June 3, 1930. G. L. FISK 1,761,470

COOLING BED

Filed Sept. 8, 1926 4 Sheets-Sheet 1

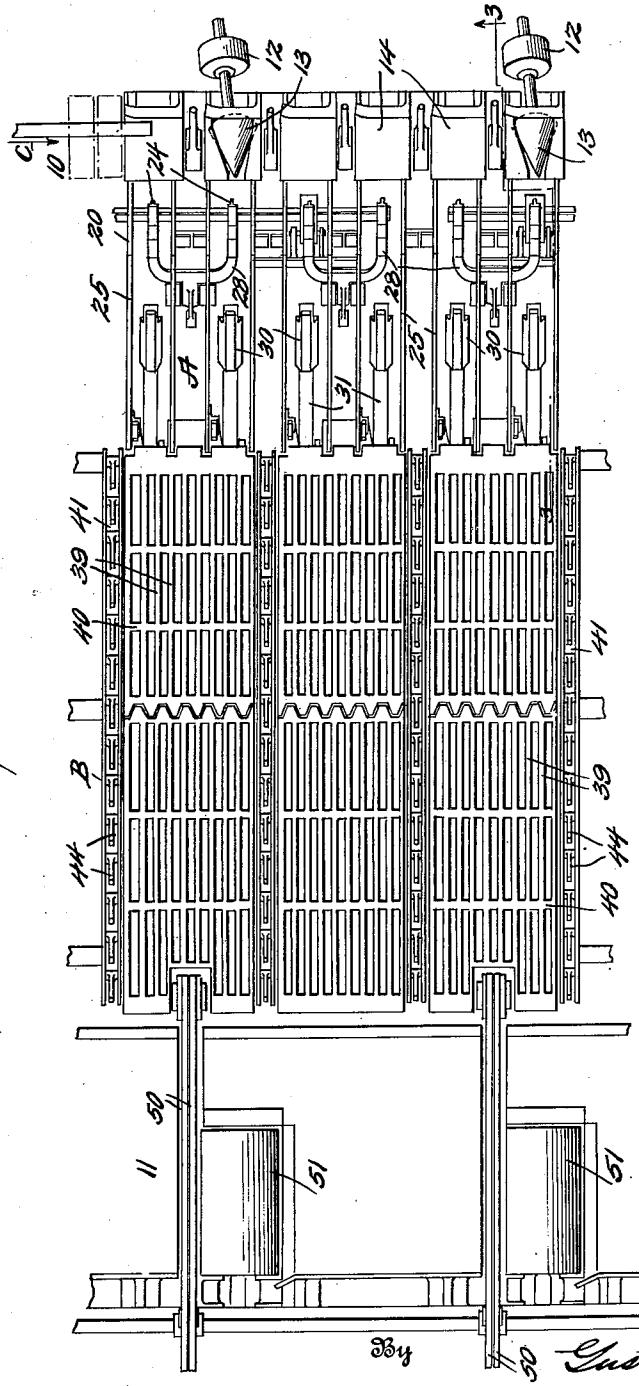


FIG. 1.

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COOLING BED

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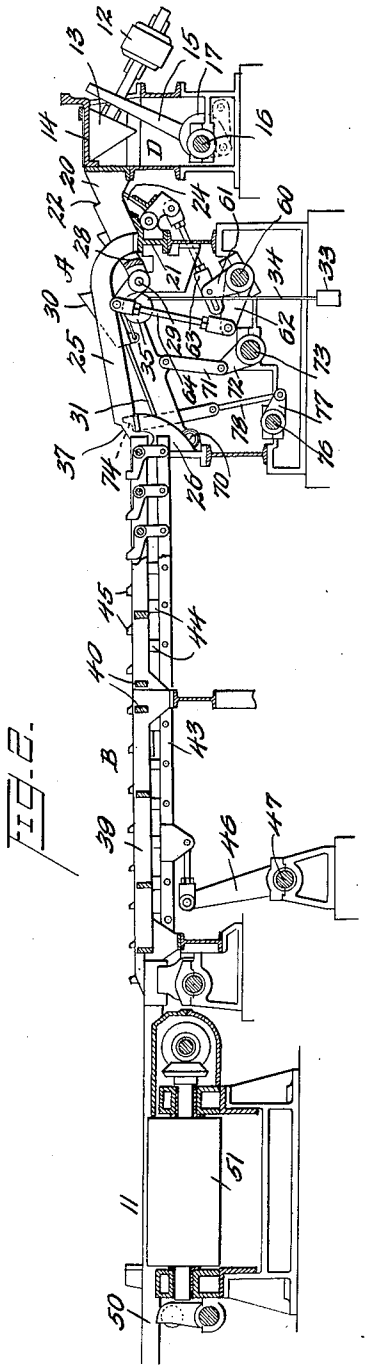


FIG. 2.

