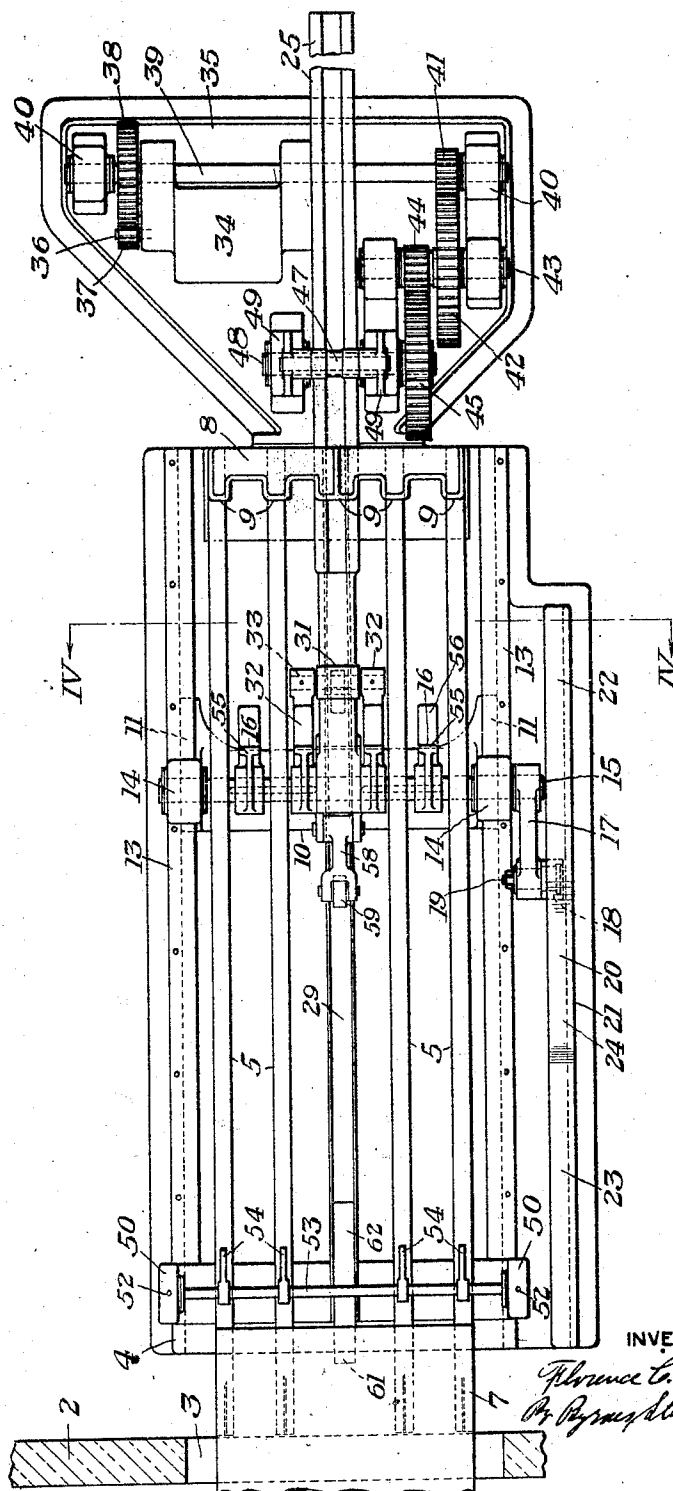
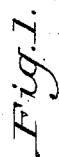


1,551,004

METHOD AND APPARATUS FOR CHARGING BILLETS INTO FURNACES

3 Sheets-Sheet 1



INVENTOR

Florence C. Biggert, Jr.
By Bryan Stebbins Carmichael
Her Atty

18

Aug. 25, 1925.

