July 5, 1932. T. F. POWERS 1,865,954

PREHEATING FURNACE

Filed Jan. 8, 1931

Fig. 1.

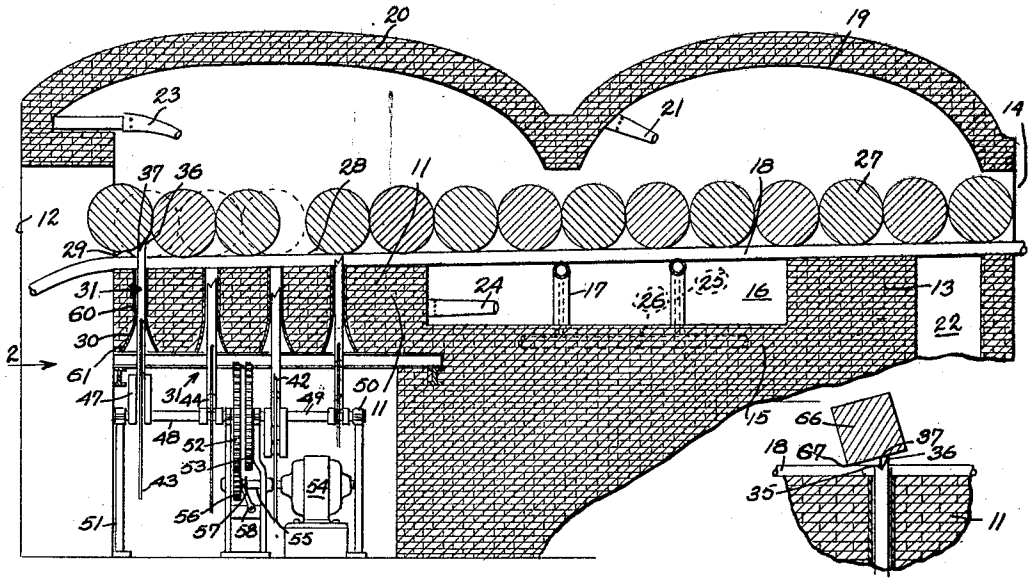


Fig. 5.

Fig. 3.

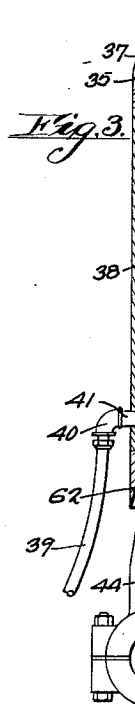


Fig. 4.

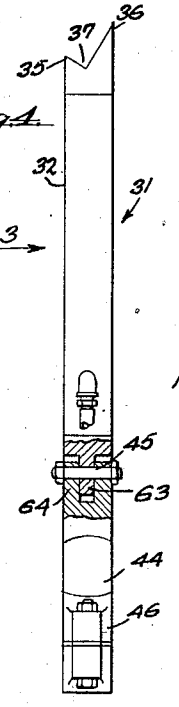
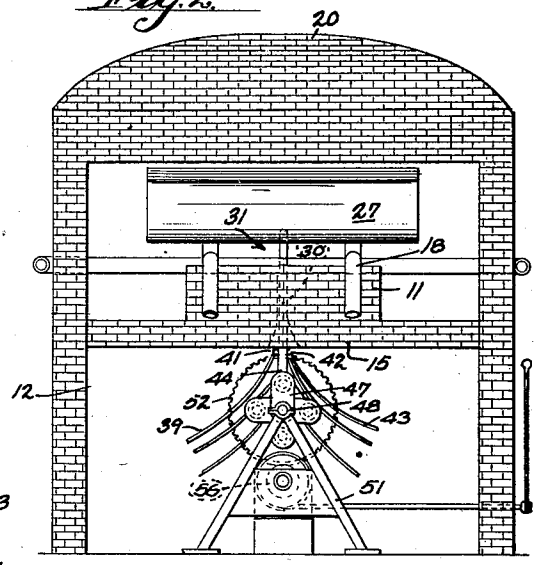


Fig. 2.



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UNITED STATES PATENT OFFICE

THOMAS F. POWERS, OF TORRANCE, CALIFORNIA

PREHEATING FURNACE

Application filed January 8, 1931. Serial No. 507,403.

My invention relates to a preheating furnace for heating billets or ingots.