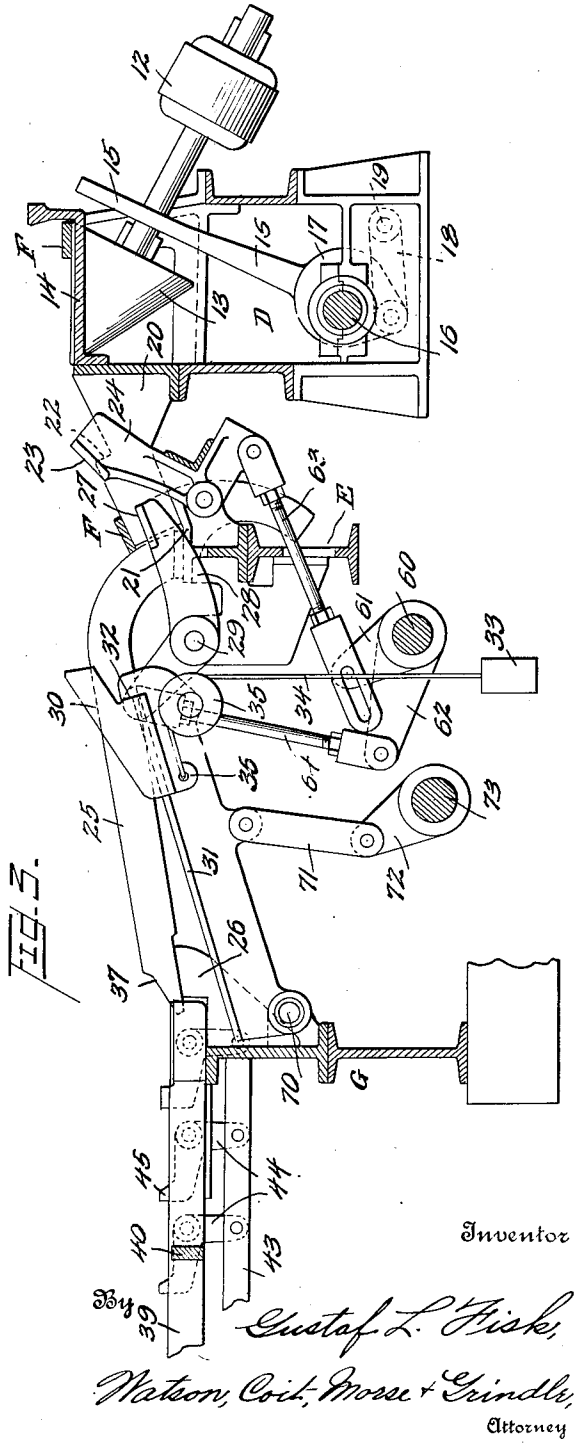


FIG. 3.

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COOLING BED

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FIG. 4.

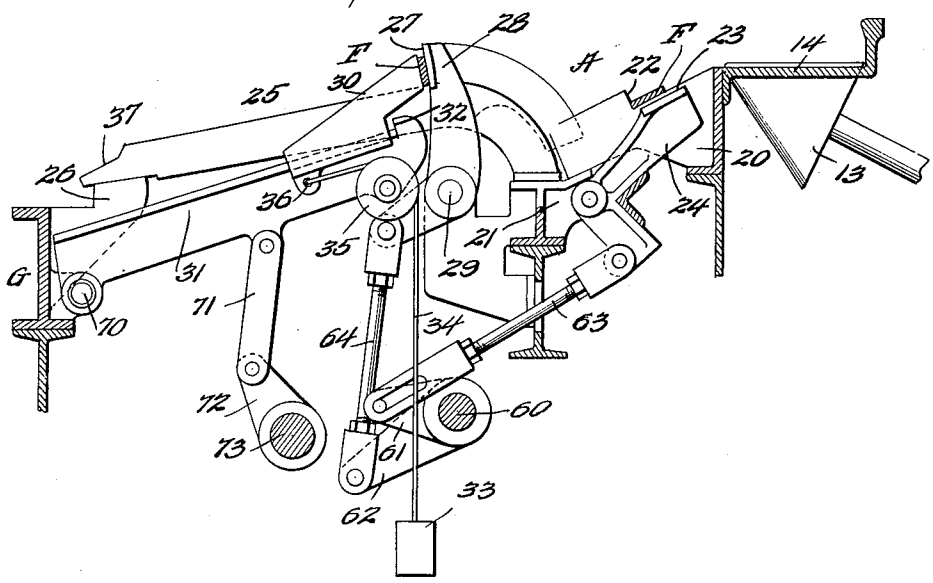


FIG. 5.

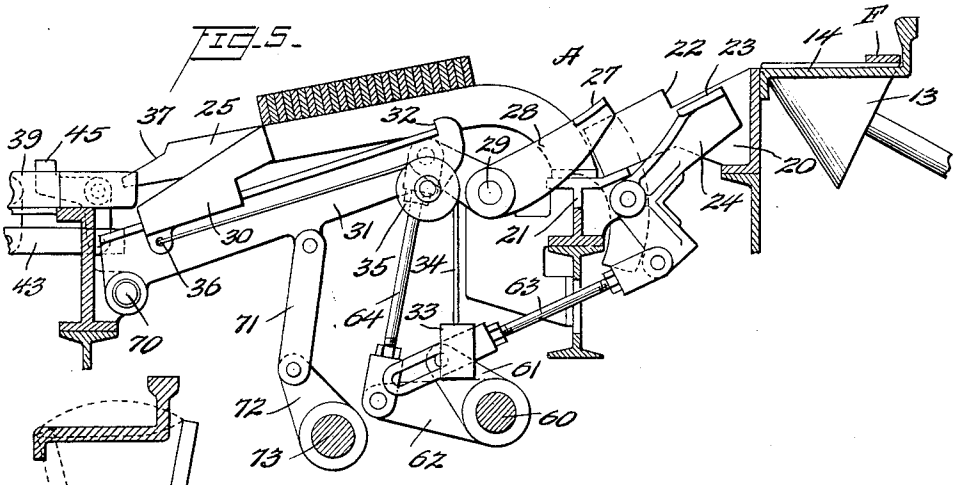
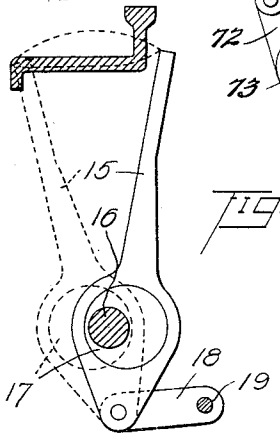


FIG. 10.



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COOLING BED

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FIG. 8.

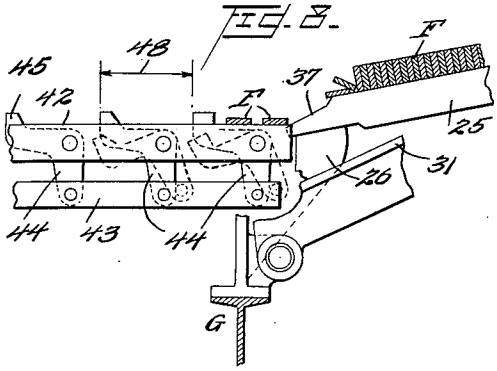


FIG. 9.