1,551,004

F. C. BIGGERT, JR

METHOD AND APPARATUS FOR CHARGING BILLETS INTO FURNACES

Filed Nov. 21, 1923

3 Sheets-Sheet 2

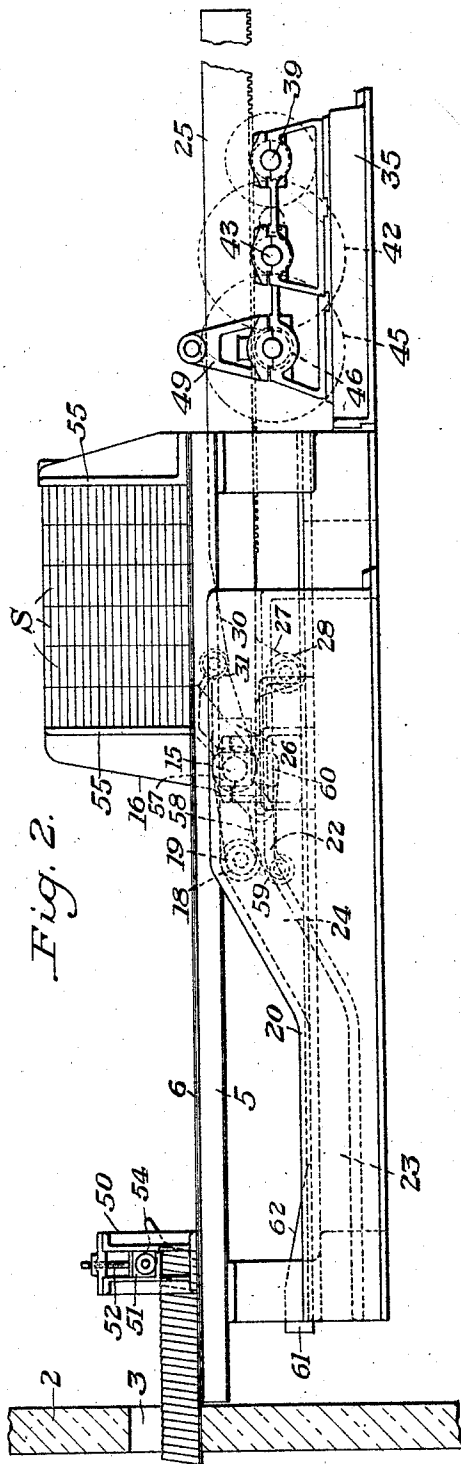
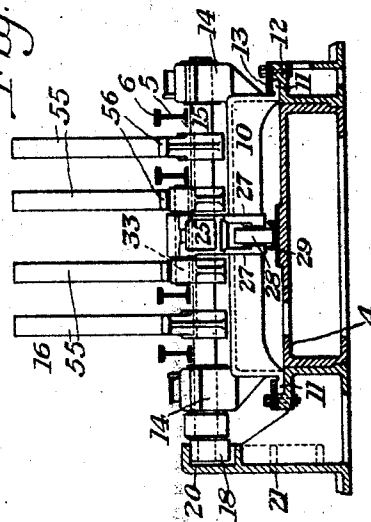


Fig. 4.



INVENTOR

Florence C. Biggart, Jr.
By Byrnes, Robbins, & Co., Attys

18

Aug. 25, 1925.

F. C. BIGGERT, JR

1,551,004

METHOD AND APPARATUS FOR CHARGING BILLETS INTO FURNACES

Filed Nov. 21, 1923

3 Sheets-Sheet 3

Fig. 3.

