Jan. 5, 1943. J. H. LOUX 2,307,413

APPARATUS FOR CHARGING BILLETS AND THE LIKE

Filed May 27, 1939 3 Sheets-Sheet 1

Fig 1.

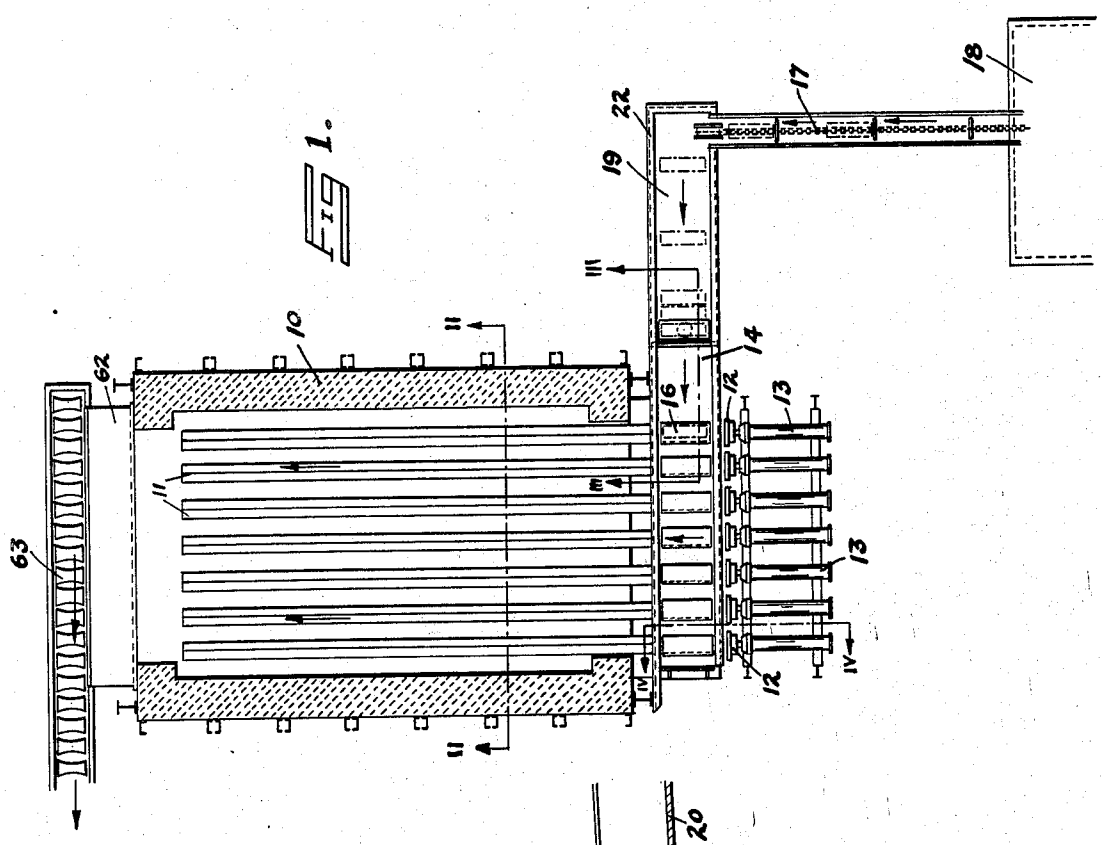


Fig 2.

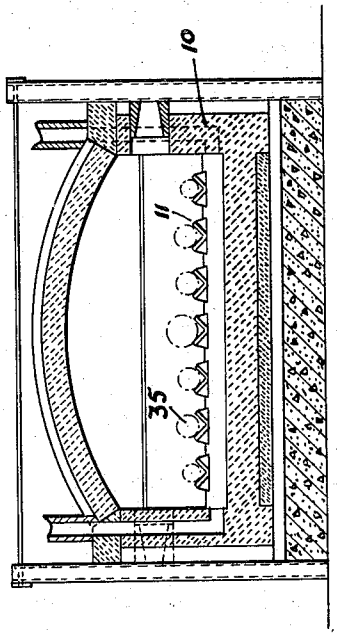
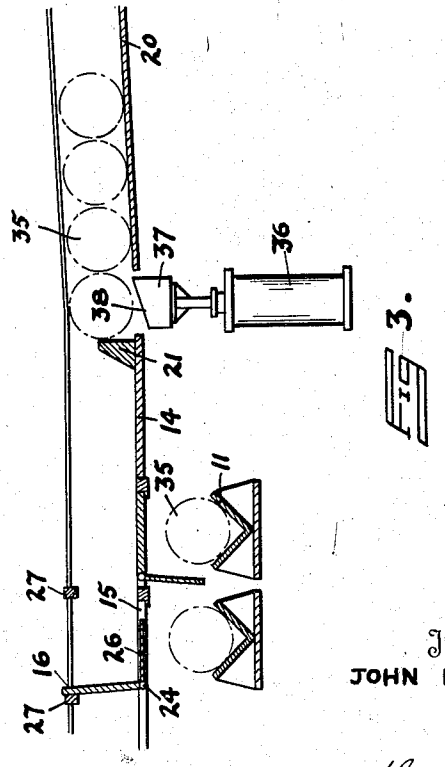


Fig 3.