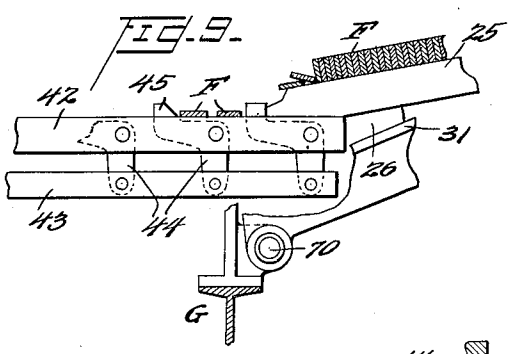


FIG. 6.

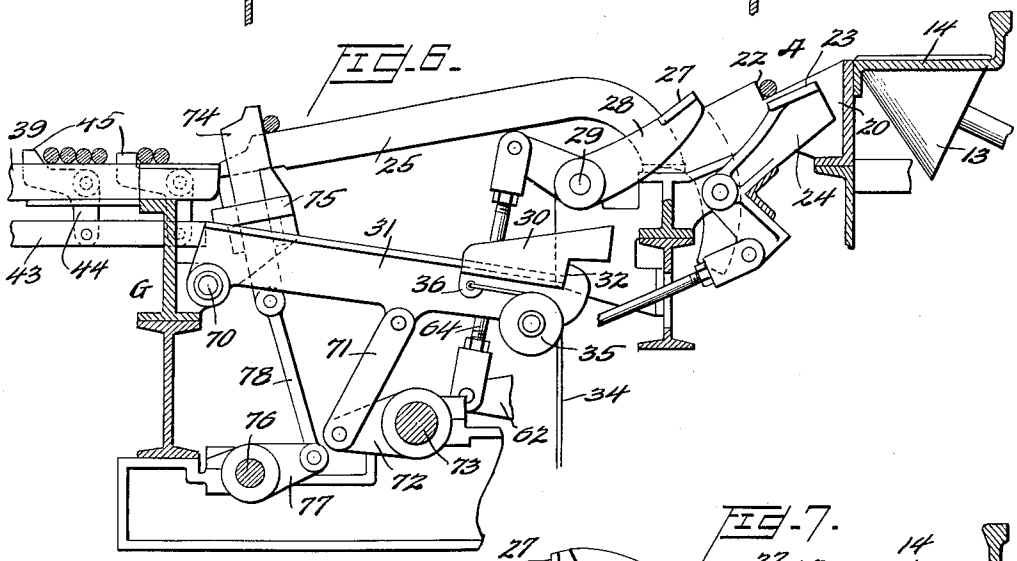
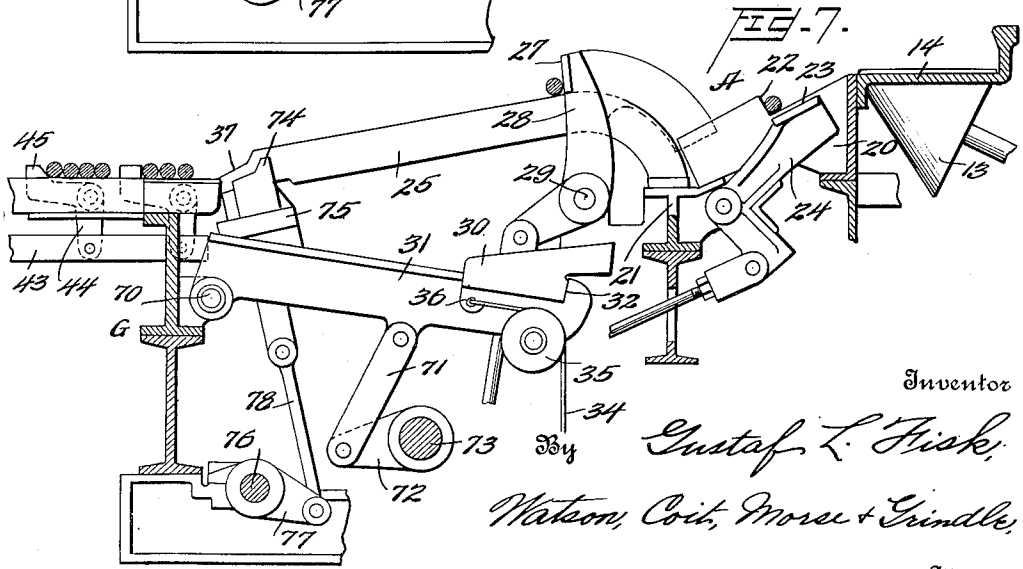


FIG. 7.



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UNITED STATES PATENT OFFICE

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COOLING BED

Application filed September 8, 1926. Serial No. 134,277.

The present invention relates to cooling beds for hot metal bars and particularly to cooling beds for spring flats.

Cooling beds of various types are now commonly used at steel plants for the purpose of receiving the hot bars which come directly from the rolling mill and holding them until sufficiently cooled to be passed on to other apparatus, such as shears, to be further fabricated. The bars are received from the mill in rapid succession, are passed on to the cooling bed in the order in which they are received, and passed from the cooling bed in the same order, remaining on the bed for the purpose of pack annealing when so required and for the time needed to insure that they are sufficiently cooled to be easily handled in the next operation to which they are to be subjected. Means is provided for gradually moving the bars across the bed, the bars lying parallel to each other with their axes at right angles to the direction of movement, in order that a bed of relatively small size may accommodate a large number of bars.

Inasmuch as any particular rolling mill may be adapted to roll spring flats, rounds, square, rectangular and miscellaneous sections, the cooling bed associated therewith should, to be generally useful, be capable of handling all such types of bars. Furthermore, it is customary to design cooling beds in such manner that bars passing over the same will be "pack annealed," that is, annealed by slow cooling when in pack formation, the rapidity of cooling being greatly decreased because of the close contact of each bar with adjacent bars.