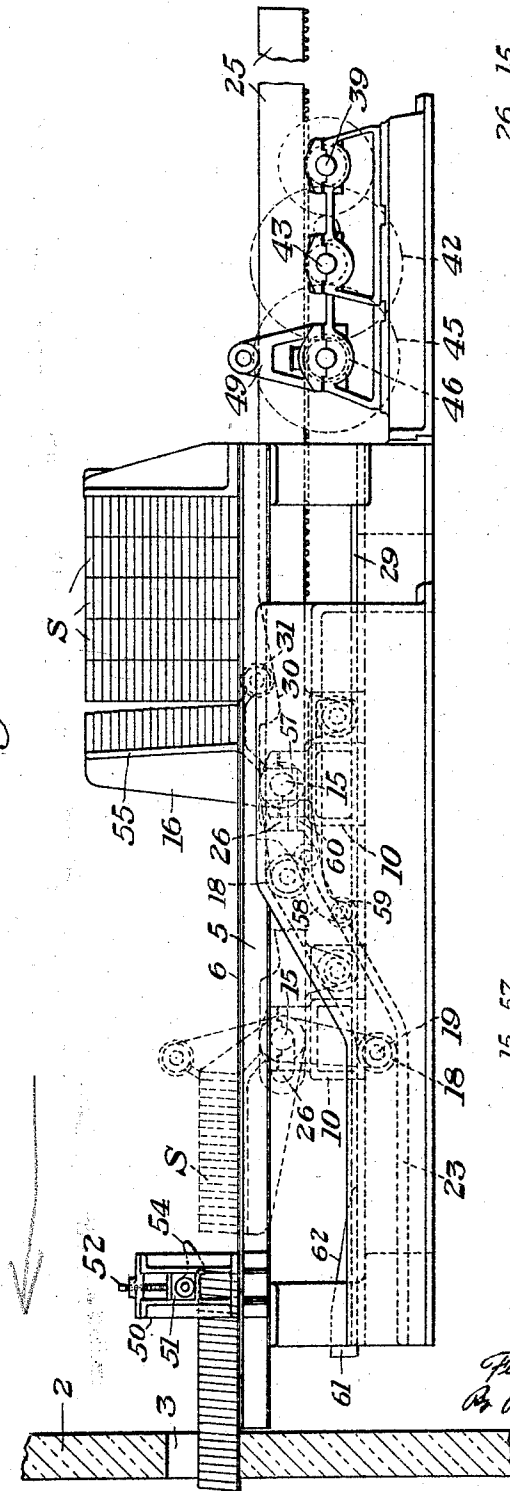
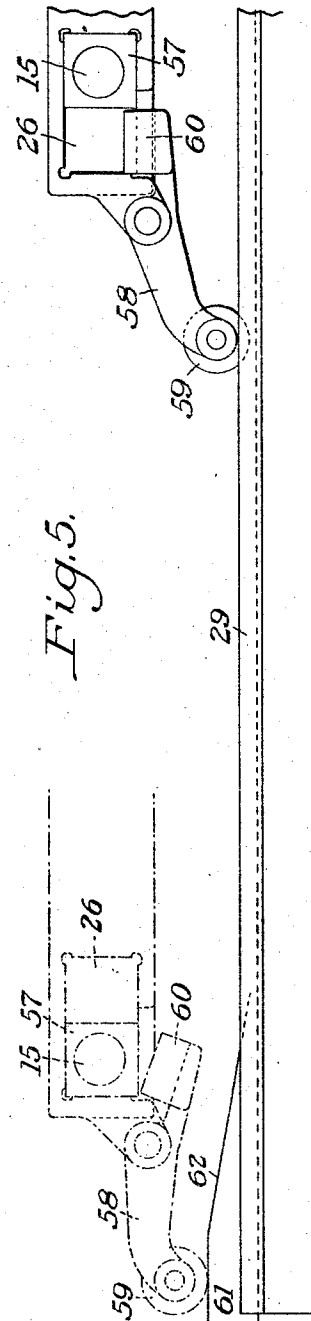


Fig. 5.



INVENTOR
Florence C. Biggert Jr
By Biggert, Atchinson & Bernick
His Atty

Patented Aug. 25, 1925.

1,551,004

UNITED STATES PATENT OFFICE.

