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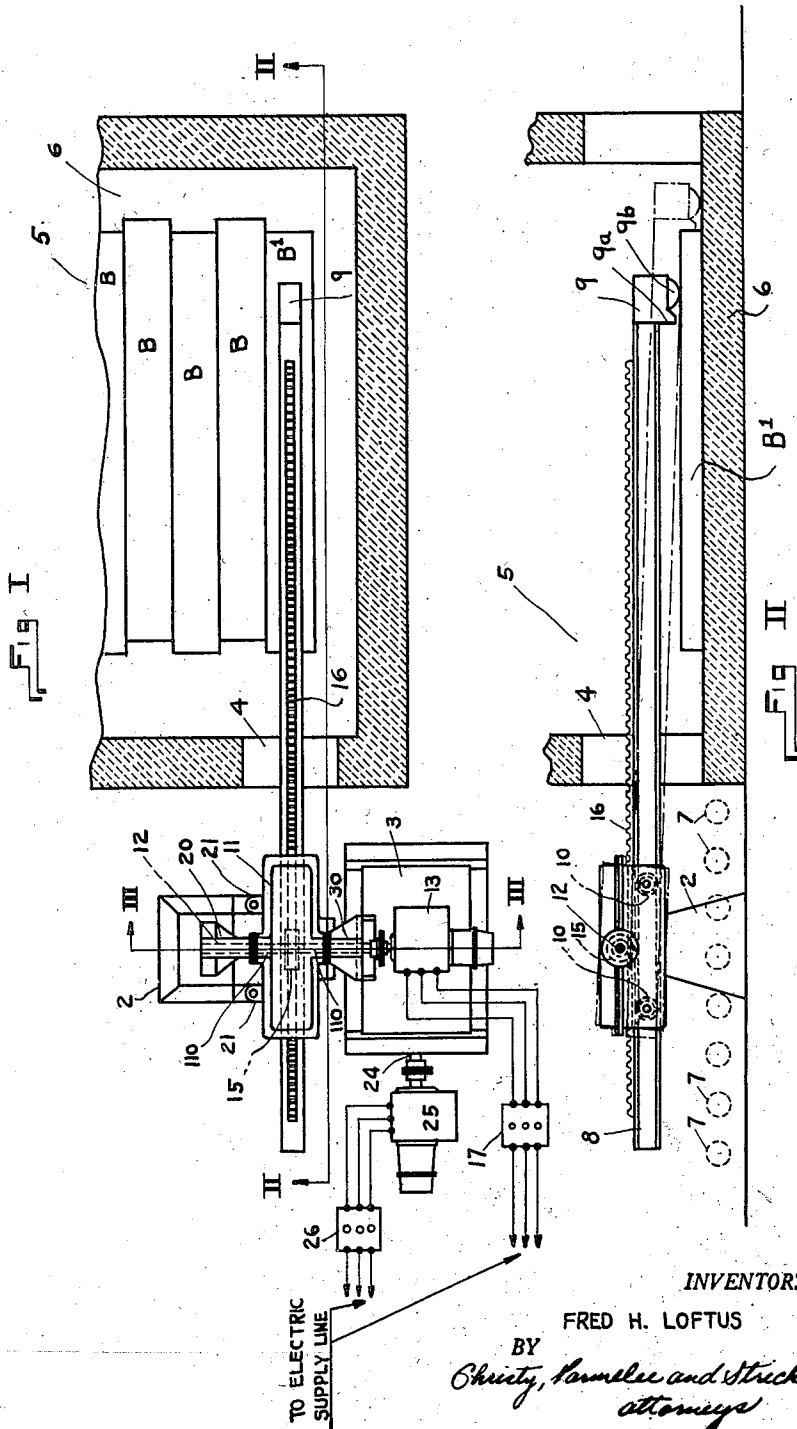
F. H. LOFTUS

