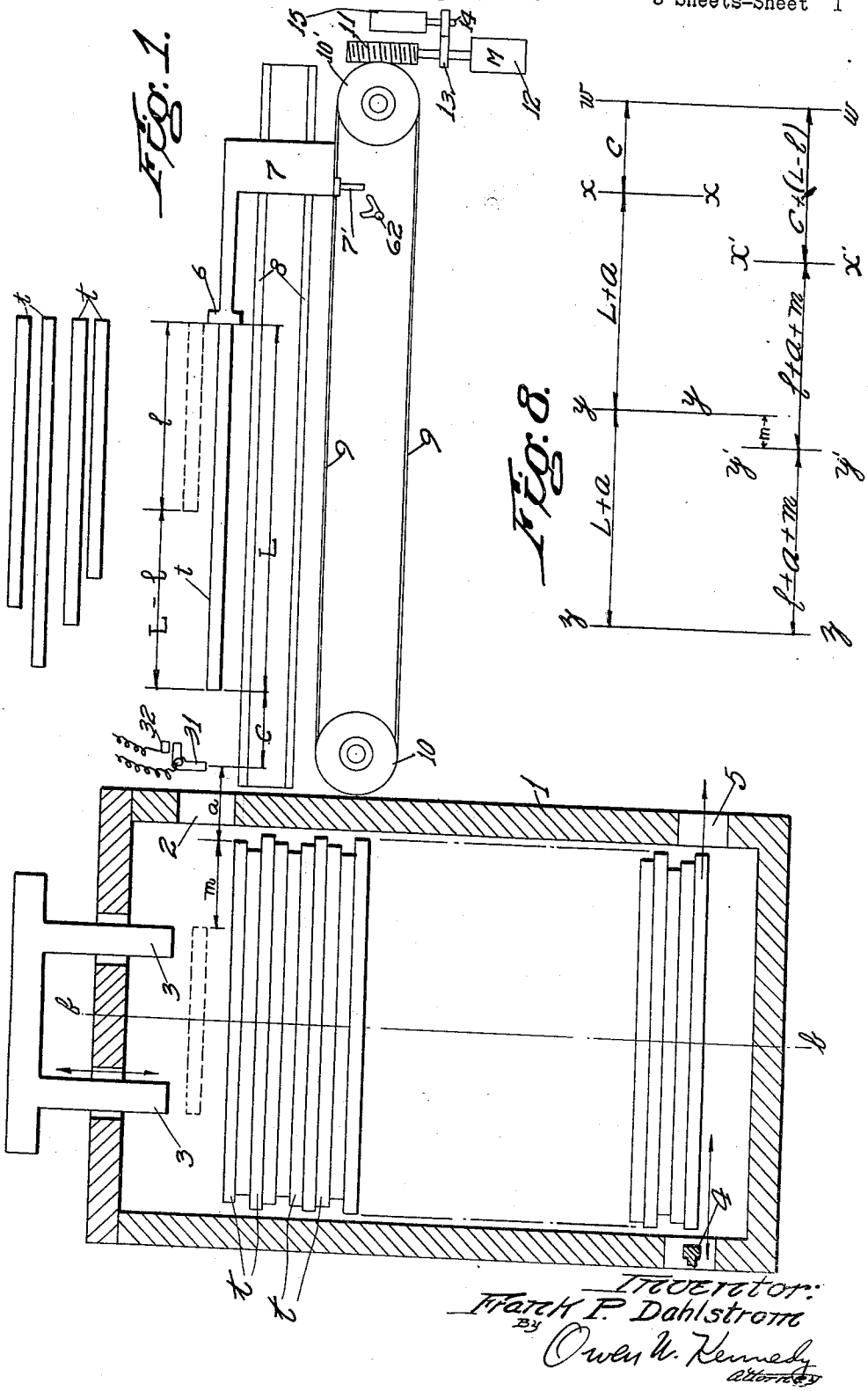
Oct. 4, 1932. F. P. DAHLSTROM 1,880,374

AUTOMATIC POSITIONING MECHANISM FOR BILLETS AND THE LIKE

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Oct. 4, 1932. F. P. DAHLSTROM 1,880,374

AUTOMATIC POSITIONING MECHANISM FOR BILLETS AND THE LIKE

Filed Aug. 4, 1930 3 Sheets-Sheet 2

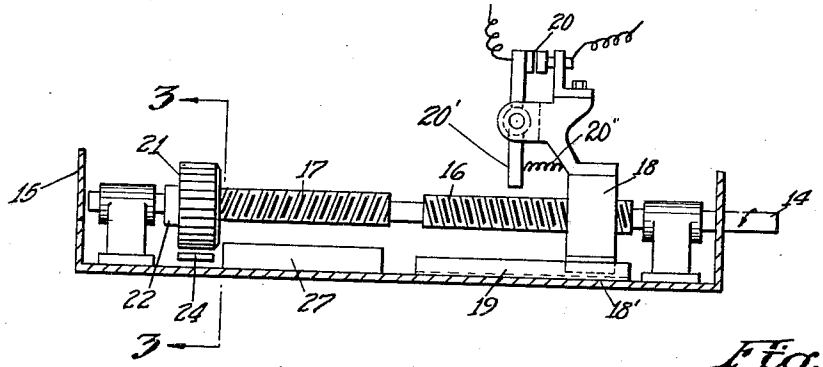


Fig. 2.

