved by the apparatus just described in that the annealing and handling mechanism is simple, rugged and inexpensive in initial and maintenance costs. It will handle merchant bar of widely varying shapes and sizes, and can be operated easily to effect any desired extent of pack annealing or a direct cooling operation without modification of its structure.

While in accordance with the patent statutes several embodiments of the invention have been illustrated and described in detail, it should be understood that the invention is not limited thereto or thereby, but is defined in the appended claims.

I claim:

1. Apparatus for handling merchant bar comprising a substantially horizontal hot run-out table, a substantially horizontal pack annealing bed positioned laterally of the hot run-out table, rotatable transfer means positioned between the bed and the table for receiving the bars from the table and standing them on edge on the bed, means for moving the bed and the bars thereon away from the transfer means as a new bar is added to the bed and for then moving the bed back below the transfer means but with the bars engaging it to place the added bar on one end of the pack and to force a bar off the other end of the pack, and a cooling table for receiving the bars forced off the bed and for carrying them in spaced relation away from the bed, the means for moving the bed being adapted to move it completely below the transfer means so that the bars are received directly by the cooling table if desired.

2. Apparatus for handling merchant bar comprising a hot run-out table, a pack-annealing bed positioned laterally of the hot run-out table, transfer means positioned between the bed and the table for receiving the bars from the table and standing them on edge on the bed, means for moving the bed and the bars thereon away from the transfer means as a new bar is added to the bed and for then moving the bed back below the transfer means but with the bars engaging it to place the added bar on one end of the pack and to force a bar off the other end of the pack, and a cooling table for receiving the bars forced off the bed and for carrying them in spaced relation away from the bed.

3. Apparatus for handling merchant bar comprising a hot run-out table, a pack-annealing bed positioned laterally of the hot run-out table, transfer means positioned between the bed and the table for transferring the bars from the table and standing them on edge on the bed, and means for moving the bed and the bars thereon away from the transfer means as a new bar is added to the bed and for then moving the bed back below the transfer means but with the bars engaging it to place the added bar on one end of the pack and to force a bar off the other end of the pack.

4. Apparatus for handling merchant bar comprising a hot run-out table, a pack-annealing bed positioned adjacent the hot run-out table, transfer means positioned between the bed and the table for receiving the bars from the table and placing them on the bed, means for moving the bed and the bars thereon away from the transfer means as a new bar is added to the bed and for then moving the bed back below the transfer means but with the bars engaging it to place the added bar on one end of the pack and to force a bar off the other end of the pack, a cooling table for receiving the bars forced off the bed and for carrying them in spaced relation away from the bed, and means for moving the annealing bed to a position where the bars are placed directly on the cooling table by the transfer means.

5. Apparatus for pack annealing merchant bar and the like comprising a plurality of rotatable means mounted in axially spaced positions on a rotatable shaft, each means including at least one notch for receiving a bar, the notches being aligned on the plurality of means, means for moving a bar in turn in a substantially tangential direction into the notches when they are near their uppermost arc of rotation, an annealing bed for removing the bar on edge from the rotatable means after they have carried it through an arc, means for reciprocating the annealing means toward and from or completely under the rotatable means, a cooling table positioned just below the upper surface of the annealing bed and extending laterally thereof and means for moving bars across the cooling table.

6. Apparatus for the controlled cooling of merchant bar and the like comprising a plurality of rotatable means mounted in axially spaced positions on a rotatable shaft, each means including at least one notch for receiving a bar, the notches being aligned on the plurality of means, means for moving a bar in turn into the notches, an annealing bed for removing the bar from the rotatable means after they have carried it through an arc of less than about ninety degrees, and means for reciprocating the annealing bed toward and from or completely under the rotatable means.