2,382,491

FURNACE UNLOADER

Filed Aug. 11, 1943

2 Sheets-Sheet 1



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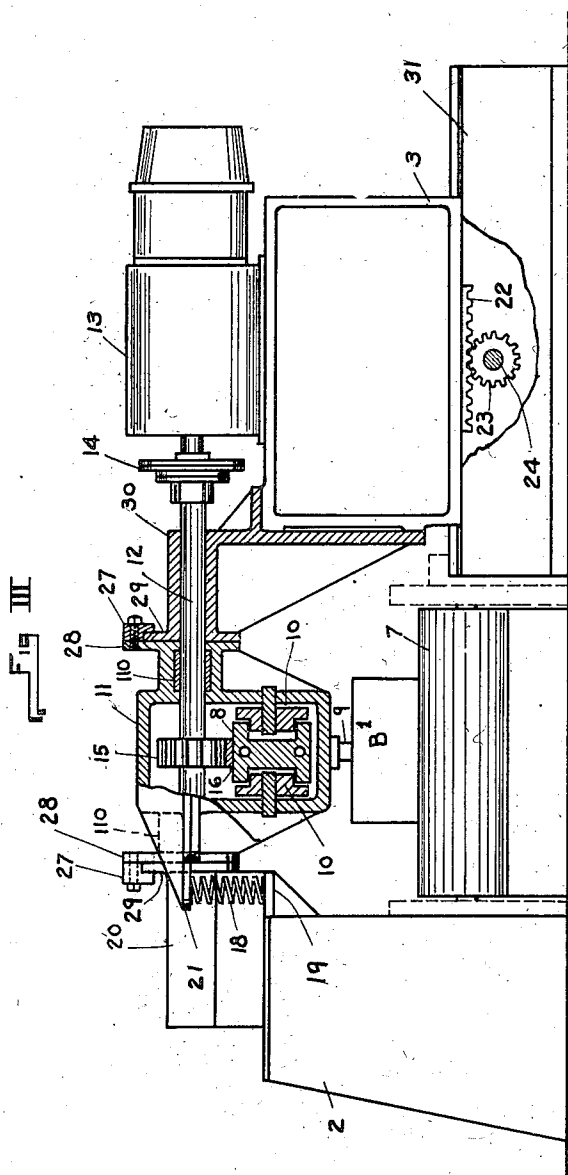
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FURNACE UNLOADER

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7 Claims. (Cl. 214—23)

My invention relates in general to industrial furnace practice; for example, to furnaces for heating slabs, billets, ingots, or other metal stock, preparatory to rolling or forging operations, and the invention is particularly directed to apparatus for handling the billets, or other stock, which form the charges of such furnaces.

More particularly, the apparatus of my invention is designed for unloading heated stock piece by piece from a furnace, and for convenience in expression, and not by way of limitation, I herein call the apparatus a furnace unloader.

The invention consists in certain new and useful improvements in apparatus of the sort alluded to, and in the ensuing specification I shall describe the invention in exemplary way, as it has been developed for the unloading of billets, with the understanding that the term "billets" in the claims shall be inclusive of other kinds of stock to be unloaded or otherwise handled.

In the accompanying drawings, an apparatus embodying the invention is illustrated:

Fig. I is a view in plan of the apparatus, showing a portion of a billet-heating furnace fragmentarily and in horizontal section;

Fig. II is a view of the apparatus as seen on the plane II—II of Fig. I;

Fig. III is a view to a larger scale of the apparatus, the view being partly in end elevation and partly in vertical section, on the plane III—III of Fig. I.

The apparatus of the invention is, when in service, positioned before the door of a furnace in which billets are heated. In this case, the apparatus is permanently mounted on two spaced basal members or pedestals 2 and 3 before the discharge door 4 of a continuous heating furnace 5, upon the hearth 6 of which a succession of billets B is advanced and heated in known way. Extending from the sill of the door is a billet receiver. This receiver may be in the form of a billet-conveying table, a known piece of equipment for transporting the billets removed from the furnace to a rolling mill, forge press, or to another conveyor for handling the billets in desired manner. The conveyor table consists in a line of rollers that may be powerfully rotated to effect the advance of billets delivered thereto from the furnace, or the line of rollers may be inclined downwardly from the door of the furnace, so that gravity will effect the travel of the billets. Again, the billet-receiver may consist in a skidway of known sort. However, the particular form of the conveyor is not of the essence of my invention, and herein I have diagrammatically indicated in dotted lines, (Fig. II),

the rollers 7 of a conveyor of the type first mentioned. The pedestals 2 and 3 are arranged on opposite sides of the conveyor, and on such pedestals, means are supported for pulling the billets B from the furnace one by one.

Such means comprise an elongate arm 8 on whose proximate end—proximate with respect to the furnace 8—a billet-engaging device 9 is carried. The arm 8 is of I shape in cross section; the arm is mounted for longitudinal or axial reciprocation upon two pairs of rollers 10 that engage the I shaped body of the arm, as shown in Fig. III. The two pairs of rollers 10 are journaled in a housing 11. The housing 11 is mounted for rocking movement upon a shaft 12, which is journaled in bearings 20 and 30 on the two pedestal members. The housing 11 includes two bearings 110 that provide the essential rotatable engagement between the housing and shaft.

A gear-motor 13, mounted upon the pedestal 3, is connected by means of coupling 14 to the shaft 12, and means are provided within the housing 11 for moving the arm 8 longitudinally in one direction or the other, according as the shaft 12 is rotated in one direction or the other. Such means comprise a gear-wheel 15 secured to the shaft 12 and meshing with a toothed rack 16 united to or integral with the upper face of the arm 8.