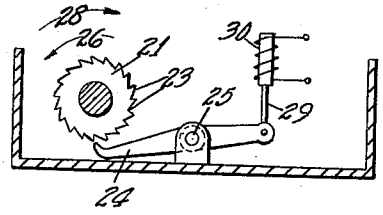


Fig. 3.

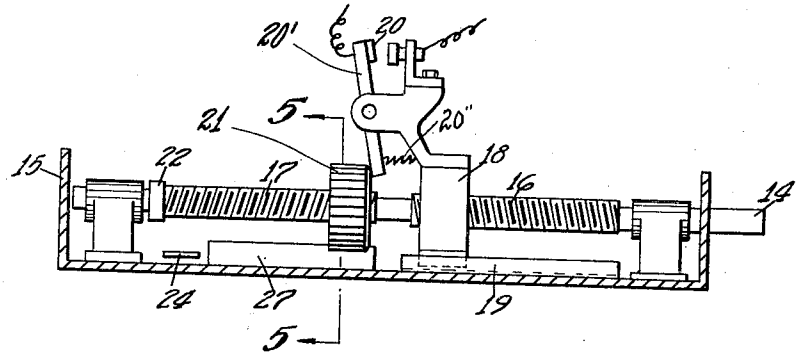


Fig. 4.

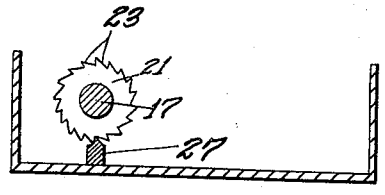


Fig. 5.

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AUTOMATIC POSITIONING MECHANISM FOR BILLETS AND THE LIKE

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Fig. 6.

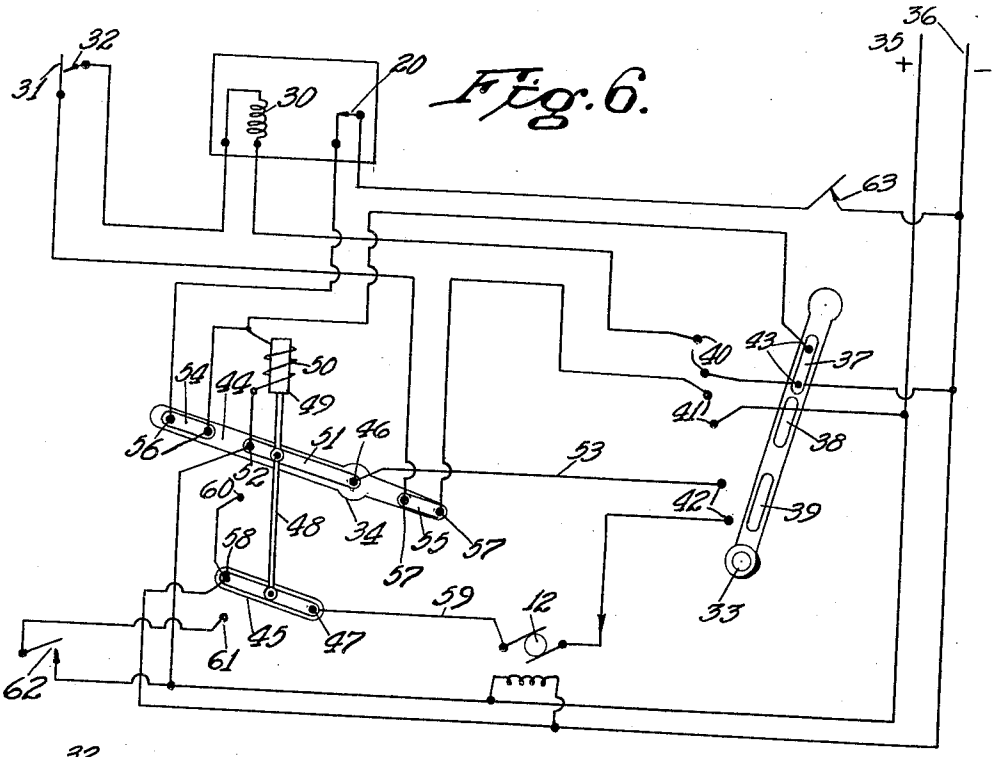
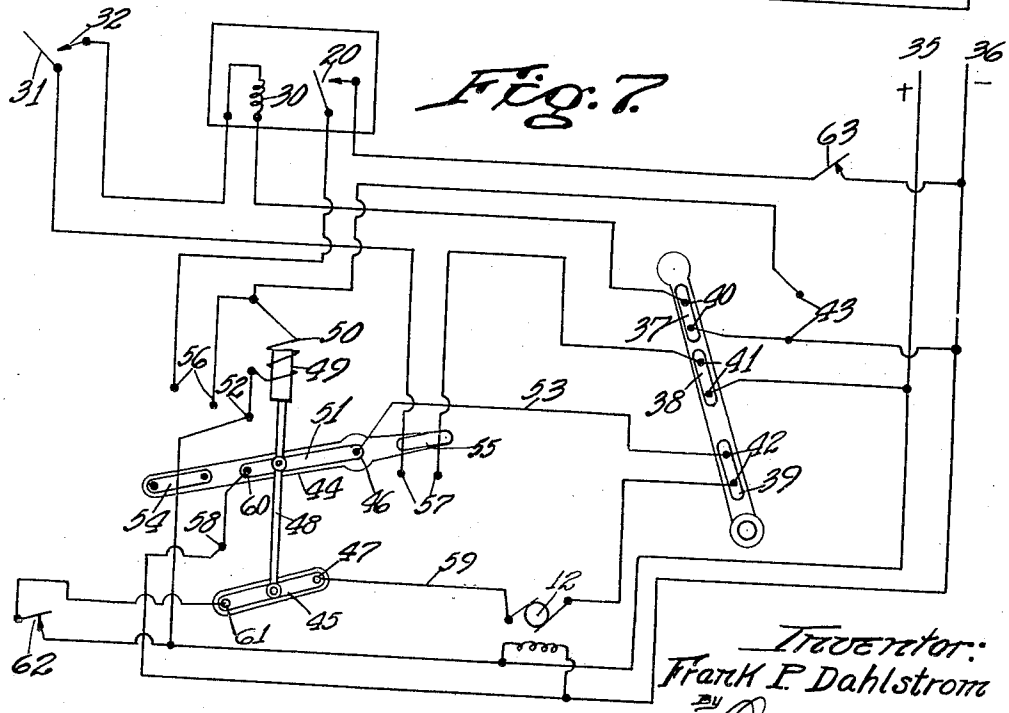