An object of my invention is in connection with a positive feed for the billets or ingots in the furnace, especially adjacent the discharge end thereof, by which the ingots or billets are given a roll or turn, the billets or ingots near the discharge door being forced outwardly and allowing the remaining series of billets to move forward slightly in the preheating furnace. In furnaces of my characteristic there is preferably a slight slope, with rails or tracks on which the billets may roll or be thrust downwardly towards the discharge end or side of the furnace.

In a furnace of this type another object and feature of my invention is the employment of nubs or abutments in the track which wil stop the rolling of the billets. While such nubs are sufficient to hold the series of billets from rolling forwardly, the billets may be readily forced over these nubs by my feeding mechanism. I preferably arrange one of these nubs adjacent the discharge end of the furnace, and another some little distance therefrom, and between these nubs I employ a series of feeding or forwarding devices such devices raising the billets over the nubs and allowing their further rolling action.

Another object and feature of my invention is in the feeding or forwarding mechanism, this having a series of vertically movable rods, these rods operating in guides and engaging the billets slightly on one side of each billet, so that on each rod in succession being elevated the billets are slightly tilted and at the same time rolled forward toward the discharge end of the furnace. These vertically moving rods are sufficient to roll the billets over the abutment nubs to continue their movement lengthwise of the furnace.

Another detailed feature of these movable rods for shifting the billets is that each rod may be connected by a connecting rod or the like to a common crank-shaft and such shaft be driven by a motor or the equivalent. In this construction I prefer, also, to use a clutch arrangement, so that one or more series of these pusher rods may be actuated independently one of the other. A detailed feature of the pusher rods is their arrangement with a hooked or notched end, which provides prongs to engage round billets or ingots for rolling these, or to engage the edge of square or rectangular billets to give these a turn in their forward movement in the furnace.

Another feature of my invention relates to the cooling of the furnace and of the pusher rods, in that the tracks are water cooled. The supports for the tracks are also water cooled, and the pusher rods are provided with a water circulation system, thus maintaining these comparatively cool. The furnace is preferably heated by gas or oil flames, and as part of the track is open the billets receive a uniform heating throughout.

My invention is illustrated in connection with the accompanying drawing, in which:

Fig. 1 is a longitudinal section of the furnace;

Fig. 2 is an end elevation taken in the direction of the arrow 2 of Fig. 1, the furnace being shown open;

Fig. 3 is an end elevation of one of the pusher rods and its connection, taken in the direction of the arrow 3 of Fig. 4, with parts broken away;

Fig. 4 is a side elevation of Fig. 3, taken in the direction of the arrow 4.

Fig. 5 is a detail longitudinal section illustrating the action of the pusher bars on rectangular section billets.

In constructing the furnace I employ a brickwork floor construction 11 adjacent the discharge end 12 of the furnace, a floor section 13 adjacent the feeding end 14 of that furnace, and a brickwork floor panel 15, there being a considerable space 16 above this floor panel, in which there is a series of supporting posts 17, these supporting part of the track 18, the remaining sections of the track being supported on the brickwork of the floor sections 11 and 13. The furnace is provided with a plurality of arches, there being an arch 19 adjacent the in-feeding end and an arch 20 adjacent the discharge end. A series of nozzles 21 discharge through the arch 19 downwardly on the in-feeding bil-

lets, the waste gases discharging through a flue 22. A second series of burners 23 discharges below the arch 20 onto the billets adjacent the outlet end. A third series of burners 24 are located in the open space 16 and discharge upwardly underneath the tracks on the bottom of the billets. The tracks are tubular, providing for water cooling. The posts 17 are also tubular and have water pipes 25 therein for cooling purposes, these being connected to headers 26. The billets indicated at 27 are illustrated as being cylindrical and roll downwardly on the tracks 18, these having a slight slope towards the discharge end. The slope, however, is quite slight, so that these billets may be stopped by a first pair of abutment nubs 28 on the tracks and also by a second pair 29 adjacent the discharge end of the furnace. This construction of these two sets of nubs gives a positive stop to the billets and allows them to be fed out of the furnace one by one, and also to be delayed at the upper nubs 28.

The brickwork structure 11 is provided with a series of vertical guideways 30, and in these guideways reciprocate pusher rods 31. These rods for the major portion are formed tubular, having a tube 32 screw threaded to a solid lower end portion 33, and having a point or tip 34 at the top. It will be noted that such tips have a pair of prongs 35 and 36 with a notch 37 therebetween. A water circulation pipe 38 is secured in the solid section 33 and has its open upper end discharging against the tip 34. This is fed by water from the water hose 39, flowing through the elbow 40 and the nipple 41 into the lower end of the pipe 38. The water is discharged through a similar connection 42 at the opposite side, this being connected to the tube 32 and a flexible discharge hose 43. The flared bottom of the guideways 30 accommodates the flexible water hose 39 and 43 during the reciprocation of the pusher rods.