The energizing of the motor 13 in one direction of rotation or the other is controlled by means of a start-stop reversing switch 17 of conventional construction.

In order to unload or remove a heated billet from the furnace, the motor 13 is energized to drive the shaft 12 in counterclockwise direction (Fig. II), with the effect that the arm 8 is moved in left-to-right direction. The proximate end of the arm is projected through the door 4 and into the furnace, and under the weight of the so-projected end of the arm, the housing 11 and arm 8 tend to turn clockwise. However, the billet-engaging device 9 includes a semi-spherical portion, or other obvious device, 9b which bears upon and "rides" the surface of the billet B¹ which is to be removed from the furnace. As soon as the proximate end of the arm 8 reaches and passes the remote end of the billet B¹, the arm tilts into the position indicated in broken lines in Fig. II, and the shoulder portion 9a of the billet-engaging device takes purchase upon the remote end of the billet. It will be perceived that the housing 11, by virtue of its pivotal support on shaft 12, rocks in clockwise direction and permits the arm 8 to tilt under the influence of gravity as described. And it will

further be noted that the direction of rotation of the shaft 12 in the bearings 110 of the rocking housing or support 11 is such that the friction between the rotating shaft and the bearings tends to oppose the rocking and tilting movements described, and thus provides for smoother operation of the apparatus.

When the billet B¹ has been engaged by the device 9, the direction of rotation of motor 13 is reversed. In consequence, the arm 8 is moved in right-to-left direction, (Figs. I and II) sliding the billet B¹ from the floor of the furnace into position upon the conveyor 7. As the billet approaches and enters delivered position upon the conveyor, the outer or distal end of the arm 8 reaches such position to the left of the rocking support or housing 11 that gravity is effective to tilt the arm and rock the housing in counterclockwise direction, whereby the proximate end of the arm rises and disengages the device 9 from the end of the billet, if indeed such disengagement has not already been effected by the action of the conveyor in moving the billet away from the furnace.

The switch 17 is operated to stop the motor 13, with the proximate end of the arm 8 in elevated position, ready again to be projected into the furnace for the removal of a billet, it being understood that the line of billets is advanced over the hearth of the furnace, step by step and in such manner that the billets are brought successively to position opposite the discharge door 4.

When the arm 8 is moved through its billet-withdrawing stroke, the friction between the rotating shaft 12 and the bearings 110 of the housing 11, acts to oppose the counterclockwise rocking movement of the housing 11 (Fig. II) and the tilting of the arm 8 into billet-disengaging position. As already mentioned, the effect of rotational friction in opposing the tilting of the arm 8 tends to eliminate violent movement of the arm as it enters unbalanced position. In further providing for the elimination of racking strains in the apparatus, I organize with housing 11 means for yieldingly limiting the angular or tilting movement of the arm. Such means comprise compression springs 18, arranged one on each side of the center 12 on which the housing 11 and arm 8 tilt. Each spring is secured between a ledge 19 on the bearing block 20 and a lug 21 integral with the housing 11, cf. Figs. I and III. The effect of these springs is to cushion the movements of the arm 8.

Sometimes it may be desirable to adjust the arm 8 laterally of its extent, so that it may be brought into centered position with respect to the billet B¹ in the furnace which is to be unloaded or removed. In order to afford such adjustment, I mount the pedestal 3 for sliding movement on a bed 31, and mount the bearing 20 in like manner on the pedestal 2. The pedestal 3 carries a toothed rack 22 (Fig. III), with which meshes a gear-wheel 23, secured to a shaft 24 that is connected to a gear-motor 25 (Fig. I) controlled through a start-stop reversing switch or controller 26. Subject to the manual control of such switch, the motor 25 may be caused powerfully to rotate the shaft 24 selectively in either direction of rotation, whereby the pedestal 3 may be shifted on the bed 31, either to the right or to the left, as desired. The slidably mounted bearing 20 and the housing 11 and arm 8 are arranged to move in unison with the pedestal 3, so that the said movement of the pedestal 3 effects the desired laterally adjustment of the arm 8. Various means may be provided for so interconnect-

ing the parts while leaving the housing 11 free for rocking or tilting movement. In this case, such means comprise keeper blocks 27 secured to flanges 28 on the housing 11, and severally embracing the peripheries of circular flanges 29 that are concentric with the shaft 12 and integral with the bearings 20 and 30 provided respectively on the pedestals or support members 2 and 3. The engagement of the blocks 27 with the flanges 29 unites the housing 11 with supporting bearings 20 and 30 for common adjustment laterally of the arm 8, without interfering with the rocking movement of the housing 11 on the axis of the shaft 12.