The general purpose of my invention is to provide a cooling bed of the type outlined above, capable of handling and effecting the annealing of all types of bars, and having a number of improved features of design and arrangement of the conventional elements, as well as numerous new elements and combinations thereof. Provision is made for handling flat or square bars in two successive stages, in the first of which each is moved with a step by step motion across a section of the bed in close contact with bars on both sides thereof, thereby promoting slow and uniform cooling of the bars throughout, insuring ultimate uniform hardness and decreasing their tendency to warp as well as decreasing their tendency to scale, because of the exclusion of air from between them. In the second stage the bars are passed across a section of the bed in open formation, either singly or in small groups so that they cool more rapidly.

While the cooling bed according to the present invention is adapted to handle bars of any form, whether or not the bars are of such a character as to require annealing, it is particularly adapted to "pack anneal" spring flats. Spring flats because of their thinness do not stand on edge without lateral support. Heretofore the beds used for pack annealing spring flats have been usually of the type shown in the patent to George, No. 863,841, the bed comprising a number of parallel notched bars arranged in two sets, a stationary set and an oscillating set. The spring flats as they come from the mill are disposed in stacks in the first groove formed by aligned notches formed in the stationary bars, resting in inclined positions against the sides of the notches, and are successively moved from notch to notch of the stationary set by the operation of the oscillating set, being cooled in their step-by-step progress over the bed. Beds of this type, of course, have all the disadvantages pointed out above, viz., they occupy a considerable space; the packs are necessarily of small size and therefore the rates of cooling of the individual bars are non-uniform, with the result that the bars are found to vary in hardness when completely cooled. Again, when cooling beds of this type are employed, the hot ductile bars are intermittently carried entirely on moving parts and consequently are apt to be bent, so that when finally discharged in relatively cool condition they are not truly straight. The present invention, on the other hand, provides a cooling bed on which spring flats may be pack annealed in a single continuous pack of relatively large size resting on a fixed bed of relatively small area.

Each section of the bed is provided with automatic means for effecting the movement of the bars thereacross in the manner stated,

the construction of which means will be hereinafter exactly described. The novel automatic means associated with the first, or pack annealing, section is furthermore capable of adjustment so as to be adapted to requirements in handling round as well as flat bars.

In the case of rounds, slow cooling is not so essential as in the case of certain flats (flats for springs), but due to their shape they are more apt to sag if allowed to come to rest when supported at spaced points. To meet this difference in requirements, the first section, having a bed of skid bars, is adjustable to permit round bars to roll by gravity over this section (which motion is useful in straightening a round bar sufficiently hot to be pliable), onto the second section, having a bed of grate bars, which form a practically continuous floor for the hot round bars to rest on while cooling.

The invention may have various embodiments without departing from its spirit and scope and in the accompanying drawings one such embodiment is fully illustrated by way of example.

In the drawings:

Figure 1 is a top plan view of my improved cooling bed;

Figure 2 is a side view of the same, partly in section and partly in elevation;

Figure 3 is a section on line 3—3 of Fig. 1, the various parts being shown on a larger scale;

Figures 4 and 5 are views similar to Fig. 3 but showing the various operating parts in different positions;

Figures 6 and 7 are views similar to Figures 4 and 5, but showing the bar feeding mechanism modified or adjusted to handle round, instead of flat, bars;

Figures 8 and 9 are enlarged side elevations of a portion of the apparatus, the operating parts being illustrated in different positions; and

Figure 10 is a detailed view of the mechanism for moving the bars onto the cooling bed.

The cooling bed comprises two main portions, the first or primary portion upon which the pack annealing of spring flats and bars of rectangular section is carried out being indicated generally at A, and the secondary portion across which the bars are advanced singly or in small groups being indicated generally at B. In addition, means is provided, indicated generally at 10, for automatically moving the bars sideways onto the primary section A as they are received from the rolling mill, and additional means, indicated generally at 11, for receiving the bars as they pass off of the secondary section B and transmitting them to a shear or other device for further fabrication. Each of these sections will now be described in detail.

Electric motors 12 are directly connected to conical feed rollers 13, the uppermost elements of which are substantially horizontal and project slightly above the upper surfaces of aprons 14 so that a bar moving onto the section 10 in the direction indicated by the arrow C will be transported quickly to a position opposite the end of section A of the cooling bed. At the proper point in its travel over the rollers 13, however, the bar is engaged by a plurality of push-off arms 15 which cause it to be thrust laterally onto the bed A. The motors, rollers 13 and aprons 14 are suitably supported on a base indicated generally at D and the shaft 16 upon which the push-off arms 15 are mounted is also supported in bearings in this base. Any suitable means may be selected for effecting the rocking movement of the push-off arms at the proper time, in the present instance this means comprising eccentrics 17 on shaft 16, upon which the push-off arms are directly mounted, the portions of the arms below the shaft being connected by links 18 to stationary pins 19 so that rotation of the shaft results in rocking movement of the push-off arms.

Assuming the mechanism to be handling flat bars, as shown in Figs. 1 to 5, inclusive, it will be seen that these bars are delivered by the push-off arms onto a series of parallel skid bars 20, each of these bars having one end supported upon the base structure D and the other end upon a bracket-like extension 21 of a suitable supporting structure indicated generally at E, the details of which may be varied to suit conditions but which may comprise conveniently two superpositioned beams, as shown in the drawings.

The upper edges of skid bars 20 are inclined downwardly from the level of the aprons 14 and each delivered thereonto by the push-off arms will slide downwardly until it encounters the aligned shoulders 22 of bars 20, which will stop its further progress. As shown in Fig. 4 a bar such as indicated at F and engaging the aligned shoulders 22 directly overlies the lifting faces 23 of a series of lifting levers 24, all of which are pivotally supported upon the structure E. These lifting levers 24 are bell cranked in form and are periodically acted upon by mechanism which causes the lifting faces 23 to simultaneously engage the bar above it and to lift this bar over the shoulder 22, whereupon it is free to continue to slide down the inclined edges of skid bars 20 until its progress is stopped by impact upon the curved end portions of a second set of parallel skid bars 25.