FLORENCE C. BIGGERT, JR., OF CRAFTON, PENNSYLVANIA, ASSIGNOR TO UNITED ENGINEERING & FOUNDRY COMPANY, OF PITTSBURGH, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

METHOD AND APPARATUS FOR CHARGING BILLETS INTO FURNACES.

Application filed November 21, 1923. Serial No. 676,035.

To all whom it may concern:

Be it known that I, FLORENCE C. BIGGERT, Jr., a citizen of the United States, residing at Crafton, county of Allegheny, and State of Pennsylvania, have invented a new and useful Improvement in Methods and Apparatus for Charging Billets into Furnaces, of which the following is a full, clear, and exact description.

The present invention relates broadly to pair-heating furnaces, and more particularly to a novel method and apparatus for charging the same with bars, slabs or billets which are subsequently to be rolled into sheets.

It is customary to take these bars, slabs or billets, which for convenience will hereinafter be referred to simply as billets, as they are sheared and place them upon the charging floor near the furnace. The billets are then manually placed one at a time in front of a suitable pusher by which they are pushed into the furnace.

By the present invention I have provided a charging apparatus adapted to have placed thereon a plurality of stacks of sheared billets and to automatically bodily transfer such stacks individually into a furnace, thereby greatly decreasing the amount of manual labor heretofore involved in the charging operation and making possible an increased efficiency of the furnace.

In the accompanying drawings, there is shown, for purposes of illustration only, one embodiment of the present invention, it being understood that the drawings do not define the limits of the invention, as changes may be made in the construction and operation therein disclosed without departing from the spirit of the invention or scope of my broader claims.

In the drawings—

Figure 1 is a plan view illustrating one embodiment of my invention;

Figure 2 is a side elevation of the structure shown in Figure 1;

Figure 3 is a view similar to Figure 2 illustrating a slightly different position of the parts;

Figure 4 is a vertical transverse sectional view on the line IV—IV of Figure 1; and

Figure 5 is a detail view of detent means forming part of the apparatus.

Referring more particularly to the draw-

ings, there is illustrated a portion of the front wall 2 of a pair-heating furnace having a charging opening 3 therein.

The charging apparatus is arranged directly in front of the opening 3 and comprises a suitable frame or housing 4. The frame supports a plurality of parallel skids 5, which may be I-beams. Each I-beam is provided on its upper surface with a wear plate 6.

The charging hearth 7 of the furnace extends over and is supported upon the forward ends of the skids, the upper surface of said hearth being flush with the upper surfaces of said skids, the skids forming a slideway leading to the charging hearth. Supported upon the rear end of the skids and extending transversely thereof is a standard 8 presenting a plurality of spaced abutment faces 9 lying in a vertical plane at right angles to the longitudinal axes of the skids.

A carriage 10 is mounted in the frame 4 beneath the skids for reciprocation in a horizontal plane towards and from the charging opening 3. The carriage is provided at its ends with outwardly extending horizontal flanges 11 engaging in channels provided in the frame 4 by flanges 12 and detachable plates 13, whereby the carriage is guided and held on the frame, but may be readily detached therefrom by removing the plates 13. The carriage 10 is provided at its opposite ends with a pair of aligned bearings 14 in which a shaft 15 is journaled. The shaft has mounted thereon between the skids 5 a plurality of arms 16 adapted to cooperate with the abutments 9, as will be hereinafter explained.

On one end of the shaft 15 is secured a crank arm 17 having a roller 18 journaled upon a pin 19 carried by the free end thereof. The roller 18 engages in a channel 20 extending longitudinally of the frame 4 and provided in a wall 21 at one side thereof. The channel 20 has horizontal end portions 22 and 23 connected by an intermediate inclined portion 24.

A rack 25 is connected at its forward end to the shaft 15, the said shaft extending through an elongated slot 26 in said end of the rack, thereby providing a lost motion connection between the shaft and rack. The rack adjacent the forward end thereof

is provided with a pair of downwardly extending spaced arms 27 between which is journaled a roller 28. The roller 28 engages a channel shaped track 29 extending longitudinally of the frame 4 and centrally thereof.