Fig. 7.



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UNITED STATES PATENT OFFICE

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AUTOMATIC POSITIONING MECHANISM FOR BILLETS AND THE LIKE

Application filed August 4, 1930. Serial No. 473,099.

The present invention relates to the mechanical handling and positioning of elongated pieces of stock. The principles of the invention can be made use of in a variety of ways, but they are particularly applicable to the mechanical handling and symmetrical positioning of unequal-length billets or the like, such as are presented successively for charging into a furnace or other chamber.

For the charging of billets into a furnace, one well known type of apparatus provides a mechanical pusher which engages the rear end of each billet to move the same longitudinally through an opening in the furnace wall, until the entire length of the billet is within the furnace chamber; thereupon, the thus-charged billet (and those preceding it in the furnace) is pushed broadside toward the discharge end of the furnace to make room for the next billet to be delivered longitudinally by the charging pusher. If the strokes of the latter are of uniform amplitude, it follows that inequalities in the lengths of the billets charged thereby will produce an unsymmetrical and unbalanced arrangement of the billets within the furnace chamber, giving rise to unequal heating effects and also to the possibility of disarrangement of the charged material, by the action thereon of the broadside pushing devices. Moreover, these difficulties cannot be overcome by using a charging pusher whose stroke is variable at the will of an operator, since the operator who would make such adjustments is unable to observe the progress across the furnace floor of the front end of any billet being charged; therefore any manual adjustment of the pusher's strokes would be purely a matter of guesswork.

This invention overcomes the above-mentioned difficulties by the provision of mechanism which, in the handling of successive billets or other pieces of varying lengths, automatically procures the advance of each piece through such a distance as will bring the longitudinal center of every piece to the same point in the furnace or other chamber; in this way, regardless of variations in the lengths of the charged pieces, a symmetrical arrangement of the same, with respect to the center line of the receiving chamber is obtained, thereby assuring, in the case of a furnace chamber, uniform heating effects, and also the proper operation of the broadside pushers against the mass of charged pieces within the furnace. According to the invention, each operative movement of the charging pusher, always from the same starting point, serves initially to carry each piece into contact with a flag or trigger having a fixed location; the distance through which the pusher moves to effect this initial contact is a variable, bearing an inverse relation to the length of the piece; and thereafter, the amplitude of the pusher's further movement, to complete the charging and positioning operation on the piece, is determined, in response to said flag contact, by the amplitude of said variable initial movement so as to reverse the pusher when its distance from a predetermined point (on the center line of the furnace) is one-half the length of the piece being charged.