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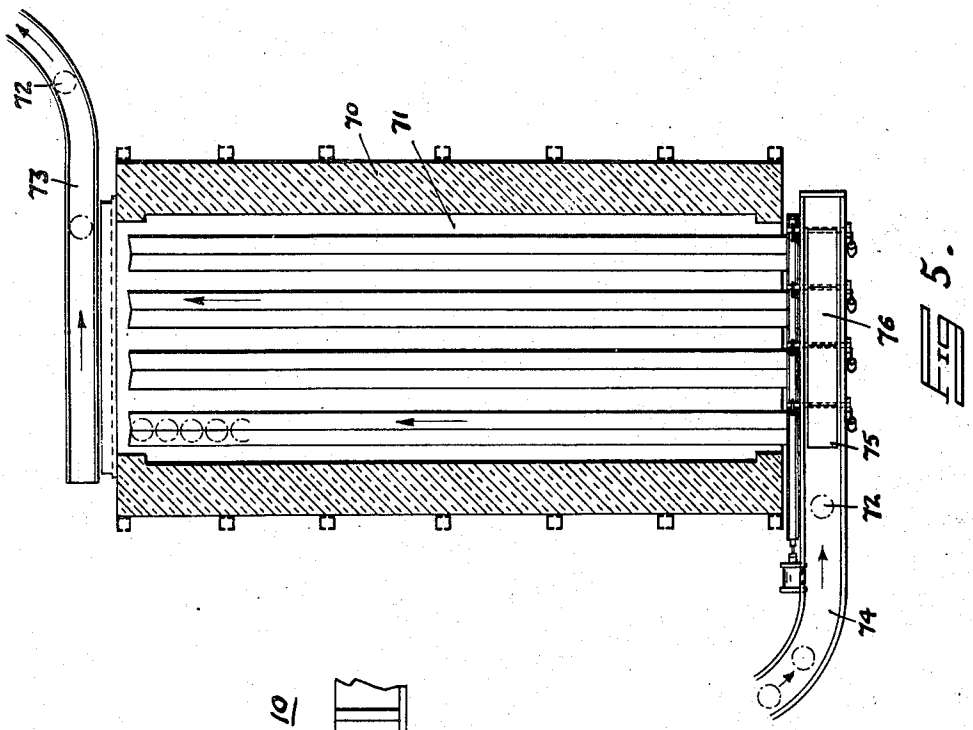


Fig 5.