Bars 25 have their curved end portions supported upon the structure E and their opposite ends supported upon brackets 26 secured to a third base structure G conveniently formed of superposed I-beams as shown in the drawings.

The bar F, lying against the curved end portions of skid bars 25, directly overlies the lifting faces 27 of a second series of lifting levers 28, hereinafter designated pack feeding arms because of the functions which they perform. The mechanism by means of which these arms are operated will shortly be described. They serve to lift bar F to a position upon the straight inclined portions of skid bars 25 with the plane of the bar substantially vertical, as shown in Fig. 4, instead of substantially horizontal as shown in Fig. 3. Upward movement of each pack feeding arm 28 is limited to an angle of substantially 90° and, during this movement, the bar remains disposed substantially radially to the common axis of rotation 29 of arms 28, the inner edges of the bar gliding along the curved surfaces of skid bars 25.

As may be clearly seen from an inspection of the drawings, particularly Figures 4 and 7, each pack feeding arm 28 has secured thereto or formed integral therewith a guard 28′ which, in side elevation, is arc-shaped, the outer edge being curved approximately about the axis of shaft 29 as a center. This guard prevents delivery of bars, by accident, into the receiving station, that is, into the position which the left-hand bar F is shown to occupy in Figure 3, while the arms 28 are elevated. The possibility of damages to the apparatus, which would naturally result in the event that arms 28, in descending from raised position, should strike a bar F lying beneath the same, is therefore obviated.

Upward movement of the pack feeding arms 28 results in elevation and rotation of the bar F and in its emplacement against a series of yielding abutments 30. These yielding abutments are block-like members slidably mounted upon trackways 31 so inclined relatively to the upper surfaces of skid bars 25 that movement of the abutments 30 from right to left, Figs. 4 and 5, eventually causes the abutments to pass entirely below the level of the upper edges of skid bars 25, as shown in Fig. 5, so that they are ineffective to prevent movement of the pack of rolled bars down the edges of the skid bars 25. Initially, however, the yielding abutments 30 are disposed as shown in Fig. 3, these abutments being drawn against stops 32 by the action of weights 33, the weights being connected to the abutments by cords or cables 34 passing over pulleys 35 and connected to lugs 36 of the abutments.

Impact of rolled bar F against the abutments 30 causes these abutments to recede only a distance equivalent to the bar thickness, as shown in Fig. 4. The pack feeding arms 28 then return to original position while the bar F, which has just been emplaced against the yielding abutments retains its position. Blocks 33 are of such weight that the abutments 30 will not force bar F back along the skids 25 when the pressure of the pack feeding arm is removed, but will merely continue to support it in a substantially vertical position as shown in Fig. 4. The succeeding operation of the pack feeding arms 28 brings a second bar into engagement with the first, and subsequent operations bring further bars until a pack such as illustrated in Fig. 5 has been formed upon the upper surfaces of the skid bars 25, the movable abutments 30 receding with a step by step action as the pack is formed, and finally passing below the upper surfaces of bars 25, as shown in Fig. 5.

Continued operations of the lifting arms 24 and pack feeding arms 28, of course, result in continued additions to the pack and, finally, the first bar F reaches the lower ends of skid bars 25 and slides down the more sharply inclined edges 37 of the skid bars and onto the surface of the secondary section B of the cooling bed. Section B is formed as a large grate-like structure having longitudinal bars 39 and transverse bars 40, the rectangular spaces between these bars constituting passages through which air may pass. This section of the cooling bed is provided with a series of guideways 41 in which are located means for effecting movement of the rolled bars thereacross from the point at which they are delivered thereonto from section A to the point of delivery to the bar removing mechanism 11.

In each of these guideways are positioned two horizontally disposed reciprocable bars indicated at 42 and 43, respectively, these bars being pivotally connected together by a plurality of L-shaped members 44 which constitute pusher-fingers for the bars which are undergoing cooling. Thus the upper end portions 45 of these pusher-fingers normally project above the level of the upper surface of the bed portion B as shown in full lines in Fig. 8. Upon movement of the lower bar 43 to the right (Figs. 2, 8 and 9) by means of an operating arm 46 mounted upon a rock shaft 47, the pusher-fingers 44 are rocked to dotted line position (Fig. 8) and both bars 42 and 43 are then drawn to the position in which they are shown in Fig. 9, a distance which is regulated so as to be substantially equal to that between two pusher-fingers, i. e. a distance indicated by the length of the line 48 shown in Fig. 8. Initial movement of arm 46 toward the left primarily results in the return of the pusher-fingers 44 to full line position as shown in Fig. 9, the first series of projections 45, however, being in rear of two of the flat bars lying upon the bed section B whereas they had, before action of arm 46, been in front of these bars, as shown in Fig. 8. Continued movement of arm 46 toward the left causes engagement of projections 45 with these flat bars and sliding of the bars along the surface of the bed

until the projections 45 have resumed their normal position as shown in Fig. 8.

Subsequent similar operations of the mechanism just described advances the rolled bars across the bed section B and these bars are finally discharged onto the mechanism for removing them and transporting them to the next machine. This last mentioned mechanism includes a series of sets of reciprocating or "shuffle" bars 50 which are relatively moved in an endwise direction and also vertically moved through short distances, in a well known manner. These bars 40 gradually bring the rolled bars into engagement with the rollers 51 by means of which they are moved transversely of the cooling bed and away from the same.

From the foregoing description it is apparent that the hot bars received from the rolling mills are automatically handled first, if rectangular or polygonal in section, by means which causes them to cool slowly in close formation and second, by means which brings about their more rapid cooling in passing in open formation over the surface of a larger cooling bed. If circular in section, the bars are automatically handled first, by means which subjects them to a turning operation for the purpose of straightening in passing over the surface of the primary bed section and second, by means which bring about a rate of cooling regulated by the number of bars admitted to each group as they are passed in groups of close formation over the surface of the secondary and larger bed section. It only remains to describe the mechanism for effecting the synchronous operation of the lifting arms 24 and pack feeding arms 28.