An adaptation of the foregoing principles to a furnace charging mechanism, operating automatically to center the pieces in the furnace, will now be described in detail, reference being had in this connection to the accompanying drawings, in which—

Fig. 1 is a diagrammatic view of the charging mechanism of the invention, shown in relation to a billet-heating furnace.

Fig. 2 is a large scale elevational view of a control device for the furnace pusher.

Fig. 3 is a sectional view on the line 3—3 of Fig. 2.

Fig. 4 is a view similar to Fig. 2, showing the control device in a different position.

Fig. 5 is a sectional view on the line 5—5 of Fig. 4.

Figs. 6 and 7 are wiring diagrams, illustrating the electrical circuits at different stages in the operation of the charging mechanism.

Fig. 8 is a diagrammatic view, by which the operation of the invention may be demonstrated.

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

Fig. 1 shows in sectional plan view a furnace 1 having a charging opening 2, through

which successive billets *t*, *t*, of varying lengths, are adapted to be projected longitudinally, each billet coming to rest on the floor of the furnace, in position to be acted upon by the usual broadside pushers 3, 3. The latter, after each billet-charging operation, are usually given a single reciprocation, whereby to impart to the newly-charged billet (and those preceding it in the furnace) a broadside movement of approximately the width of a billet; in this manner, the way is cleared each time for the charging of the next billet, and the farthest-advanced billet in the furnace is brought into line with a discharging pusher 4 at the other end of the furnace, which is operated to procure the endwise delivery of the successive billets through an opening 5.

The endwise charging movement of each billet, through opening 2, is effected in the present instance by a pusher head 6, suitably mounted in overhanging relation upon a reciprocatory carrier 7, the head 6 being adapted to pass through opening 2 well into the furnace when the carrier approaches the left hand limit of its movement, Fig. 1. The carrier 7 runs on suitable guides or rails 8, 8, being moved in any suitable way as by a cable or chain 9 attached thereto and passing around the pulleys 10, 10′, the last named, as here shown, being the driving pulley for said cable, and for this purpose being suitably connected, as by reduction gearing 11, to the shaft of a reversible electric motor 12. Other reduction gearing 13 connects said motor shaft to the shaft 14 of a control device 15, the latter being of the general construction shown in Fig. 2.

Referring to Fig. 2, and also to Figs. 3, 4 and 5, the shaft 14 provides oppositely-threaded portions 16 and 17, the former fitted with a nut 18 which is compelled always to travel longitudinally when the shaft 14 rotates by reason of being restrained against rotation, as for example, by the reception of a tongue 18′ thereon in an elongated slot or guideway 19. The travelling nut 18 carries a normally-closed switch 20, contained in an electric circuit hereinafter to be described that controls the reversal of motor 12.

The other oppositely threaded portion 17 of shaft 14 has fitted thereto a nut 21, normally free to rotate in unison with said shaft when disposed adjacent to a collar or stop 22 thereon, as shown in Fig. 2. The periphery of nut 21 provides equally spaced ratchet teeth 23, as shown in Figs. 3 and 5, with which a pawl 24, pivoted at 25, is adapted to cooperate, when the nut 21 is at the outer end of screw portion 17 against the collar 22 and directly over said pawl, as shown in Fig. 2. Under these conditions, so long as the pawl remains out of engagement with teeth 23, the nut 21 will turn in unison with the shaft, in the absence of endwise movement thereon; when the pawl 24 is rocked, so as to engage the teeth, the nut 21 cannot rotate in the direction of arrow 26, Fig. 3, and if this be the direction of rotation of the shaft, said nut will start to move inwardly on the screw portion 17. Such inward movement will continue, even after the teeth 23 have left the pawl 24, because said teeth will then be in engagement with an elongated stationary projection 27 (see Fig. 5) which holds said nut against rotation. If the direction of rotation of shaft 14 is that of the arrow 28, Fig. 3, when the pawl 24 engages with teeth 23, the nut 21, when disposed against the collar 22, will turn with said shaft, because the teeth 23 can ratchet past the pawl 24.

The pawl 24, as shown in Fig. 3, has a link connection 29 with the plunger of a solenoid 30; when the latter is energized, said pawl is prevented from engaging the teeth 23; deenergization of said solenoid, as by breaking of the electrical circuit in which it is contained, renders said pawl operative to hold the nut 21 against rotation, as above described. As shown in Fig. 1, a pivoted flag or trigger 31 is disposed adjacent the charging opening 2 in position to be struck and rocked by the front end of each billet successively acted upon by the charging pusher 6. In its normal position, in the absence of billet engagement, said flag or trigger 31 engages with a stationary contact 32, thereby to close an electrical circuit which, as hereinafter described, contains the solenoid 30, whose energization keeps the pawl 24 out of action. At a certain point in each charging movement of pusher 6, the billet being charged strikes the trigger 31, and opens this circuit at the contact 32, thereby deenergizing the solenoid 30 and, through pawl 24, inaugurating the inward travel of nut 21 along screw portion 17; this point comes at different times, depending upon the length of the billet being charged; with a long billet, it comes early in the charging movement of the pusher, and with a short billet it comes later.