Each of the pusher rods is pivotally attached to a connecting rod 44 by the pivot pins 45, and such connecting rods have journals 46 for connecting to the cranks 47 of the crank-shafts 48 or 49. These crank-shafts are supported in journals 50 mounted on V-shaped frames 51, and there is a drive gear 52 for the shaft 48 and a drive gear 53 for the shaft 49. The drive is from an electric motor 54, which has a motor shaft 55 mounted in suitable journals in the V frames 51, and on this shaft there is a slidable pinion 56 shifted by a shiftable yoke 57, this being controlled by a rock lever 58 in any suitable manner, so that the pinion may be made to mesh with either of the gears 52 or 53.

The manner of operation and functioning of my furnace is substantially as follows:

It will be understood that all of the burners, or the desired number, are in operation to heat the billets to the proper temperature desired in the length of time the billets pass through the furnace. These billets, after being fed into the furnace, roll slowly downwardly until they are engaged by the nub 28. The pinion 56 is then brought into mesh with the gear 53, and this, through the electric motor, operates the crank-shaft 49, which action gives a vertical reciprocating motion to the upper set of pusher rods. These rods reciprocate vertically, and the prongs on the tip engage the billets slightly on the in-feeding side of the furnace. These rods tend to partly lift the billets and cause each billet in succession to be pushed over the nub 28 and rolled downwardly towards the second nub 29. Manifestly, by stopping the motor or by shifting the pinion out of mesh with either of the gears 52 or 53, the billets remain stationary. When it is desired to discharge the billets the pinion 56 is brought into mesh with the gear 52, operating the crank-shaft 48 which pushes the billet at the discharge end over the abutment nub 29, allowing this to roll out of the furnace and the next billet to roll downwardly against such nub. By manipulation of the pusher rods, therefore, the billets may be discharged at the desired rate after proper heating. It will be noted by my furnace construction that the billets are rotated so that all sides are exposed to the heating flames, and also on account of the burners 24 being below the billets they are thoroughly heated on the lower portions. On account of the pusher rods being cooled by the water circulation there is no danger of over heating. It is quite obvious that this type of furnace and pusher rod feed may be adapted for square or rectangular billets, in which case, however, these billets are usually thrust forwardly from the in-feeding end until they contact with the upper nub 28. The pusher rods then are designed to engage these billets and turn them over on the edge nearest the discharge part of the furnace, raising the billets over the nub 28 and turning these in their path towards the nub 29, and finally turning and thrusting the billets out of the furnace.

In the detailed construction of the pusher rods and their guides, I employ pipes 60 embedded in the brick work 11 of the floor section. These pipes have an outwardly cone shaped section 61 at the bottom, this providing a guidance for the pusher rods in their reciprocating motion. The pusher rods are connected to the connecting rod 44 by employing a socket 62 (note Figs. 3 and 4). This socket has a tongue 63 extending downwardly, and a pair of ears 64 on the cranks fit on opposite sides of the tongue and are secured by the bolt 45.

In the construction of Fig. 5 I illustrate

a rectangular shaped billet 66 in which the pusher rod in its lifting movement engages the block and tilts it on the corner 67. This gives the billet a quarter turn, and thus exposes a different portion of the billet to the heat of the furnace as well as advancing the billet in the furnace.

Various changes may be made in the details of construction without departing from the spirit or scope of the invention as defined by the appended claims.

I claim:

1. A furnace having a downwardly inclined runway for billets from a feeding to a discharge end of a furnace, a plurality of abutment nubs in the runway, one being positioned adjacent the discharge and the other remote therefrom, said nubs stopping the movement of the billets, two reciprocating pusher rods, means to guide said rods in a straight line reciprocating motion substantially transverse to the track, one adjacent each nub, means to operate said rods, one independent of the other, each rod being adapted to engage one billet at a time and to shift said billet over the abutment nub adjacent thereto toward the discharge end.

2. A furnace having a runway for billets from a feeding to a discharge end of a furnace, a plurality of abutment nubs, one being positioned adjacent the discharge end and the other remote therefrom to stop the movement of the billets, a plurality of vertically reciprocating pusher rods each operative adjacent a nub and on the feeding end side thereof, means to guide each of the rods in a vertically reciprocating motion, means to actuate said rods one independent of the other, each rod being adapted to engage a billet stopped by the adjacent nub and to shift such billet over the nub toward the discharge end of the furnace.