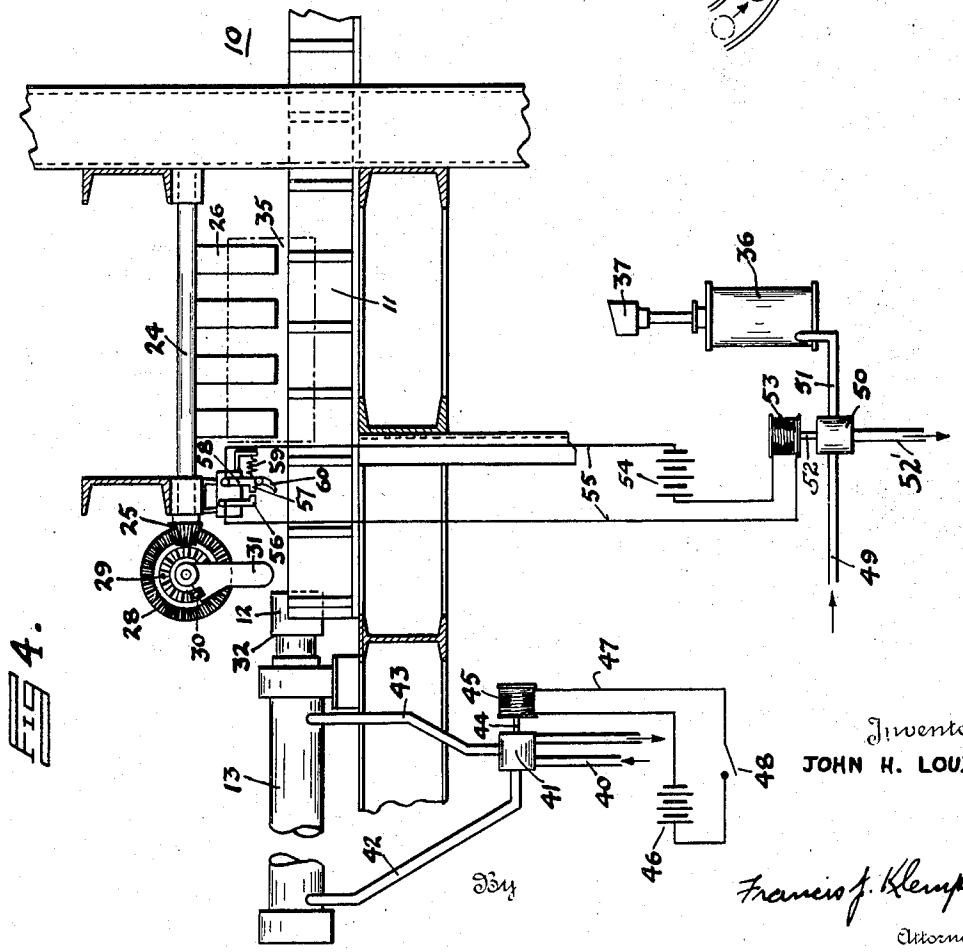


Fig 4.

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APPARATUS FOR CHARGING BILLETS AND THE LIKE

Filed May 27, 1939 3 Sheets-Sheet 3

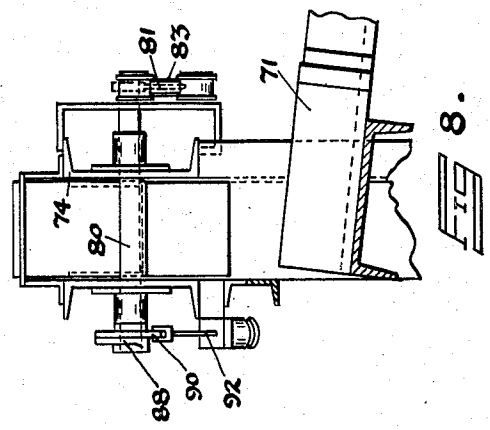


FIG 8.

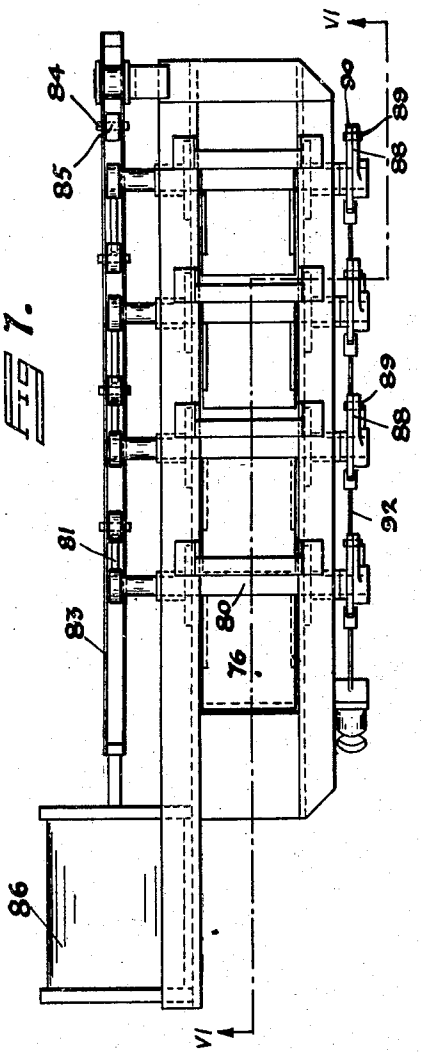


FIG 7.