The drawings and specification hereof disclose a preferred embodiment of the invention, but it will be understood that within the spirit and terms of the appended claims, many modifications, refinements and elaborations are permissible.

I claim as my invention:

1. Apparatus for removing billets from a furnace comprising a housing with two aligned laterally extending bearings, means for tiltably supporting said housing comprising a shaft extending through said bearings, an arm mounted in said housing below said shaft for longitudinal movement, means carried by the furnace-entering end of said arm for engaging a billet, the weight of the furnace-entering end of said arm effecting, as the end of the arm is advanced into the furnace, a tilting of said housing and arm, whereby a billet in the furnace may be engaged by said billet-engaging means, means for moving said arm into and out of the furnace including a toothed rack on said arm, a pinion on said shaft in mesh with said rack, and means provided for rotating said shaft in reverse directions whereby the friction between the shaft and said bearings opposes the tilting of said housing and arm.

2. Apparatus for removing billets from a furnace comprising a housing with two aligned laterally extending bearings, means for tiltably supporting said housing comprising a shaft extending through said bearings, an arm mounted in said housing for longitudinal movement, means carried by the furnace entering end of said arm for engaging a billet, the weight of the furnace-entering end of said arm effecting, as the end of the arm is advanced into the furnace, a tilting of said housing and arm, whereby a billet in the furnace may be engaged by said billet-engaging means, means for moving said arm into and out of the furnace including a toothed rack on said arm, a pinion on said shaft in mesh with said rack, means provided for rotating said shaft in reverse directions whereby the friction between the shaft and said bearings opposes the tilting of said housing and arm, and means positioned between said housing and supporting means for inhibiting, in conjunction with said friction, the violent tilting of said housing and arm.

3. Apparatus for removing billets from a furnace to a billet receiver comprising two supporting members standing in straddling relation with respect to said receiver, a rocking support, an arm mounted in said support for longitudinal movement, means carried by the furnace-entering end of said arm for riding the surface of and engaging the end of a billet, mechanism for moving said arm and projecting said end thereof into the furnace, the weight of the projecting end of said arm effecting, as the arm advances into the furnace, a rocking of said support and tilting of said arm, whereby said means descend into position to bear upon and engage a billet in

the furnace, and means for reversing said mechanism to reverse the movement of said arm and withdraw the engaged billet from the furnace, the weight of the outer end of said arm effecting, as the billet approaches withdrawn position, a rocking of said support and a tilting of said arm in opposite direction, whereby the billet is disengaged.

4. Apparatus for removing billets from a furnace to a billet receiver comprising two supporting members standing in straddling relation with respect to said receiver, a rocking support, an arm mounted in said support for longitudinal movement, means carried by the furnace-entering end of said arm for riding the surface of and engaging the end of a billet, mechanism for moving said arm and projecting said end thereof into the furnace, the weight of the projecting end of said arm effecting, as the arm advances into the furnace, a rocking of said support and a tilting of said arm, whereby said means descend into position to bear upon and engage a billet in the furnace, means for reversing said mechanism to reverse the movement of said arm and to withdraw the engaged billet from the furnace, the weight of the outer end of said arm effecting, as the billet approaches withdrawn position, a rocking of said support and a tilting of said arm in opposite direction, whereby the billet is disengaged, and means cooperating with said rocking support to cushion the movement of said support and arm as they tilt in either direction.

5. Apparatus for removing billets from a furnace to a billet receiver comprising two supporting members standing in straddling relation with respect to said receiver, an arm mounted between said supporting members for reciprocation

and tilting movements, billet-engaging means on said arm, means for reciprocating said arm and causing it to tilt under gravity between billet-engaging and billet-disengaging positions, and means for adjusting said arm on said supporting members transversely of the extent of the arm without interference with the capacity of the arm to tilt.

6. Apparatus for removing billets from a furnace to a billet receiver comprising two supporting members standing in straddling relation with respect to said receiver, a support mounted between said members for rocking movement, an arm mounted in said support for longitudinal movement, billet-engagement means on said arm, means for reciprocating said arm in said support and causing the arm and support to tilt under gravity between billet-engaging and billet-disengaging positions, and means for adjusting said rocking support on said supporting members transversely of the direction of the extent of the arm.

7. Apparatus for removing billets from a furnace to a billet receiver comprising two supporting members arranged in straddling relation with respect to said receiver, a bearing member movably borne on each of said supporting members, a support mounted between said bearing members for rocking movement, an arm mounted in said support for longitudinal movement, billet-engaging means on said arm, means for uniting said bearing members and said rocking support for movement in unison in a direction extending transversely of said arm while leaving the arm free for rocking movement with said support, and means for effecting said movement of the so united support and bearing members.

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