Referring now to the wiring diagram of Figs. 6 and 7, the motor 12, switch 20, solenoid 30 and flag switch 31, 32 are shown in their respective circuits in connection with a control switch 33 and a double pole reversing switch 34, the electrical current supply having its plus and minus sides at 35, 36, respectively. The master switch carries three bars 37, 38 and 39 which, in the "on" position of said switch shown by Fig. 7, connect respectively the pairs of spaced stationary contacts 40, 40, 41, 41, and 42, 42; in the "off" position of said switch shown in Fig. 6, the bar 37 connects the pair of spaced stationary contacts 43, 43. The reversing switch 34 comprises members 44 and 45, pivoted respectively at 46 and 47, and connected by a link 48 for movement in unison. Said movement is effected by the plunger 49 of a solenoid 50; when the latter is energized, the switch bars 44 and 45

occupy the positions shown in Fig. 6. In this position, a bar 51 of member 44 connects a stationary contact 52 of solenoid 50 with the pivot 46, the latter having a conductor 53 running to one of the stationary contacts 42; also the bars 54 and 55 of member 44 connect in this position the pairs of spaced stationary contacts 56, 56 and 57, 57, respectively; also in this position, the member 45 connects a stationary contact 58 with the pivot 47, the latter having a conductor 59 running to the motor 12. In the other position of reversing switch 34, the bar 51 connects a fixed contact 60 with pivot 46, and the member 45 connects a fixed contact 61 with pivot 47.

Let it be assumed that the pusher 6 is in its full retracted position shown in Fig. 1, this corresponding to the maximum separation of the nuts 18 and 21, as indicated on Fig. 2, the motor 12 being inoperative, and the shaft 14 at rest. By any suitable means, not shown, one of the billets *t* is deposited in the path of pusher 6, in line with opening 2, for charging into the furnace. In order to initiate a single cycle of pusher operation, the control switch 33 is first moved into the "off" position shown by Fig. 6; this establishes a circuit for the energization of solenoid 50, the current flowing by conductor 35 to contact 52, through the solenoid 50, and thence by way of bridged contacts 43, 43 to the minus side 36 of the supply. With the solenoid 50 thus energized, the reversing switch 34 moves into the position shown in Fig. 6, and this establishes a holding circuit for solenoid 50, in parallel with the bridged contacts 43, 43, the flow of current from said solenoid being through the bridged contacts 56, 56, and then through the closed switch 20 on nut 18 and the closed switch 63 back to the minus side 36 of the electrical supply. In this position of the reversing switch, the motor 12, when its circuit is completed, will run in the direction that produces the charging stroke of pusher 6, being the direction corresponding to rotation of shaft 14 in the direction of arrow 26, which causes the nuts 18 and 21 to approach each other.

To inaugurate the operation of motor 12 and its control device 15, the switch 33 is shifted into the "on" position shown in Fig. 7; by this movement, notwithstanding the opening of contacts 43, 43, by disengagement of the bar 37, the energized condition of solenoid 50 remains undisturbed, because of the holding circuit established for such solenoid through the bridged contacts 56, 56, and closed switch 20. Hence, initially, the reversing switch 34 maintains the position shown in Fig. 6, notwithstanding movement of control switch 33 to the "on" position. Referring to Fig. 6, and assuming control switch 33 in its "on" position, two circuits are established; one of them energizes the solenoid 30 to draw the pawl 24 away from the nut 21, the flow of current, in this instance, being through the bridged contacts 41, 41, bridged contacts 57, 57, closed flag switch contacts 31, 32, solenoid 30, and bridged contacts 40, 40 to the minus side 36 of the electrical supply. The other circuit so established is through the motor 12, to inaugurate the latter's operation; the flow of current in this instance is by conductor 35 to contact 52, thence through bar 51, pivot contact 46, conductor 53, bridged contacts 42, 42 through the motor 12 and then by way of conductor 59, pivot contact 47, switch member 45 and contact 58 to the minus side 36 of the supply line.

As the carrier 7 starts to travel inwardly from its full-retracted position, Fig. 1, a projection 7′ thereon moves into closed position a switch 62 (Figs. 6 and 7) which connects the open contact 61 with the plus side 35 of the electrical supply. The inward movement of carrier 7 is accompanied by rotation of shaft 14 in the direction of arrow 26, and this produces inward movement of nut 18, but not of nut 21, the latter having been released by pawl 24, so that it rotates initially in unison with shaft 14. However, when the billet *t*, under the influence of inwardly moving pusher 6, contacts at its front end with the trigger 31, the latter is moved away from contact 32, thereby opening the circuit of the solenoid 30; thereupon, by the deenergization of said solenoid, the pawl 24 becomes operative to hold the nut 21 against rotation, whereby inward movement of said nut along the threaded portion 17 of shaft 14 is inaugurated. From this point on, in the charging stroke of pusher 6, both nuts 18 and 21 participate in the approach toward each other; finally, at some point (the location of which depends upon how soon the nut 21 may have started its inward movement), the nut 21 contacts with the movable member 20′ of switch 20 on nut 18, thereby opening said switch, and breaking the circuit of the solenoid 50.

