

Dec. 18, 1945.

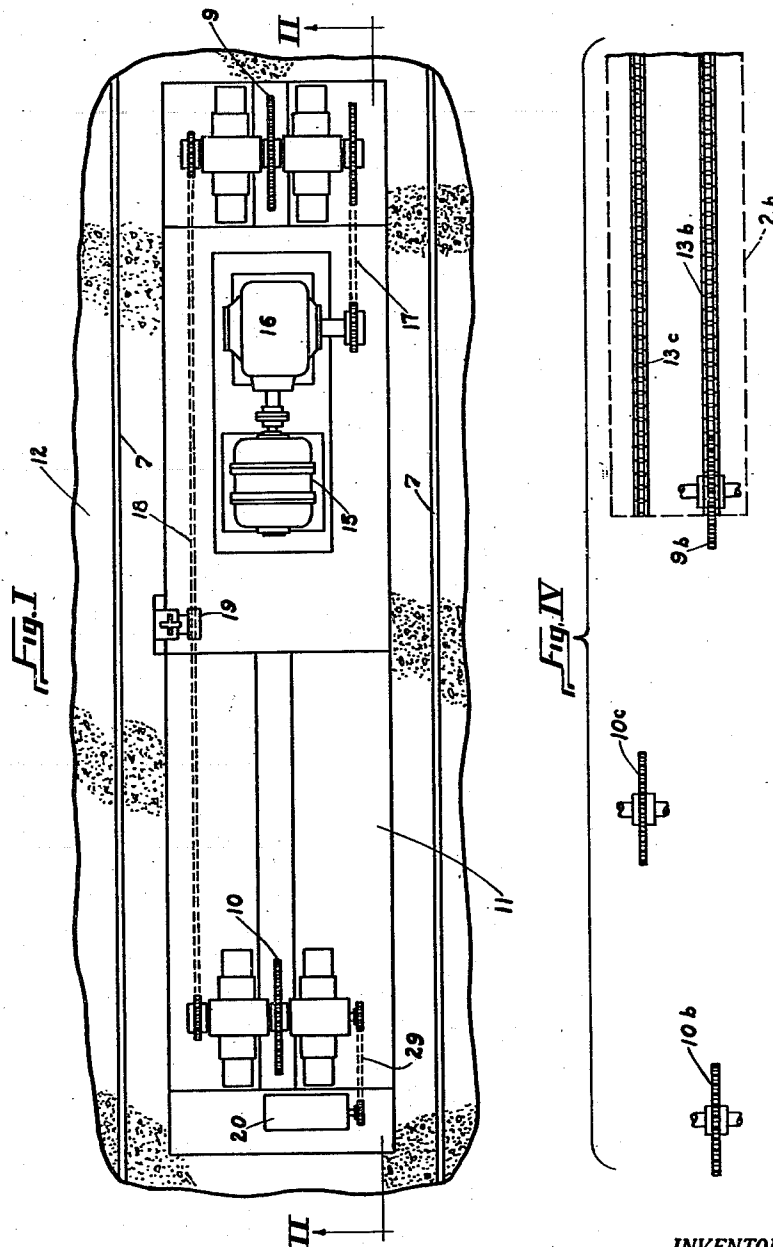
F. H. LOFTUS ET AL

2,391,173

CAR-BOTTOM FURNACE

Filed Aug. 21, 1943

2 Sheets-Sheet 1



INVENTORS
FRED H. LOFTUS
VINCENT R. TROGLIONE
BY
Christy, Parmelee and Strickland
attorneys

Dec. 18, 1945.