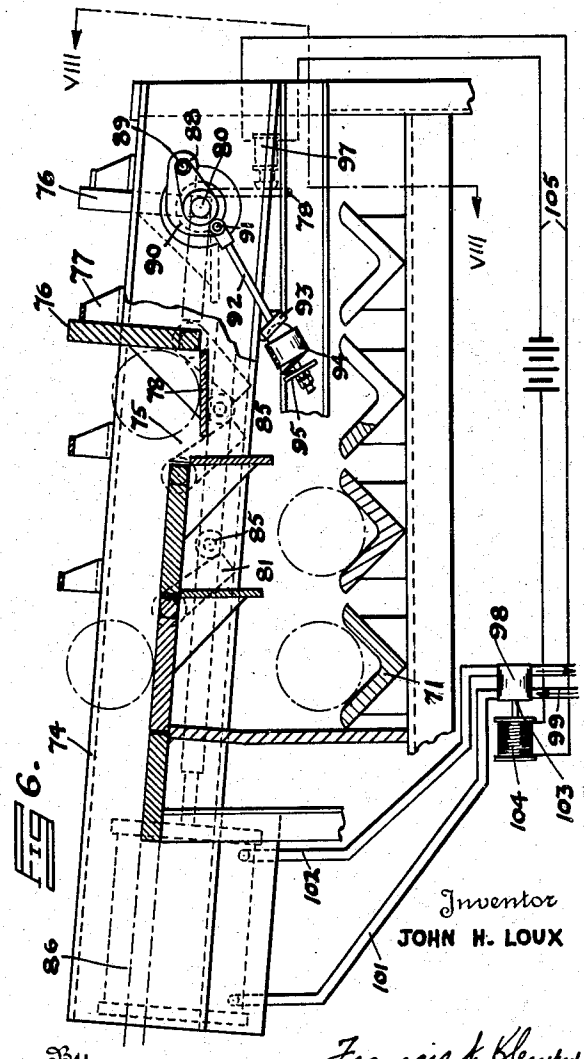


FIG 6.

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UNITED STATES PATENT OFFICE

2,307,413

APPARATUS FOR CHARGING BILLETS AND THE LIKE

John H. Loux, Salem, Ohio, assignor to Salem Engineering Company, Salem, Ohio, a proprietorship

Application May 27, 1939, Serial No. 276,194

9 Claims. (Cl. 214—18)

This invention relates to apparatus for handling round objects such as cylindrical and spherical shapes, for example, and more particularly to a method and apparatus for loading such objects onto a conveying means. The apparatus of the invention is particularly applicable for the purpose of charging billets, balls and other rounded metallic objects into a heating or annealing furnace or other apparatus utilized in the particular production process involved and the invention will be specifically described in such connection although it should be readily understood that the generic apparatus involved is applicable to other specific uses.

A primary object of the present invention is the provision of apparatus, which may be entirely automatic in its operation, for the purpose of distributing rounded objects coming from a common source onto a multiplicity of conveying apparatus in an orderly and regulated manner, whereby the proper functioning of said conveying means is not interfered with.

A more specific object of the invention is the provision of an improved apparatus for loading rounded metal objects, such as billets and balls, onto the parallel conveying troughs of a pusher type heating or annealing furnace whereby such loading may be automatically and expeditiously accomplished, thus insuring maximum efficiency in the operation of the furnace.

Yet another object of the invention is the provision of an improved apparatus for loading rounded metal objects, such as billets and balls, onto the conveying troughs of a pusher type heating and annealing furnace or other equipment utilizing a pusher type of feed which will automatically insure the full and complete loading of such conveying troughs whereby a positive material moving action will be effected by each actuation of the material pushing means. A broader aspect of the invention seeks to simplify the operation of such furnaces or other equipment and, accordingly, a further object of the invention is the simplification of such operation.

A still further object of the invention is the provision of an improved apparatus for selectively directing a plurality of round billets rolling toward an inlet to a heating furnace or other equipment onto conveying troughs extending from pushing mechanisms outside of said furnace into said furnace and along which the billets will be moved longitudinally in accordance with a preferred practice.

These and other objects and advantages of the invention will become apparent from a consideration of the drawings and the following detailed specification wherein the invention is specifically described as being applied for the purpose of charging round metal billets and metal balls into a heating and annealing furnace, respectively.

In the drawings:

Figure 1 is a plan view of a billet charging apparatus constructed according to the principles of my invention, the apparatus being shown in connection with a billet heating furnace;

Figure 2 is a cross-sectional view of the furnace of Figure 1;

Figure 3 is a cross-sectional view of a portion of the apparatus of Figure 1, the view being taken along the line III—III of Figure 1;

Figure 4 is a sectional view taken along the line IV—IV of Figure 1 and including a schematic showing of certain control instrumentalities utilized in the apparatus;

Figure 5 is a plan view of a modified form of apparatus which is especially useful in feeding grinding balls and similar objects to an annealing furnace;

Figure 6 is a side view of the feeding apparatus of Figure 5; and

Figures 7 and 8 are top and end views, respectively, of the feeding apparatus of Figure 5.