The rack is provided in its upper edge adjacent its forward end with an inclined surface 30 engaged by a roller 31, the latter being journaled between a pair of arms 32 upon a pin 33 carried by the outer ends of said arms. These arms are arranged on opposite sides of the rack and are carried by the shaft 15.

The rack 25 is reciprocated by power derived from a suitable motor 34 mounted upon a suitable base 35 arranged in front of the frame 4. The driving shaft 36 of the motor carries a pinion 37 engaging a gear 38 upon a shaft 39 journaled in bearings 40 on the base 35. The shaft 39 is provided with a pinion 41 engaging a gear 42 carried by a shaft 43 parallel to the shaft 39. The shaft 43 carries a pinion 44 engaging a gear 45 and the latter carries a pinion 46 meshing with the teeth of the rack bar. Immediately above the pinion 46 there is provided a roller 47 for engagement with the upper edge of the rack bar. This roller is journaled upon a shaft 48 mounted in the upper end of a pair of standards 49 at opposite sides of the rack.

At the forward end of the slideway formed by the skids 5, retaining means is provided for engagement with the outermost billet of a stack after the latter has been pushed over the slideway past said retaining means. The retaining means comprises a pair of housings 50 at opposite sides of the slideway for bearing blocks 51 which are vertically adjustable in said housings by means of screws 52. Journaled in the bearings 51 is a shaft 53 which carries a plurality of latch arms 54. Each latch arm is provided with a beveled outer end adapted to be engaged by the stack to lift the arm and permit the stack to pass beneath the same until the rear end of the stack passes by a shoulder on the arm whereupon the latter falls by gravity and the shoulder thereon engages the end of the stack.

The hereinbefore referred to arms 16 constitute pusher means for turning a stack S to lie on its side on the slideway and for pushing said stack over said slideway and hearth 7 into the furnace. Each arm 16 is provided with an upright portion 55 to engage the side of a stack and with a portion 56 to engage the bottom of the stack. Preferably, the engaging surfaces of the portions 55 and 56 are arranged at an angle to each other slightly greater than a right angle for a purpose which will appear hereinafter.

The operation of the charging apparatus described is as follows:

A plurality of stacks of sheared billets are placed upon the skids 5 in front of the abutment means 8, the arms 16 being separated from the abutment means 8 a sufficient distance to permit the stacks to be received therebetween. The motor 34 is then operated to move the carriage 10 towards the abutment means 8 to press the stacks between the abutment means and the upright portions 55 of the arms 16 in order to even the same so that the side edges of the individual billets in each stack will all lie in the same vertical planes. After this has been done, the motor 34 will be run in the reverse direction to move the rack 25 towards the furnace. The first part of the movement of the rack 25 in this direction will serve to take up the lost motion in the connection between the end of the rack and the shaft 15 due to the elongated slot 26 in the rack through which the shaft passes. During this movement of the rack the roller 31 will ride up the incline 30 on the upper surface of the rack and cause the arms 16 to be tilted from the position shown in Figure 2 into the position shown in Figure 3. This tilting of the arms 16 will cause the portions 56 thereof to engage the bottom of the endmost stack S and lift the same off the slideway formed by the skids 5. Owing to the fact that the engaging surfaces of the portions 56 of the arms 16 lie at an obtuse angle to the engaging surfaces of the portions 55 thereof, the individual billets in the stack will lie at an acute angle to the surface of the portions 55. The tilting movement of the arms 16 from the position shown in Figure 2 to the position shown in Figure 3 is permitted by reason of the fact that the depth of the channel 20 is greater than the diameter of the roller 18 carried by the crank arm 17. Continued movement of the rack 25 towards the furnace, after the lost motion between the rack and shaft 15 has been taken up, causes the carriage 10 to be moved longitudinally of the frame 4 towards the furnace and during this movement the arms 16 are turned from the full line position shown in Figure 3 into the dotted line position shown therein by reason of the travel of the roller 18 in the inclined portion 24 of the channel 20. This turning of the arms 16 into the dotted line position thereof, shown in Figure 3, results in the stack carried by said arms being laid on its side on the slideway with the individual billets thereof inclined slightly to the rear. Further movement of the carriage 10 towards the furnace causes the portions 56 of the arms 16 to push the stack beneath the latch arms 54 until said arms fall by gravity into engagement with the end billet. The operation described may be repeated to transfer the next stack into the furnace and