7. Apparatus for pack annealing merchant bar and the like comprising a plurality of rotatable means mounted in axially spaced positions on a rotatable shaft, each means including a plurality of notches which are aligned on the plurality of means to form groups each adapted to receive a bar in turn, means for moving a bar in turn into the notches when they are near their uppermost arc of rotation, means for removing the bar on edge from the rotatable means after they have carried it through an arc, and means for reciprocating the removing means from the rotatable means prior to the removing operation and toward the rotatable means between removing operations.

8. Apparatus for pack annealing merchant bar and the like comprising a plurality of transfer means mounted for arcuate movement, each means including at least one notch for receiving a bar, the notches being aligned on the plurality of means, means for moving a bar into the notches means for removing the bar on edge

from the transfer means after they have carried it through an arc of less than about ninety degrees, and means for moving the removing means away from the transfer means prior to removal of a bar and toward the transfer means after removal of a bar.

9. In combination, an inclined conveyor for moving merchant bar laterally, an annealing bed for laterally receiving the bar, a plurality of axially spaced rotatable means for receiving the bar from the conveyor and depositing it on edge on the bed, means for moving the bed toward and from the rotatable means whereby to leave space for the reception of an added bar and then to force the end bar off the bed, and a cooling table for receiving the bars forced off the bed.

10. In combination, an inclined conveyor for moving merchant bar, an annealing bed for receiving the bar, a plurality of simultaneously operated means for receiving the bar from the conveyor and depositing it on edge on the bed, means for changing the length of the bed to vary the size of the pack of bars annealed thereon, and a cooling table for receiving the bars from the bed.

11. In combination, an inclined conveyor for moving merchant bar, a cooling table for receiving the bar, an annealing bed adjustably positioned over the table, transfer means for receiving the bar from the conveyor and depositing it on edge on the bed, and means for moving the bed toward and from the transfer means.

12. Mechanism for pack annealing merchant bar comprising a substantially horizontal annealing bed, means for reciprocating the bed, a plurality of stops at one end of the bed between which the bed can be moved but which engage any bars on the bed to move one or more bars off the other end of the bed when it is moved between the stops, and means associated with the stops for placing a bar on edge on the bed between the stops and the bars already on the bed when it is moved away from the stops.

13. Mechanism for the controlled cooling of merchant bar comprising an annealing bed, means for moving the bed substantially in the plane of its surface, a stop at one end of the bed below which the bed can be moved but which engages any bars on the bed to move one or more bars off the other end of the bed when it is moved below the stop, and means associated with the stop for placing a bar on edge on the bed between the stop and the bars already on the bed when the bed is moved to provide clearance between the bars thereon and the stop.

14. Mechanism for the controlled cooling of merchant bar comprising an annealing bed, means for moving the bed substantially in the plane of its surface, a stop at one end of the bed below which the bed can be moved but which engages any bars on the bed to move one or more bars off the other end of the bed when it is moved below the stop, a hot run-out table and means associated with the stop for receiving a bar from the table and depositing it on the bed.

15. Mechanism for the controlled cooling of merchant bar comprising a conveyor, an annealing bed, means for reciprocating the bed, a rotatable stop at one end of the bed below which the bed can be moved but which engages any bars on the bed to move one or more bars off the other end of the bed when the bed is moved below the stop, said rotatable stop having means for receiving a bar from the conveyor and adapted to place it on the bed and means for turning the stop.

16. In combination, a hot run-out table, an inclined slide positioned at the side of the table, a pack-annealing bed adjacent the lower end of the slide, means for moving the bar laterally off the hot run-out table onto the slide, means for transferring the bar from the slide and placing it on edge on the annealing bed, means for moving the annealing bed to and from or completely below the transfer means and a cooling table for reeciving the bar from the bed.

17. In combination, a hot run-out table, a slide positioned at the side of the table, a pack-annealing bed adjacent the slide, means for moving the bar laterally off the hot run-out table onto the slide, means for transferring the bar from the slide and placing it on edge on the annealing bed, and means for moving the annealing bed to and from the transfer means.

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