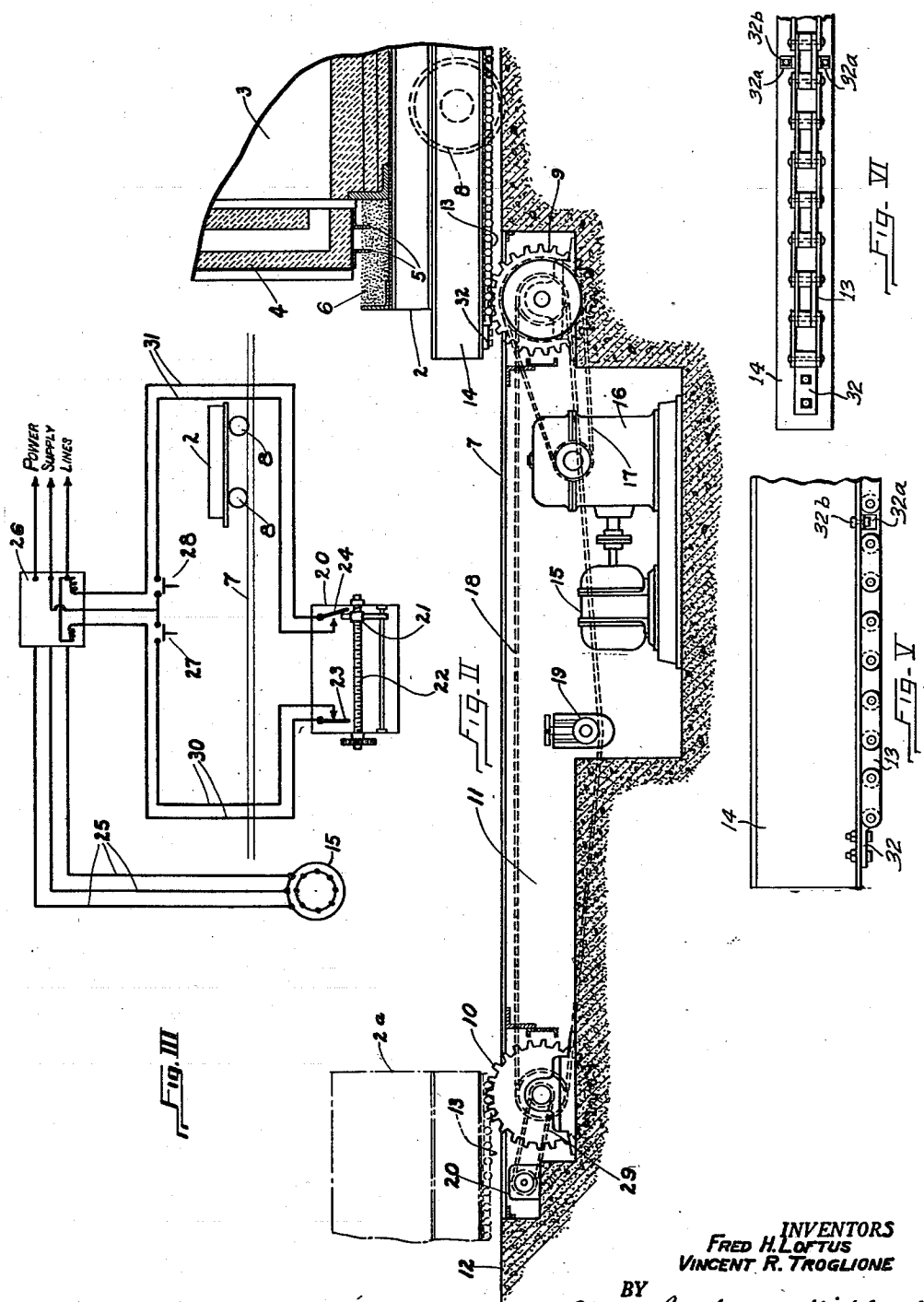
F. H. LOFTUS ET AL

2,391,173

CAR-BOTTOM FURNACE

Filed Aug. 21, 1943

2 Sheets-Sheet 2



INVENTORS
FRED H. LOFTUS
VINCENT R. TROGLIONE
BY
Christy, Parmelee and Strickland
attorneys

UNITED STATES PATENT OFFICE

2,391,173

CAR-BOTTOM FURNACE

Fred H. Loftus, Mount Lebanon, and Vincent R. Troglione, Wilkensburg, Pa.; said Troglione assignor to Loftus Engineering Corporation, Inc., Pittsburgh, Pa., a corporation of Delaware

Application August 21, 1943, Serial No. 499,466

3 Claims. (Cl. 104—165)

Our invention relates to industrial furnaces for heating, or annealing, or heat treating metal castings, or other articles formed of other materials. The invention is particularly, though not exclusively, designed for car-bottom furnaces, and in such association it will be described.