Referring now more particularly to the embodiment of the invention illustrated by Figures 1 through 4 of the drawings, reference numeral 10 designates a heating furnace which may be of the kind commonly employed to uniformly heat metal billets preparatory to their utilization in tube production processes and for other purposes and in accordance with established practice the furnace may be provided with a plurality of spaced parallel V-shaped troughs 11 along which the billets travel axially through the furnace. The troughs 11 extend outwardly of the charging end of the furnace and each is provided with a pusher 12 operated by a cylinder 13 for the purpose of slidably moving the lines of billets in the troughs through the furnace. The stroke of each pusher 12 is of sufficient length to enable a billet to be accommodated in the end of a trough between the pusher and the last billet of the line in the trough upon completion of an inward and outward cycle of movement of the pusher. The primary function of the apparatus now to be specifically described is to convey the billets into the troughs adjacent the pushers upon the completion of their respective cyclic movements so that the troughs will always be filled.

The above is accomplished, in accordance with the preferred embodiment of the invention, by

providing an inclined table 14 down which the billets are adapted to roll, the table being provided with a plurality of spaced parallel slits 15 each provided with a swinging trap door 16 which automatically closes as a billet falls through the particular slit associated with the door in order that the next succeeding billet rolling down the table may pass over the particular slit so closed.

Referring to Figure 1 of the drawings, there is provided a lug chain conveyor 17 for moving the billets from a storage area 18 to a magazine 19, the magazine consisting of an inclined bottom wall 20, a stop 21 and suitable side guides 22.

Doors 16 are swingably mounted along the side edges of the slits 15 on shafts 24 which extend outwardly of the table 14 and each of which is provided at its outer end with a bevel gear 25, see Figure 4. Extending outwardly from the hinged edge of each of the doors 16 is an arm 26 which is adapted to be engaged by the billet as the latter falls through the slit to move the door to closed position. Arm 26 is light in weight as compared with the door proper and when the door is opened to a position shown in Figure 3, which represents a rotational movement of the door through slightly more than 90°, the door will remain in open biased position. A stop 27 limits the opening rotational movement of the door and it should be obvious from an inspection of Figure 3 that the door itself when in open position forms a barrier against further rolling movement of the billets along the table 14.

Meshing with each of the bevel gears 25 is a large bevel gear 28 provided with ratchet teeth 29 for engagement by the dog 30. Dog 30 is carried by an arm 31 pivotally mounted on the shaft mounting the gear 28 and is adapted to be rocked to and fro as the pusher 12 traverses its cyclic path of movement. Upon inward movement of the pusher and the consequent rotation of arm 31 in a counter-clockwise direction dog 30 simply ratchets over the teeth 29 and the gear 28 remains at rest. However, as the pusher 12 returns to its initial starting position, a rear shoulder 32 of the pusher will engage the arm 31 and move the arm 31 through a limited clockwise rotation. As arm 31 moves clockwise dog 30 will engage the teeth 29 and move gears 28, 25 and shaft 24 to rotate the door carried by shaft 24 to open position. It should be observed, as shown in Figure 3, that an outwardly extending portion of each of the V-troughs 11 is positioned directly underneath one of the slits 15 and that a particular pusher 12 is operated only after a billet has been deposited onto the trough through the slit associated with the pusher and at this time the door is closed.

The billets, indicated by reference numeral 35, are moved one at a time from magazine 19 onto the inclined table 14 by a lift cylinder 36 having a billet engaging plunger 37. The latter is provided with an inclined upper end 38 and it should be apparent from Figure 3 that as the plunger 37 is lifted, a billet will be raised and rolled over the stop 21. After the billet passes the stop 21 it will roll down the table 14 until it engages an open door 16 whereupon it will fall through the slit associated with the open door into the trough therebelow. As it does so it will close the door in the manner indicated above.

In accordance with usual practice, means may be provided to control the operation of the pusher operating cylinders individually and, by way of example, I have schematically illustrated such means. This may consist of a suitable source of hydraulic fluid under pressure connected by means of a conduit 40 to a combined solenoid and pressure operated valve 41 of which there is one for each cylinder. Valve 41 is connected with the ends of the cylinder 13 by conduits 42 and 43, respectively, and its operation is such that when solenoid 45 is energized valve stem 44 is moved to the right, as viewed in Figure 4, and fluid pressure is admitted to conduit 42 moving the plunger 12 inwardly. Inward movement of pusher 12 continues until the end of the stroke is reached causing a high pressure to be built up in conduit 42. Valve 41 is provided with means responsive to the pressure in conduit 42 and as this pressure reaches a predetermined set minimum valve stem 44 is moved inwardly by the pressure responsive device to connect conduit 40 with conduit 43 to reverse the flow of fluid to cylinder 13, thereby moving the pusher back to its initial starting position. The parts remain in this position until solenoid 45 is again energized. Solenoid 45 is adapted to be momentarily energized through circuit 47 including a current source 46 and a manually operable switch 48. The operation of the pusher control is such that a momentary closing of switch 48 results in an inward and outward stroke of the pusher 12. Assuming that a billet has been deposited on the trough 11 ahead of the pusher 12, actuation of the pusher will move this particular billet into the furnace 10 and will move all of the billets ahead of this particular billet lying in the trough a distance equal to the length of the particular billet deposited. Obviously, when the furnace is filled, the charging of a cold billet at the entering end thereof will result in the discharge of a billet from the leaving end thereof. Such discharged billet may roll down a sloping hearth 62 (Figure 1) and onto a conveyor 63 for conveyance to a piercing mill or other apparatus which may be used to work on the billet.