Thereupon, by the deenergization of solenoid 50, the reversing switch 34 shifts into the position shown by Fig. 7, procuring reversal of the direction of current through motor 12, the flow of current now being from conductor 35 through closed switch 62 to contact 61, thence by switch member 45, pivot contact 47 and conductor 59 to the motor, with return to the minus side 36 of the electrical supply through contacts 42, 42, bar 39, conductor 53 and contacts 46 and 60. In this way, by reversal of motor 12, the inward stroke of pusher 6 is terminated and its outward or return stroke is begun,—the shaft 14 also being reversed, so that the nuts 18 and 21 begin to recede from each other. Although this recession permits the switch 20 to close (under the action, for example, of a spring 20″), there is no ensuing reenergization of solenoid 50 to shift the reversing switch 34, since the holding circuit of said solenoid 50

has been opened at the contacts 56, 56 by the aforesaid reversal of switch 34. Also, notwithstanding the return of switch 31, 32 to closed position (in consequence of billet t moving completely past the same), there is no effect on the solenoid 30, since the reversal of switch 34 has broken the circuit of said solenoid at the contacts 57, 57, while the nut 21 is being held against rotation by projection 27; hence toward the end of the return movement, the receding nut 21 encounters the pawl 24, and continues to recede until it strikes the collar or stop 22; thereafter, while the nut 18 is completing its return movement, said nut 21 turns with shaft 14 in the direction of arrow 28, being permitted to ratchet past the pawl 24 on account of the shape of its teeth 23. With the arrival of the carrier 7 at its full retracted position, its projection 7′ strikes the switch 62 to open the same, thereby breaking the circuit of motor 12 and causing stoppage of the mechanism at the completion of a single cycle of operations thereof. In order to repeat the cycle, for the charging of the next presented billet t, the control switch 33 must first be moved into its "off" position (Fig. 6) to energize the solenoid 50 and thereby restore the reversing switch 34 to the position shown in Fig. 6; thereafter, the control switch 33 is shifted to the "on" position (Fig. 7) to start the motor 12.

The diagram of Fig. 8, taken in connection with Fig. 1, establishes the capacity of the above described mechanism to centralize different-length billets in the furnace 1, so that invariably each billet is brought to rest in the furnace with its longitudinal center on the center line b—b of said furnace. Assume L as the length of the longest billet receivable in the furnace, c as the distance the retracted pusher 6 must travel before billet L strikes the switch 31, 32, and a as the distance from switch 31, 32 to the stopping point of pusher 6 when the latter centers billet L in the furnace. Thus the total pusher movement, in the case of billet L, is $c+L+a$,—c representing the initial independent travel of nut 18, and $L+a$ representing the joint travel of the two nuts 18 and 21. On Fig. 8, line w—w represents the full retracted position of pusher 6, and also the corresponding position of nut 18; line z—z represents the outermost position of nut 21; line x—x represents for billet L the travel of pusher 6 through distance c to open switch 31, 32, said distance c measuring the indepenednt travel of nut 18; and line y—y, midway between z—z and x—x, represents the meeting point of the nuts 18 and 21, to open switch 20,—the travel of each nut in this case being measured by the distance $L+a$.

For a shorter billet l, the travel of pusher 6 required to effect opening of switch 31, 32, is $c+(L-l)$; on Fig. 8, this distance is represented as requiring initial pusher movement from line w—w to line x'—x', and this distance, $c+(L-l)$, is a measure of the independent movement of nut 18 when the shorter billet l is being charged. The line y'—y', midway between z—z and x'—x', represents the meeting point of the two nuts 18 and 21 in their joint movements, to complete the charging of the shorter billet l.

Now the pusher 6, after moving a distance $c+(L-l)$ to engage the short billet l with switch 31, 32, would thereafter move the distance $l+a$ to travel to the point of its reversal for the long billet L. But as shown in Fig. 8, the pusher goes farther always for the short billet than for the long billet, — the excess of travel being represented in Fig. 8 by the distance m between the median lines y—y and y'—y'. In other words, as shown in Fig. 1, the pusher travel to complete the charging of the short billet l, after engaging the latter with the switch 31, 32, is first through a distance $l+a$ (to the point of pusher reversal for the long billet L), and then through a certain further distance, here called m. Therefore on Fig. 8, the travel of each nut 18 and 21, in the period of their joint approach, is measured by the distance $l+a+m$.