Both sets of these arms are actuated from a rock shaft 60. This rock shaft has two sets of cranks, the first set being indicated at 61 and the second set at 62. Cranks 61 are connected by links 63 to the ends of bell crank lifting arms 24 and arms 62 are connected by links 64 to the ends of pack feeding arms 28, which arms are also in the form of bell crank levers. Arms 61 have pin and slot connections with links 63 and it will be seen that when shaft 60 moves to the right to cause the lifting arms 24 to move from the normal position shown in Fig. 5 to the position shown in Fig. 3, the pack feeding arms will be depressed from their normal position shown in Fig. 5 to the position shown in Fig. 3 so as not to obstruct the forward movement of bar F. Upon movement of shaft 60 in the opposite direction, the pack feeding arms 28 will be elevated to the position shown in Fig. 4 while the lifting arms 24 will return to their normal positions. During the motion of pack feeding arms 28 from position shown in Fig. 4 to their normal position shown in Fig. 5, however, the lifting arms 24 will remain stationary while the shaft 60 makes part of its movement to the right, the lifting arms 24 not being actuated during the entire movement of shaft 60 because of the pin and slot connection between arms 61 and links 63.

In view of the fact that it is frequently desired to roll round bars and to pass them over the cooling bed, the machine may be modified or adjusted so that pack annealing is not attempted. Thus the adjustable trackways 31 may be depressed as shown in Figs. 6 and 7 so that the yielding abutments 30 do not project above the level of the upper edges of skid bars 25. The trackways 31 are pivoted at 70 to the supporting structure G and are adjustably supported by links 71, the lower ends of which are pivoted to arms 72 fast on shaft 73. Rotation of shaft 73, therefore, results in the raising or lowering of the trackways. By oscillating shaft 73 and manipulating stops 30, the residual bars of a back resting upon skid bars 25 may be dislodged and urged downwardly toward section B of the bed when hot bars have ceased to be supplied from the mill, so that the cooling bed may be entirely cleared. With the yielding abutments removed, the round sections are free to roll down the inclined edges of the skid bars 25. To prevent these hot bars from rolling too far out onto the bed section B, and also to properly align them prior to their discharge onto this section of the cooling bed, a plurality of movable stops 74 is provided, these stops sliding in bearings 75 and being reciprocated in a generally vertical direction by means of a shaft 76 having arms 77 to which the stops are connected by links 78.

The movement of shafts 76 and 60 is so synchronized that the stops 74 are below the level of the upper edges of bars 25 when a round bar is delivered by the pack feeding arms upon the straight sections of these bars, as shown in Fig. 7, but project upwardly to intercept the movement of the downwardly moving bar when the pack feeding arm again returns to its normal position, as shown in Fig. 6. Stops 74 abruptly stop the movement of each rod as it moves toward the section B of the cooling bed, but immediately thereafter release the same so that it may continue its rolling movement onto the bed section B. After reaching the bed section B the round bars are advanced across the same exactly in the manner set forth in connection with the flat bars.

It is believed that the nature of my invention is set forth in the foregoing paragraphs in such manner that one skilled in the art may readily practice the same. In the interests of conciseness, I have not illustrated the motive power means for operating the several power shafts nor the specific means whereby the timed operation of these shafts and their connected mechanism is brought about. The power may be that which may be most eco-

nomically employed at the plant at which the cooling bed is installed and operated, as steam, electricity, etc. The means for bringing about the operation of the various elements in proper sequence may furthermore be of any convenient type or design. Furthermore, the cooling bed illustrated and described is one embodiment of the invention only, set forth by way of example, and many changes may be effected without departure from the spirit of the invention.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. A cooling bed for hot metal bars, comprising in combination, a section for slidably supporting a series of bars in pack formation, a second section for slidably supporting bars positioned to receive bars discharged from the first section, means for feeding bars successively onto said first section to form a pack, moving the pack across said section with a step by step motion, and causing the successive discharge of said bars onto said second section, and means for moving the bars thus discharged onto the second section thereacross either singly or in groups.

2. A cooling bed for hot metal bars having a section for pack annealing and mechanism associated with said section for successively manipulating flat bars placed horizontally thereon into a continuous pack in which the individual bars are vertically disposed, advancing the pack step by step, and causing their successive discharge therefrom said mechanism including means for supporting the bars against overturning during formation of the pack.

3. The mechanism set forth in claim 2, in which yielding abutments oppose movements of the pack during its formation but cease to oppose such movements after the pack is formed.

4. Mechanism of the class described comprising combination, a bed, means for feeding hot metal bars of rectangular cross section transversely onto the bed with the sides of the bars resting on the bed surface, and means for erecting the bars and forming them into a pack on said bed, without raising the bars out of contact with the surface of the stationary bed.

5. The combination set forth in claim 4 in which said last mentioned means comprises a plurality of members movable through the plane of the supporting surface of the bed.

6. The combination set forth in claim 4 in which said last mentioned means comprises a plurality of levers mounted to rotate about an axis beneath the bed surface and having portions which move through the plane of the supporting surface of the bed to contact with the lower surfaces of the flat bars resting on the surface of the bed.

7. Mechanism of the class described comprising in combination, a bed comprising parallel skid bars each having a curved and a substantially straight portion, and means for moving transversely extending flat bars around the curved portions of the skid bars and onto the substantially straight portions, the edges of said flat bars only being in contact with said skid bars during such movement.

8. The combination with a cooling bed of means for forming a pack of bars of rectangular cross section thereon including mechanism for yieldingly opposing movement of the bars across the bed and mechanism for intermittently feeding bars on edge onto the bed.