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so on until all of the stacks have been transferred.

As has been explained, the first part of the movement of the rack 25 towards the furnace serves to take up the lost motion in the connection between the end of the rack and the shaft 15 and to simultaneously effect tilting of the arms 16 from the position shown in Figure 2 into the position shown in Figure 3. In the continued movement of the rack towards the furnace, after this lost motion has been taken up, the roller 18 travels in the inclined portion 24 of the channel 20, causing the turning of the arm 16 into the dotted line position thereof, shown in Figure 3. During this portion of the movement of the carriage 10 the weight of the stack carried by the arm 16 tends to cause a sudden acceleration of the movement of the carriage 10 towards the furnace which, if not prevented, would bring the shaft 15 to the opposite end of the slot 26 with a jar, tending to overturn the billets in the stack and also tending to cause the entire stack to slide off the arms.

In order to prevent the carriage 10 from overrunning the rack 25 in the above manner, I provide detent means on the end of the rack for engagement with a bearing block on the shaft 15. Referring to Figure 5, the shaft 15 is provided with a bearing block 57 sliding in the slot 26. Pivoted on the end of the rack is a lever 58 carrying a roller 59 at its forward end which normally runs in the track 29. The rear end of the lever has formed thereon an integral detent 60 adapted to engage the front side of the bearing block 57 when such bearing block is at the righthand end of the slot 26, as shown at the right of Figure 5 and which corresponds to the position of the parts as shown in Figure 3. It will be apparent that the weight of the forward arm of the lever 58 and of the roller 59 carried thereby is sufficient to cause the detent 60 to automatically move into position in front of the bearing block 57 as soon as the latter reaches the righthand end of the slot 26 during the first portion of the movement of the rack 25 towards the furnace, in which movement of the rack the lost motion between the same and the carriage 10 is taken up preliminary to moving the carriage towards the furnace. Positioned in the forward end of the track 29 is a block 61 having an inclined surface 62 upon which the roller 59 travels during the latter portion of the movement of the carriage towards the furnace. The movement of the roller up this inclined surface effects swinging of the detent 60 downwardly into the position shown at the left in Figure 5, thereby permitting the rack 25 during the first portion of its movement away from the furnace to move relatively to the shaft 15 until the bearing block 57 is positioned

in the lefthand end of the slot 26, whereupon the carriage 10 is moved to the right with the rack.

It will be seen that the provision of the detent means described above enables the arms 16 to be given a preliminary tilting movement to lift a stack off the slideway formed by the skids 5 and then to be gradually turned into a substantially horizontal position to place the stack on its side on the slideway with the individual billets thereon inclined to the rear without the mechanism being subjected to any sudden jar tending to cause the stack to slide off the arms.

The advantages of the present invention arise from the provision of charging apparatus whereby the billets to be charged into a furnace may be handled in stacks, thereby decreasing the amount of manual labor required in the ordinary method of handling the billets individually and rendering it possible to charge the billets into the furnace much more rapidly than by the prior method. This enables stacks of billets as formed by the shear to be bodily transferred to the charging apparatus and charged into the furnace.

While in the illustrated embodiment of the invention the stacks of billets are placed in upright position upon the rear end portion of the slideway formed by the disks 5, it may be desirable in certain cases to place the stacks upon a rack which might be at an elevation to the slideway.