It is, of course, possible to effect operation of the particular apparatus described by controlling lift cylinders 36 manually but, as it is more desirable to provide for automatic operation of the billet supplying means, I propose to operate the cylinders 36 in connection with the operation of the pusher 12 so that a billet will be positioned on the table 14 immediately after the completion of a pushing cycle by any of the pushers 12. This is accomplished by controlling the flow of fluid under pressure, preferably air, from conduit 49 to cylinder 36 by a valve 50 operated by solenoid 53 through the valve stem 52. A conduit 51 connects valve 50 with cylinder 36 and the valve is provided with a discharge outlet 52. The operation of valve 50 is such that when solenoid 53 is energized fluid under pressure will be admitted to cylinder 36 to move plunger 37 to upper position, thereby lifting a billet over the stop 21, and when solenoid 53 is deenergized conduit 49 is closed off and conduit 52 connected with the cylinder 36. Solenoid 53 is controlled through circuit 55 including a switch 56—57 and current source 54.

Contact 56 of the switch referred to immediately above is fixed while contact 57 thereof is carried by the pivotally mounted arm 58 and normally biased to open position by the tension spring 59. The lower end of arm 58 is provided with a resilient extension 60 for engagement by the pusher head 12. As the pusher 12 moves inwardly arm 58 is rotated in a counterclockwise direction whereby the switch contacts are kept open, but as the pusher moves back toward its

starting position the shoulder 32 thereof will engage the resilient extension 60 rotating arm 58 clockwise and making contact between the points 56—57. This contact will be held so long as pusher 12 engages the extension 60 and will be of sufficient duration to insure the full upward stroke of the plunger 37. As the pusher 12 leaves the extension 60, spring 59 will break contact 56—57, thereby deenergizing solenoid 53.

It should be noted that the operation of the apparatus described immediately above is such that the cylinder 36 is operated to boost one billet over the stop 21 whenever any of the doors 16 are moved to open position, this resulting from the fact that the pusher 12, through arm 31, gears 25, 28 and shaft 24, moves the door 16 to open position as it approaches its initial starting position. A switch 56—60 is provided for each of the pushers and are connected in parallel with the solenoid 53 so that closure of any one of the switches will result in energization of the solenoid. It is also possible to provide for complete automatic operation of the furnace and, if this is desired, the switches 48 may be actuated by time controlled or other condition responsive means.

The embodiment of the invention shown in Figures 5 through 8 illustrates the manner in which the principles of the invention may be employed to feed grinding balls or other spherical objects to an annealing furnace or other apparatus. The annealing furnace 70 is provided with inclined troughs 71 down which the balls, indicated by 72, are adapted to roll by gravity, suitable means, not shown, being employed to control the rate of movement through the furnace. After the balls leave the furnace they are carried away by a suitable track 73. For illustration purposes but four of the troughs 71 are shown but it should be obvious that any number of these might be employed in the particular apparatus with which the invention is associated.

As in the embodiment first described, the invention has to do with the feeding of the objects into the troughs and this is accomplished in the instant apparatus by providing an inclined feeding trough 74 provided with an aperture 75 above each of the troughs 71. Apertures 75 are each provided with a hinged door 76 opening against a stop 77 and provided with an arm 78 adapted to be engaged by a ball as it drops through the aperture to move the door to closed position. Referring now more particularly to Figures 6 through 8, each of the doors 76 is carried by a shaft 80 extending outwardly from either side of trough 74. An arm 81 is keyed to an end of each shaft 80 along one side of the feed trough 74 and the ends of the arms are positioned between parallel bars 83 of a door resetting mechanism now to be described. Evenly spaced along these bars are the transverse spanning bolts 84 each carrying a roller 85 positioned between the bars. The bars, bolts and rollers are thus assembled into a unitary structure which is arranged for longitudinal movement by a cylinder 86 connected with one end of the structure. By referring to Figure 6, it will be noted that as the doors 76 are moved to closed positions their attached arms 81 will move counterclockwise, as viewed in the figure, into close proximity to the rollers 85 and it should be obvious that as the bars 83 and rollers 85 are moved to the left, as viewed in the figure, by cylinder 86 that the arms 81 will be rotated counterclockwise, consequently moving all of the doors 76 that may have been closed to an open position.