9. The combination with a cooling bed having a substantially horizontal portion for supporting a pack, of means for intermittently placing flat bars on edge on one side of the bed, and means yieldingly supporting the bars so positioned during the formation of a pack.

10. The combination set forth in claim 9 in which said last mentioned means becomes inactive when the pack is formed.

11. The combination set forth in claim 9 in which said last mentioned means comprises a plurality of slidable abutment members, the movement of each of which is opposed in one direction by a weight.

12. The combination with a cooling bed having a substantially horizontal portion for supporting a pack, of means for feeding bars of round or polygonal cross section intermittently onto said bed portion, and means for yieldably supporting polygonal bars during the formation of a pack, which means is adjustable so as not to assist in forming a pack when round bars are being fed onto the bed.

13. The combination with a cooling bed of means for intermittently feeding bars polygonal in cross section onto one end thereof, and mechanism for acting on each bar as it is received, adding it to a pack, and intermittently advancing the pack, said mechanism including two sets of bar lifting levers and means for operating said levers in synchronism.

14. A cooling bed for thin flat bars which do not stand on edge without lateral support comprising, in combination, means to place the bars as they come from the mill on the bed with their edges resting on the bed, means engaging the first bar fed to prevent overturning thereof, means to withdraw said engaging means after the pack has attained a predetermined size, and means to cause thereafter discharge of bars from the pack at the same rate bars are fed thereto.

15. A cooling bed for thin flat bars which do not stand on edge without lateral support comprising, in combination, means to push bars laterally as they come from the mill

onto the bed with their edges resting on the bed, movable abutments engaging the first bar fed, means for withdrawing said abutments when the pack has attained a predetermined size, and a conveyor onto which bars are discharged singly from the pack.

16. A cooling bed for thin flat bars which do not stand on edge without lateral support comprising, in combination, a bed composed of spaced members slightly inclined downwardly, means for pushing bars laterally as they come from the mill onto the upper end of said bed with their edges resting on the bed, movable abutments engaging the first bar fed, means for withdrawing said abutments after the pack has attained a predetermined size, and means for discharging the bars singly from the lower end of the pack.

17. A cooling bed for thin flat bars which do not stand on edge without lateral support comprising, in combination, means to place the bars singly as they come from the mill onto the bed with their edges resting on the bed to form a pack of predetermined size, means to support the pack laterally during the formation thereof, and a conveyor onto which the bars are discharged singly from the pack as bars are added to the pack.

18. A cooling bed for hot metal bars having a primary flat section for pack annealing and a secondary section, means for successively feeding bars onto said primary section, forming a pack, successively sliding the bars in pack formation across the primary section, and effecting their successive discharge onto the secondary section, and a separate means for moving said bars singly or in groups across said secondary section.

19. Mechanism of the class described comprising in combination a bed, means for feeding hot metal bars of rectangular cross-section transversely onto the bed with the sides of the bars resting on the bed surface, means for erecting the bars and forming them into a pack on said bed without raising the bars out of contact with the surface of the stationary bed, and means for laterally supporting bars otherwise subject to overturning during the formation of the pack.

20. The combination with a cooling bed having a bed surface for slidably supporting a pack, of means for intermittently placing flat bars on edge on one side of the bed and means for supporting the bars so positioned against overturning during the formation of a pack and during their sliding movement across the bed.

21. The combination with a cooling bed of means for intermittently feeding bars polygonal in cross-section onto one end thereof and mechanism for acting on each bar as it is received, adding it to a pack and at the same time moving the pack a distance equal to the thickness of the bar added, said mechanism including two sets of bar lifting levers and means for operating said levers in synchronism.

22. A cooling bed having a bar supporting surface, means for intermittently delivering bars onto one end of said bed and means for intermittently advancing said bars across said bed singly or in groups in a direction transverse to their axes, in which the last mentioned means comprises a plurality of reciprocable members arranged in pairs, the two reciprocable members of which are pivotally inter-connected by tilting pressure fingers for engaging and pushing said bars, and means for operating said fingers by reciprocating said reciprocable members.

23. The combination with a cooling bed, of means for successively feeding bars transversely onto one end thereof, said means including skids for slidably supporting bars and provided with means for interrupting the forward movement of each bar as it moves thereacross, and mechanism associated with each interrupting means for disengaging a bar therefrom and promoting its forward movement.

24. The combination set forth in claim 23 in which each such mechanism includes a plurality of members which rise and fall through the plane of the bar supporting surfaces of the skids.

25. The combination set forth in claim 23 in which each such mechanism includes a plurality of levers pivotally supported beneath the plane of the bar supporting surfaces of the skids and each of which has a bar engaging end which rises and falls through said plane.

26. The combination set forth in claim 23 in which said mechanisms are interconnected so as to act in synchronism.

27. The combination with a cooling bed of means for feeding bars singly onto one end thereof, a rocking frame below said bed, means mounted on said frame and projecting upwardly beyond the bar supporting surface of the bed for yieldingly opposing movement of bars thereacross, and means for raising and lowering said frame to render said first mentioned means operative or inoperative as desired.

28. The combination with a cooling bed of means for feeding bars singly onto one end thereof, a rocking frame below said bed, slides mounted on said frame and projecting upwardly beyond the bar supporting surface of the bed for yieldingly opposing movement of bars thereacross, and means for lowering said frame to render said slides operative or inoperative as desired.

29. The combination set forth in claim 28 in which a weight is flexibly connected to each slide to cause the same to yieldingly oppose movement of the bars.

30. Apparatus for pack annealing of thin

flat bars which do not stand on edge without lateral support, comprising, in combination, means for building a pack of bars, means for laterally supporting said bars during the formation of the pack, means for intermittently feeding bars to the pack at one end and withdrawing bars from the other end, whereby the size of the pack is maintained substantially constant and the bars are protected and slowly cooled by traveling through the pack in contact with bars on either side.