Now the total travel of the two nuts 18 and 21, from rest position to meeting position in the cases of the two billets L and l, must always be the same; therefore, from Fig. 8, in terms of total nut travel for the two cases comes the equation:—

$$c+L+a+L+a=c+(L-l)+l+a+m+l+a+m.$$

Solving this for m, I have:—

$$c+2L+2a=c+L+l+2a+2m$$

or

$$2L-L-l=2m$$

or

$$L-l=2m$$

or

$$\frac{L-l}{2}=m.$$

In other words, the distance m, Fig. 1, is always one-half the difference of the lengths L and l; that is to say, for any billet l shorter than billet L, the switch 20 will open so as to reverse the pusher 6, when the latter has moved inwardly past the rear end of billet L, a distance $\frac{L-l}{2}$; consequently each such shorter billet will come to rest with its longitudinal center coinciding with the center line b—b of the furnace, (the same as assumed for billet L), because that is the only condition which establishes $\frac{L-l}{2}$ as the projection of length L beyond length l.

In the operation of the above described mechanism, if at any time it is desired to interrupt the action of pusher 6 on any piece of stock, the operator can simply move the control switch 33 to an intermediate position, between the off position shown in Fig. 6 and the on position shown in Fig. 7, thereby breaking the circuit of motor 12. Also, before the charging movement of any piece of stock is completed, the pusher 6 can, if desired, be reversed by the manual opening of a normally-closed switch 63, Figs. 6 and 7, in the circuit of the switch 20, —such opening breaking said circuit and procuring deenergization of the solenoid 50 to throw the reversing switch 34.

I claim,

1. In mechanism of the class described, a charging member, means for reciprocating said member to produce, by its travel in one direction, the endwise charging movements of successively-presented pieces of different lengths, and automatic means for reversing said charging member in response to its arrival, on each charging movement, at a point whose distance from a predetermined point is substantially one-half the length of the piece being charged.

2. In mechanism of the class described, a charging member, means for reciprocating said member to produce, by its travel in one direction, the endwise charging movements of successively-presented pieces of different lengths, and means responsive to the length of each piece for establishing the amplitude of the charging movement of said member for said piece.

3. In mechanism of the class described, a reciprocatory member whose movements in one direction produce the endwise charging movements of successively-presented pieces of different lengths, and means for varying the amplitude of such movements inverse ratio to the lengths of said pieces.

4. In mechanism of the class described, a charging member, means for reciprocating said member to produce, by its travel in one direction, the endwise charging movements of successively-presented variable length pieces, and means responsive to the length of each piece for establishing the amplitude of the charging movement of said member on said piece.

5. In mechanism of the class described, a reciprocatory member whose movements in one direction procure the endwise charging and positioning of successively-presented pieces, and means controlled by the length of each piece for establishing the point at which the charging movement of said member on said piece is terminated.

6. In mechanism of the class described, a reciprocatory member for the endwise charging and positioning of successively-presented pieces, and means controlled by the length of each piece for establishing the point at which the charging movement of said member on said piece is reversed.

7. In mechanism of the class described, a reciprocatory member for the charging and positioning of successively-presented pieces, a device engaged by each piece in its charging movement, and means responsive to the distance moved by said member in engaging each piece with said device for determining the amplitude of the subsequent charging movement of said member on said piece.

8. In mechanism of the class described, a reciprocatory member for the endwise charging and positioning of successively-presented pieces of different lengths, a device adapted to be operated by each piece in its charging movement, and means for proportioning the charging movement of said member, following operation of said device by a piece being charged, to the amplitude of the charging movement that produced such engagement.

9. In mechanism of the class described, a reciprocatory member for the charging and positioning of successively-presented pieces of different lengths, and controlling means operative on each charging stroke of said member, to establish the amplitude of said stroke in relation to the length of the piece being charged.

10. In mechanism of the class described, a reciprocatory member for the endwise charging and positioning successively-presented pieces of different lengths, controlling means operative on each charging stroke of said member for varying the length of said stroke in relation to the length of the piece being charged, and means for terminating each return stroke of said member always at the same point.

11. In mechanism of the class described, a reciprocatory member for the endwise charging and positioning successively-presented pieces of different lengths, the charging strokes of said member being variable in length, and the return strokes of said member terminating always at the same point, a device adapted to be engaged by each piece in its charging movement, said engagement requiring greater or less movement of said member from said terminal point, depending upon the length of the piece being charged, and means responsive to the amplitude of the movement producing said engagement for establishing the amplitude of the subsequent charging movement, before reversal of said member takes place.

12. In mechanism of the class described, a pusher for the feeding and positioning of successive unequal-length pieces, a pair of members for controlling the stroke of said pusher, said members having their maximum separation at the starting point of said pusher, and approaching each other during said stroke for termination of the latter when

they meet, and means for restraining the approach movement of one of said members until the front end of the piece being fed reaches a point at a fixed distance from said starting point, whereby the meeting point of said members, and consequently the length of pusher stroke, is determined by the length of said piece.