Doors 76 are retained in open position primarily by gravity but it has been found desirable in certain installations to provide, in addition, spring biasing means to aid in maintaining the doors in open position and this is accomplished, in accordance with the present invention, by keying arms 88 to the ends of shafts 80 opposite the arms 81. Arms 88 are pivotally connected at their outer ends by the pins 89 with the curved members 90 extending about the shafts 80 and provided at their other ends with pivot pins 91. A rod 92 passing through an apertured lug 93 is connected with each of the pins 91 and is resiliently urged away from the shafts 80 by coil springs 94 positioned between lugs 93 and a retaining collar 95 adjustably mounted on the outer end of the rod. By referring to Figure 6 it will be noted that the line of the axis of the rod 92, which will, of course, pass through the center of pin 89, passes slightly below the axis of rotation of the shaft 80 and, therefore, as the shaft 80 begins its rotation initiating the closing movement of the door, a slight additional compression of the spring 94 will take place while the line referred to above is approaching the axis of the shaft 80. After this line passes the axis, spring 49 will accelerate the closing movement of the door thus providing in effect an over-center device to aid in keeping the door in open position and to accelerate movement of the door to closed position after initial movement of the door toward closed position has been initiated by other means.

A switch 97 is so positioned that the arm 78 of the last or lowermost door 76 of the series will engage and operate it as the last or lowermost door is closed. Switch 97 controls the operation of cylinder 86 through a valve 98 which operates in the same manner as does the valve 41 described above. Valve 98 connects a fluid pressure supplying conduit 99 with cylinder 86 through conduits 101 and 102, respectively. Stem 103 of valve 98 is adapted to be moved by solenoid 104 which is energized and controlled by circuit 105, including a current source and the switch 97. The operation of the control for cylinder 86 is such that, when switch 97 is closed by the arm 78 of the last door 76, the piston in cylinder 86 will traverse its stroke to the left and then its stroke to the right, as viewed in Figure 6, and will remain at rest at the end of its right stroke until switch 97 is again energized, when the cycle will be repeated. As the piston moves to the left the rollers 85 will open all the doors in the manner explained above.

The operation of the embodiment described immediately above is as follows: The balls or other objects will come into the trough 74 one by one from a quenching machine or other apparatus and, assuming all the doors 76 to be open, the first ball to reach the first door will be stopped by the barrier created by the door since it is open and the ball will fall through the aperture immediately in front of the door into the trough 71 therebelow and as it falls through the aperture it will close the door. This closed door will then span the aperture providing a path for the next succeeding ball to the second door and this will continue until the last door is closed, upon which closing the cylinder 86, controlled by switch 97, will move all the doors to open position, thus recycling the apparatus for further handling of the objects.

It should now be apparent that I have pro-

vided an improved apparatus which fully accomplishes the objects initially set out. The invention provides an inexpensive apparatus for handling round billets, balls and other round objects which may be applied in connection with, and to feed such objects to, furnaces and other equipment and the efficiency of operation of such furnaces or other equipment will be materially enhanced. Moreover, the use of the invention enables the objects to be charged in a fully automatic manner, thus enabling the rate of production of any process utilizing such objects to be materially increased.

The above specifically described embodiments of my invention should be taken as illustrative only, as obviously many changes may be made therein without departing from the spirit or scope of the invention. For example, in the embodiment illustrated by Figures 5 through 8, it would, of course, be apparent that a stop and lifting mechanism, as shown at **21** and **36—37**, respectively, in Figure 3 of the first embodiment described, may be employed in the trough **74** forward of the door **76** to control the movement of the balls towards the doors, if this were considered necessary or desirable. Also, in such a construction the cylinder **36** could be periodically actuated in synchronism with the desired speed of movement of the balls **72** through the annealing furnace or other apparatus with which the feeding mechanism might be associated. It should also be clearly understood that various operating and control devices, well known in the control arts, could be substituted, without altering the final results, for the means specifically disclosed herein for the control of the operation of the pushers **12** and the plunger **37**. Also, the control and operation of the resetting mechanism employed in the embodiment illustrated by Figures 5 through 9 may be accomplished by the substitution of a pilot valve for the switch **97** or by the substitution of various other instrumentalities well understood in the arts.