31. The combination with a cooling bed of receiving means for rolled bars delivered from the mill, a stationary bar supporting surface comprising sloping stationary skids over which the bars slide side-wise from said receiving means, and a bed section to accommodate a pack of bars, means for feeding bars from said skids to said bed section, without moving the bars out of contact with the stationary bar supporting surface, to form a pack, and means to cause thereafter the discharge of bars singly from the pack.

32. The combination with a cooling bed of receiving means for rolled bars delivered from the mill, a stationary bar supporting surface comprising sloping stationary skids over which the bars slide side-wise from said receiving means, and a bed section to accommodate a pack of bars, means for feeding bars from said skids to said bed section, without moving the bars out of contact with the stationary bars supporting surface, to form a pack, and means to cause thereafter the discharge of bars from the pack at the same rate they are fed thereto, whereby the size of the pack is maintained substantially constant and the bars travel through the pack step by step in contact with bars on either side.

33. The combination with a cooling bed for packing of rectangular bars which cannot stand on edge without lateral support, of means for intermittently feeding bars onto one end thereof, a mechanism for acting on each bar as it is received, adding it to a pack and at the same time moving the pack a distance equal to the thickness of the bar added, and means to laterally support the bars in the pack until the pack has reached a predetermined size.

34. The combination with a cooling bed having a substantially horizontal portion for supporting a pack, of means for intermittently placing flat bars on edge on one side of the bed, and means yieldingly supporting the bars so positioned during the formation of the pack, said last mentioned means being adjustable so as to be rendered inactive, at the will of the operator.

35. The combination with a cooling bed having a substantially horizontal portion for supporting a pack, of means for intermittently placing flat bars on edge on one side of the bed, and means yieldingly supporting the bars so positioned during the formation of a pack, said last mentioned means being adjustable to vary the size of the pack formed thereagainst.

36. A cooling bed, comprising a receiving station for material lying generally flat, a cooling rack spaced therefrom, means for engaging successive pieces of material at the receiving station and delivering them to the cooling rack on edge and in pack relation, and yieldable backing means for the pack.

37. A cooling bed, comprising a receiving station for material lying generally flat, a cooling rack spaced therefrom, means for engaging successive pieces of material at the receiving station and delivering them to the cooling rack on edge and in pack relation, and backing means for engaging the pack, the backing means being slidable.

38. A cooling bed, comprising a receiving station for material lying generally flat, a cooling rack spaced therefrom, means for engaging successive pieces of material at the receiving station and delivering them to the cooling rack on edge and in pack relation, and yieldable backing means for the pack, the backing means being arranged to move out of engagement with the material after a pack of desired size has been formed.

39. A cooling bed, comprising a cooling rack which constitutes a dead support, means for successively supplying pieces of material to one side of the cooling rack and in pack relation, means for conveying material delivered from the other side of the cooling rack, and transfer means for engaging residual material on the cooling rack and conveying it therefrom.

40. A cooling bed, comprising a run-out table, a cooling rack spaced therefrom, and means for engaging successive pieces of material adjacent the run-out table and moving them into pack relation on the cooling rack, said means being effective for substantially continuously engaging a piece from the time it leaves the run-out table until it lies in pack relation on the cooling rack.

41. A cooling bed, comprising a run-out table, a cooling rack spaced therefrom, supports extending from a point adjacent the run-out table to the cooling rack, and an arm movable from said point to the cooling rack for engaging successive pieces of material at said point and sliding them over the supports to bring them into pack relation on the cooling rack.

42. A cooling bed, comprising a run-out table, a cooling rack spaced therefrom, and an arm for engaging successive pieces of material adjacent the run-out table and moving them into pack relation on the cooling rack, the arm being effective for substantially continuously engaging a piece from the time it leaves the run-out table until it lies in pack relation on the cooling rack.

43. A cooling bed, comprising a cooling

rack, a receiving station for material lying generally flat, an arm having a material engaging portion, the arm being so mounted that when the material engaging portion is adjacent the station, it is in a horizontally extending position and, when adjacent the cooling rack, is in a vertically extending position, and means for moving the arm.

44. A cooling bed, comprising a cooling rack, a receiving station for material lying generally flat, an arm having a material engaging portion, the arm being so mounted that when the material engaging portion is adjacent the station, it is in a horizontally extending position and, when adjacent the cooling rack, is in a vertically extending position, means for moving the arm, and a support extending from the station to the cooling rack and adapted to provide support for material as it is moved by the arm from the receiving station to the cooling rack.

45. A cooling bed, comprising a receiving station, a cooling rack spaced therefrom, and an arm for engaging material at the receiving station and delivering it to the cooling rack in pack relation, the arm being so shaped as to prevent delivery of material to the receiving station while the arm is conveying material from the receiving station to the cooling rack.

46. A cooling bed, comprising a receiving station, a cooling rack spaced therefrom, and an arm for engaging material at the receiving station and delivering it to the cooling rack in pack relation, the apparatus being so formed as to prevent delivery of material to the receiving station while the arm is conveying material from the receiving station to the cooling rack.

47. A cooling bed for bars of rectangular cross section and bars of circular cross section, comprising, in combination, a primary bed section, means associated with said primary bed section for cooperatng therewith in effecting the pack annealing of flat bars which will not stand on edge without lateral support and which means may be adjusted to inoperative position to permit round bars to roll freely thereacross, a secondary section for receiving bars of either rectangular or circular cross section discharged from said first section, and means for moving said bars across said second section in spaced relation.

48. A cooling bed for bars of rectangular cross section and bars of circular cross section, comprising in combination, a run-in table, a primary bed section having an effective upper supporting surface which is downwardly inclined in a direction away from said run-in table, means for transferring bars from the run-in table to the upper surface of the primary section, means associated with said primary section for cooperating therewith in effecting the pack annealing of flat bars which will not stand on edge without lateral support and which means may be adjusted to inoperative position to permit round bars to roll freely thereacross by gravity, a secondary section for receiving bars of either rectangular or circular cross section discharged from said primary section, and means for moving said bars across said second section in spaced relation.

In testimony whereof I hereunto affix my signature.

GUSTAF L. FISK.