I claim:

1. In a method of charging billets into a heating furnace, the steps consisting in bodily placing a stack of the billets in upright position on a slideway leading into the furnace, evening the sides of said stack, turning said stack so as to lie on its side on said slideway, and pushing said stack into the furnace, substantially as described.

2. In a method of charging billets into a heating furnace, the steps consisting in bodily placing a stack of the billets on a slideway leading into the furnace so as to lie on its side thereon, with the individual billets inclined rearwardly, and pushing said stack into the furnace while maintaining said inclination of the billets, substantially as described.

3. In a method of charging billets into a heating furnace, the steps consisting in placing a stack of the billets in upright position on a slideway leading into the furnace, turning said stack to lie on its side on said slideway, and pushing said stack into the furnace, substantially as described.

4. In a method of charging billets into a heating furnace, the steps consisting in placing a stack of the billets in upright position on a slideway leading into the furnace, turning said stack to lie on its side on said slideway with the individual billets

inclined rearwardly, and pushing said stack into the furnace while maintaining said inclination of the billets, substantially as described.

5 5. In a method of charging billets into a heating furnace, the steps consisting in placing a plurality of stacks of the billets in a row in side-by-side relationship on a slideway leading into the furnace, even-
10 ing the sides of said stacks, turning the end stack nearest the furnace to lie on its side on said slideway, pushing said stack into the furnace, and repeating the two last mentioned steps with each succeeding stack
15 until all of said stacks have been charged into the furnace, substantially as described.

6. In an apparatus for charging billets into a heating furnace, a slideway adapted to receive a stack of the billets in upright
20 position thereon, means associated with said slideway for turning said stack to lie on its side on said slideway and for pushing the same over slideway into a furnace, and means for actuating said first mentioned
25 means, substantially as described.

7. In an apparatus for charging billets into a heating furnace, a slideway adapted to receive a stack of the billets in upright
30 position thereon, pusher means associated with said slideway adapted to engage the bottom and one side of said stack, said pusher means being mounted for rocking
35 movement to turn said stack to lie on its side on said slideway and for movement longitudinally of said slideway to push said stack into a furnace, and means for imparting said movements to said pusher
40 means, substantially as described.

8. In an apparatus for charging billets into a heating furnace, a slideway adapted to receive a stack of the billets in upright
40 position thereon, pusher means associated with said slideway for turning said stack to lie on its side on said slideway with the
45 individual billets inclined rearwardly and for pushing said stack over said slideway into a furnace while maintaining said inclination of said billets, and means for actuating said pusher means, substantially as
50 described.

9. In an apparatus for charging billets into a heating furnace, a slideway adapted to receive a stack of the billets in upright
55 position thereon, pusher means associated with said slideway having a portion for engagement with a side of said stack and a portion for engagement with the bottom thereof, the engaging surface of the latter portion lying in a plane at an obtuse
60 angle to the engaging surface of the first mentioned portion, said pusher means being mounted for rocking movement to turn said stack to lie on its side on said slideway with the individual billets of said stack inclined
65 rearwardly and for movement longitudinal-

ly of said slideway to push said stack into a furnace, and means for imparting said movements to said pusher means, substantially as described.

10. In an apparatus for charging billets into a heating furnace, a slideway adapted to receive a stack of the billets in upright
70 position thereon, abutment means extending transversely of said slideway and adapted to engage one side of said stack, pusher
75 means mounted for movement towards said abutment means to engage the other side of said stack and press said stack between said pusher means and abutment means and
80 for movement away from said abutment means to turn said stack to lie on its side on said slideway and push the same over said slideway into a furnace, and means for imparting said movements to said pusher
85 means, substantially as described.