What I claim is:

1. Apparatus for heat treating round metal objects comprising in combination a heating furnace, a plurality of spaced troughs extending from outside of to within said furnace and in which the objects are adapted to be moved into the furnace, means to load said objects onto the outer projecting end portions of said troughs comprising an inclined support along which said objects are adapted to roll, a plurality of openings in said support spaced longitudinally along the same and being of sufficient dimensions to allow said objects to drop through said support, a trap door for each of said openings hingedly mounted in each opening at the end thereof opposite the end first engaged by said objects as the latter advance, means limiting the outward pivotal movement of said doors whereby said doors serve as barriers to the further advance of said objects as the latter move along said inclined support, an arm connected with each of said doors and adapted to be engaged by said objects as the latter drop through said openings, said arm being operative to rotate said doors to closed positions as said objects fall through said openings, and means to simultaneously move all of said doors to open positions.

2. Apparatus for heat-treating round metal objects comprising in combination a heating furnace, a plurality of spaced troughs extending from outside of to within said furnace and in which the objects are adapted to be moved into the furnace, means to load said objects onto the outer projecting end portions of said troughs comprising an inclined support along which said objects are adapted to roll, a plurality of openings in said support spaced longitudinally along the same and being of sufficient dimensions to allow said objects to drop through said support, a trap door for each of said openings hingedly mounted in each opening at the end thereof opposite the end first engaged by said objects as the latter advance, means limiting the outward pivotal movement of said doors whereby said doors serve as barriers to the further advance of said objects as the latter move along said inclined support, an arm connected with each of said doors and adapted to be engaged by said objects as the latter drop through said openings, said arm being operative to rotate said doors to closed positions as said objects fall through said openings, a pusher associated with each trough and adapted to push the objects falling thereon along the trough, and means operable after actuation of each pusher to move the door associated with said pusher to open position.

3. In combination with a pusher type heating furnace having a plurality of spaced parallel troughs extending from outside to within said furnace and a pusher associated with each of said troughs, a charging device therefor comprising a support extending transversely and above the outwardly projecting ends of said troughs, an opening in said support above each of said troughs, a spanning device associated with each of said openings and operative to span the openings as the objects to be charged fall therethrough, said objects upon falling through said openings being positioned between said pusher and said furnace, each of said pushers operating inwardly to move the objects in the trough associated with the pusher through the furnace, means responsive to the outward movement of said pushers to render said spanning devices inoperative, and means responsive to the outward movement of each of said pushers to feed another object to said support.

4. Apparatus for heat treating round metal objects comprising in combination a heating furnace, a plurality of spaced troughs extending from outside of to within said furnace and in which the objects are adapted to be moved into the furnace, means to load said troughs outwardly of said furnace comprising an inclined support extending transversely above said troughs adjacent their outer ends and along which said objects are adapted to roll, an opening in said support above each of said troughs to allow the objects to fall into said troughs, an element associated with each of said openings and movable from an open to a closed spanning position and vice versa, and means to move said elements to their closed spanning positions as said objects fall through the respective openings.

5. Apparatus for heat treating round metal objects comprising in combination a heating furnace, a plurality of spaced troughs extending from outside of to within said furnace and in which the objects are adapted to be moved into the furnace, means to load said objects onto the outer projecting end portions of said troughs sequentially comprising a support extending transversely of and above said objects, an opening in said support above each of said troughs to allow the objects to fall into said troughs, means associated with each of said openings to

limit the progression of the objects moving along said support whereby an object moving along said support will be diverted through the opening associated with the first of such means encountered, means associated with each of said openings to span said openings as the objects fall therethrough, the arrangement being such that as any particular opening is spanned the limiting means associated with the particular opening is withdrawn.

6. Apparatus according to claim 5 further characterized by the inclusion of means to simultaneously move the spanning means of an opening to inoperative position and the associated limiting means to operative position.

7. Apparatus according to claim 5 further characterized by the inclusion of means to simultaneously move all said spanning means to inoperative positions and all of said limiting means to operative positions.

8. Apparatus according to claim 5 further characterized by the inclusion of means responsive to the fall of one of said objects through the most advanced of said openings to simultaneously move all of said spanning means to inoperative positions and all of said limiting means to operative positions.

9. Apparatus for heat treating round metal objects comprising in combination a heating furnace, a plurality of spaced troughs extending from outside of to within said furnace and along which said objects are adapted to move, an inclined trough extending laterally above the projecting ends of said first mentioned troughs and along which said objects are adapted to roll, a trap door in the bottom wall of said inclined trough above each of said projecting ends, a member connected with and movable with each of said trap doors to form a stop for said objects when the trap doors are in unsprung position, said members being operative to span said openings after the doors are sprung.

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