3. A furnace as claimed in claim 2, additional reciprocating rods with means to guide said rods in a vertical movement, said latter rods operating between the abutments to move the billets from one of the nubs remote from the discharge end toward the discharge end of the furnace without shifting said billets over a nub.

4. A furnace having a runway for billets from a feeding toward a discharge end, a first abutment nub adjacent the discharge end and a second abutment nub remote therefrom toward the feeding end, two vertically reciprocating pusher rods operating in vertical guideways one adjacent each nub and on the feeding end side thereof, and at least two other vertically reciprocating pusher rods, the rods adjacent the nubs being adapted to engage a billet one at a time and to shift such billet over the adjacent nub, and the second rods being adapted to engage the billets between the nubs and to shift said billets toward the discharge end of the furnace.

5. A furnace as claimed in claim 4, a driving connection for operating at least two of the adjacent pusher rods independently of the other two.

6. A furace having a runway for billets from a feeding to a discharge end, a plurality of arches one adjacent the feeding and the other adjacent the discharge end, means to discharge a heating medium on the upper portion of the billets from each archway, the said runway being open in part underneath and having a third heat applying medium therein to heat the under side of the billets, a vertically reciprocating pusher rod having a guideway in a refractory construction adjacent the discharge end, said rod being adapted to engage one billet at a time and to shift it toward the discharge end of the furnace.

7. A furnace having a downwardly inclined runway comprising a plurality of parallel smooth surfaced rails from a feeding to a discharge end, a nub in the runway extending upwardly above the surface of the rails, a vertically reciprocating pusher rod on the upper side of the nub, means to guide said rod and to reciprocate the rod in vertical motion to engage one billet at a time and shifting such billet past said nub.

8. A furnace as claimed in claim 7, the pusher rod having a hollow section with means to circulate water through such section, said means permitting the vertical reciprocation of the rod and continuing the circulation during such reciprocation.

9. A furnace having a downwardly sloping runway comprising a plurality of parallel smooth surfaced rails, a plurality of nubs positioned in the runway and extending upwardly above the surface of the rails, said nubs being positioned at different distances along the runway, a plurality of reciprocating pusher rods, vertical guideways for said rods, said pusher rods being positioned on the upper side of the nubs and operating between the tracks, and means to reciprocate said rods to engage billets and to feed same one at a time past said nubs.

10. A furnace as claimed in claim 9, said furnace having two arches, one being adjacent the discharge end above the tracks, means to discharge a heating medium downwardly from each of the arches from the side adjacent the discharge onto the billets, the furnace having an open construction below the tracks substantially at the junction line of the arches, and a third means for injecting a heating medium from the open construction upwardly on the billets.

11. In a furnace having a track for billets, a vertical reciprocating pusher rod with vertical guides for said rod, the rod being formed with an outer tube and an inner water circulating pipe open at the top, a flexible water hose connected to the bottom of the pipe and to the bottom of the tube, said guide means

providing space to accommodate said hose, a crank shaft having a connecting rod connected thereto and to the lower part of the rod.

12. A furnace having a runway for billets comprising a plurality of downwardly inclined smooth surfaced tracks, the furnace having a pair of arches above the tracks and an open construction below the tracks substantially adjacent the junction line of the arches, means to project a heating medium from the arches downwardly on the billets and from the open construction upwardly on the billets, the runway having a plurality of nubs extending above the tracks, a plurality of vertical guideways between the tracks and spaced longitudinally thereof, there being an open space below said guideways with a longitudinally extending crank shaft, each with a connecting rod and a vertically reciprocating pusher rod in each guideway operative by each connecting rod, the pusher rods being positioned to engage billets adjacent the nubs and advance same over the nubs, said pusher rods being hollow and having means for circulating water therethrough.

13. In a furnace having a runway for billets, a vertically reciprocating pusher rod, with means to reciprocate said rod vertically, said rod being formed with an outer tube and an inner water circulating pipe extending upwardly through the tube, means to connect a water supply service at the lower end of the pipe and the lower end of the tube, there being an annular space for water cooling between the pipe and the tube, the rod having tips at its upper end comprising an upper and a lower prong, the upper prong being larger than the lower prong with a notch between said prongs.

In testimony whereof I have signed my name to this specification.

THOMAS F. POWERS.