11. In an apparatus for charging billets into a heating furnace, a slideway adapted to receive a plurality of stacks of the billets arranged in a row in side-by-side relation-
90 ship thereon, abutment means extending transversely of said slideway and adapted to engage one end of said row, pusher means mounted for movement towards said abutment means to engage the other end of
95 the row and press said stacks between said pusher means and the abutment means to even the same and for movement away from said abutment means to turn the end stack to lie on its side on said slideway and push
100 the same over said slideway into a furnace, and means for imparting said movements to said pusher means, substantially as described.

12. In an apparatus for charging billets into a heating furnace, a slideway adapted to receive a stack of the billets in upright
105 position thereon, a carriage extending transversely of said slideway and slidable longitudinally thereof, pusher means pivotally mounted on said carriage, means for reciprocating said carriage and means coop-
110 erating with said pusher means for causing the same to engage said stack upon movement of said carriage in one direction and for causing it to turn said stack to lie on
115 its side on said slideway and push the same over said slideway into a furnace upon movement of said carriage in the opposite direction, substantially as described.

13. In an apparatus for charging billets into a heating furnace, a slideway adapted to receive a stack of the billets in upright
120 position thereon, a carriage extending transversely of said slideway and slidable longitudinally thereof, a rock-shaft extending transversely of said slideway and journaled in said carriage, pusher means carried by
125 said rock-shaft and adapted to engage a side and the bottom of said stack, means for reciprocating said carriage, and means co-

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operating with said rock-shaft for causing said pusher means to engage said stack upon movement of said carriage in one direction and for causing it to turn said stack to lie on its side in said slideway and push the same over said slideway into a furnace upon movement of said carriage in the opposite direction, substantially as described.

14. In an apparatus for charging billets into a heating furnace, a slideway adapted to receive a stack of the billets in upright position thereon, a carriage extending transversely of said slideway and slidable longitudinally thereof, a rock-shaft extending transversely of said slideway and journaled in said carriage, pusher means carried by said rock-shaft and adapted to engage a side and the bottom of said stack, including a member having a lost motion connection with said rock-shaft, means cooperating with said rock-shaft for causing said pusher means to engage said stack upon movement of said carriage in one direction and for causing it to turn said stack to lie on its side on said slideway and push the same over said slideway into a furnace upon movement of said carriage in the opposite direction, and cooperating means on said rock-shaft and member for causing said pusher means to lift said stack off the slideway and initially tilt the same during the initial movement of said member towards the furnace in taking up the lost motion between said member and rock-shaft, substantially as described.

15. In an apparatus for charging billets into a heating furnace, a slideway adapted to receive a stack of the billets in upright position thereon, pusher means associated with said slideway for turning said stack to lie on its side on said slideway and for pushing the same over said slideway into a furnace, means for actuating said pusher means, and adjustably mounted latch means

associated with said slideway for engagement with the outermost billet in a stack being pushed over said slideway, substantially as described.

16. In a furnace charging apparatus, a support for a stack of billets, and means cooperating with said support to initially tilt a stack of billets placed in upright position thereon, turn the same through substantially 90°, and then move the turned stack longitudinally of the apparatus, substantially as described.

17. In a furnace charging apparatus, a support for a stack of billets, and means cooperating with said support to even a stack of billets placed in upright position thereon, turn the stack through substantially 90°, and then move the turned stack longitudinally of the apparatus, substantially as described.

18. In a furnace charging apparatus, a support for a stack of billets, and means cooperating with said support to turn a stack placed in upright position thereon through substantially 90° and then move the turned stack longitudinally of the apparatus, substantially as described.

19. The combination with a heating furnace having a charging hearth, of charging means associated with said hearth adapted to support a plurality of stacks of sheared material and individually transfer said stacks over said hearth into said furnace, substantially as described.

20. The combination with a heating furnace having a charging hearth, of charging means associated with said hearth adapted to support a plurality of stacks of sheared material in upright position and individually transfer said stacks over said hearth into said furnace, substantially as described.

In testimony whereof I have hereunto set my hand.

FLORENCE C. BIGGERT, JR.