13. In mechanism of the class described, a pusher for the feeding and positioning of successive unequal-length pieces, a pair of controlling members having their maximum separation at the starting point of said pusher, and adapted for approach during the feeding stroke of said pusher to terminate said stroke when they meet, means for moving one of said members during the entire feeding stroke of said pusher, and means responsive to the length of the piece being fed for inaugurating the approach movement of the other control member.

14. In mechanism of the class described, a pusher for the feeding and positioning of successive unequal-length pieces, a pair of members movable toward each other during the feeding stroke of said pusher to control the amplitude of said stroke, the latter terminating when said members meet, and means controlled by the length of the piece being fed for delaying the approach movement of one of said members.

15. In mechanism of the class described, a pusher for the feeding and positioning of successive unequal-length pieces, a pair of members movable toward each other during the feeding stroke of said pusher to control the amplitude of said stroke, the latter terminating when said members meet, means for starting the approach movement of one of said members at the commencement of pusher operation, and means for starting the approach movement of the other member when the front end of the piece being fed reaches a point at a fixed distance from the starting point of said pusher.

16. In mechanism of the class described, a pusher for the feeding and positioning of successive pieces of varying lengths, a pair of members movable toward each other during the feeding stroke of said pusher to control the amplitude of said stroke, the latter terminating when said members meet, and means controlled by the length of a piece being fed for determining the periods of separate and joint approach of said members.

17. In mechanism of the class described, a reciprocatory feeding member for successive variable-length pieces, a member engaged by each piece in its feeding movement, and means controlled by the length of travel of the feeding member in effecting said engagement for establishing the latter's total feeding movement.

18. In mechanism of the class described, a reciprocatory feeding member for successive variable-length pieces, a member at a fixed distance from the starting point of said feeding member, and adapted to be engaged by each piece in its feeding movement, whereby the length of travel of the feeding member, to effect said engagement, is inversely related to the length of the piece being fed, and means responsive to the amplitude of said travel for limiting the further feeding movement of said feeding member, whereby to terminate the feeding movement of each piece when its longitudinal center arrives at a predetermined point.

19. In mechanism of the class described, a pusher for operation on successive variable-length pieces, measuring means brought into action by the initial movement of a piece by said pusher, and means controlled by said measuring means to determine the total movement of said pusher in positioning said piece.

20. In mechanism of the class described, a pusher for operation on successive variable-length pieces, a reversible motor for reciprocating said pusher, and control devices responsive to the length of a piece for reversing said motor, to return said pusher to starting position.

21. In mechanism of the class described, a pusher for operation on successive variable-length pieces, a reversible motor for reciprocating said pusher, a control device responsive to the length of a piece for reversing said motor, to return said pusher to starting position, and means responsive to said pusher's return to starting position for stopping said motor.

22. In mechanism of the class described, a pusher for operation on succesive variable-length pieces, a reversible motor for reciprocating said pusher, control devices responsive to the length of a piece for reversing said motor, to return said pusher to starting position, and means operable by the reversal of said motor to return said control devices to starting position.

23. In mechanism of the class described, a pusher for operation on successive variable-length pieces, a motor for reciprocating said pusher, a reversing switch for said motor, and a control switch whose movement into one position sets said reversing switch to procure an operative stroke of said pusher by said motor, and whose movement into another position establishes the circuit of said motor.

24. In appartus for the endwise charging and positioning of unequal-length pieces of stock, a charging pusher, having the same starting point for each charging stroke, characterized in this that automatic means are provided, responsive to the length of the piece being charged, to control the length of said pusher's charging stroke on said piece, said means procuring the reversal of said pusher when it is distant from a predetermined point

by substantially one-half the length of the piece being charged.

25. In apparatus for the endwise charging and positioning of unequal-length pieces of stock, a variable-stroke charging pusher, having the same starting point for each charging stroke, characterized in this that means are provided for imparting to said pusher for any given piece a total charging stroke exceeding that for a longer piece by one-half the difference between the lengths of said pieces, said means including a control device, at a fixed distance from said starting point, adapted to be operated by front-end engagement of each piece therewith in the first part of each charging stroke of said pusher.

26. In apparatus for the endwise charging and positioning of unequal-length pieces of stock, a variable-stroke charging pusher, having the same starting point for each charging stroke, characterized in this that means are provided for imparting to said pusher for any given piece a total charging stroke exceeding that for a longer piece by one-half the difference between the lengths of said pieces, said means including a control device, at a fixed distance from said starting point, adapted to be operated by front-end engagement of each piece therewith in the first part of each charging stroke of said pusher and a stroke-terminating device, responsive to the operation of said control device, for proportioning the length of the final part of each charging stroke to said first part of each charging stroke.

27. In apparatus of the class described, a reciprocatory member for the feeding and positioning of successive variable-length pieces, a device substantially in the path of feed of said pieces and responsive to the arrival thereat of each piece's advancing end, and means controlled by said device for establishing the amplitude of the further feeding movement imparted to said piece by said member.

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