A furnace of the sort in mind comprises a furnace chamber constructed of refractory brick-work, externally reinforced and tied by means of structural steel and tie-rods. The floor portion of the furnace, upon which the articles to be heated are borne, comprises the body of a car—a car that may be likened to a railroad flat-car, whose floor is constructed of refractory blocks. The car is adapted to travel on wheels or rollers between service position within the furnace, and loading and unloading position externally thereof. The front wall of the furnace is provided with a door which is opened and closed, as need be, to permit of the said movement of the car into and out of the furnace, and, when the furnace contains its charge, the door is sealed shut.

In normal operation of the furnace, fuel and air are projected in regulated quantities into the furnace chamber, maintaining combustion therein and heating to desired temperature the articles to be treated. The products of combustion find escape through suitable outgo ports that open through the walls of the furnace chamber and communicate through suitable flues to a stack or other vent. After the work has been heated at regulated rate to the required temperature, the combustion within the furnace is retarded or interrupted, and the work allowed to cool through a specified cooling cycle.

As indicated above, the upper surface of the car body provides the work-bearing floor portion of the furnace chamber. Means are provided for sealing the car body along its two sides and inner or back end to the two side walls and back wall of the furnace chamber, while the door of the furnace is sealed to the front wall of the furnace chamber and to the outer or front end of the car body. The art is familiar with the structure and organization of sand seals for this purpose. As organized within the closed furnace, the body of the car is in effect integrally united with the furnace walls, providing a furnace chamber in which the desired conditions of combustion and thermal head may be established and maintained.

In order to facilitate the loading and unloading of the furnace charge, the car that forms the work-bearing floor of the furnace is moved

in linear path out of the furnace chamber, into a position where the work is accessible to an overhead crane, or other work-handling equipment.

Various mechanisms have been proposed and used for moving the car between said position of service within the furnace and said loading and unloading position externally thereof, and it will be understood that our invention is directed to new and useful improvements in such mechanisms.

One type of car-shifting mechanism hitherto in use consists in a cable anchored at one end to the front end of the car and extending therefrom to a sheave spaced from the front of the furnace by an interval exceeding the length of the car. The outer end of the cable, trained over said sheave, is connected to a crane, which, by pulling the cable, draws the car out of the furnace. In order to move the car back into the furnace, one end of a second cable is anchored to the inner end of the car, whence it extends over a sheave journaled beneath the car at the inner end of the furnace, and from such sheave extends the length of the furnace to another sheave that is spaced from the front of the furnace, after the manner of the first-mentioned sheave. The crane is connected to the outer end of this second cable, and tension applied to the cable is effective to pull the car into the furnace. In a more elaborate form of this mechanism, the sheaves spaced from the front of the furnace are replaced by a motor-driven drum, upon which the otherwise free ends of the cables are wound, one cable being wound in opposite direction to the other, whereby by rotating the drum one cable is paid out, and an equal length of the other rolled in, effecting the travel of the car. Rotation of the drum in one direction moves the car outward from the furnace, and rotation in opposite direction moves the car inward into the furnace. While a mechanism of this sort is effective in its intended capacity, it is open to certain objections, among which may be noted: The sheave and cable within the furnace are exposed (particularly when the car is withdrawn from the furnace) to the harmful effect of the heat developed within the furnace and radiated from the hot furnace walls. Additionally, the floor space in front of the furnace is obstructed, obviously an objectionable circumstance.

Another car-shifting mechanism comprises a toothed rack secured upon the bottom of the car and extending longitudinally thereof. At the front of the furnace a gear-pinion meshes with the teeth of such rack, and a motor is con-

nected to drive the gear-pinion in either direction of rotation, whereby the car may be moved into and out of the furnace at will. In order that the distance of travel of the car will be adequate to carry the car entirely out of the furnace, the rack is made longer than the work-bearing body of the car; that is, the rack extends several feet beyond the front end of the car. When the car is positioned within the furnace, the rack projects from the furnace, and is engaged by the gear-pinion, whereby rotation of the pinion is adapted to shift the car outward a greater distance than the length of the car body that forms the work-bearing floor of the furnace, with the effect that the work-bearing floor is moved clear of the furnace for accessibility to a crane or other car-loading and unloading apparatus. The objection to this car shifting mechanism is that the floor space immediately in front of the furnace is obstructed by the outward extending rack when the furnace is in normal operation.

The mechanism of our invention avoids objections of the nature indicated, and affords many advantages which will be apparent to those skilled in the art.

A mechanism embodying the invention is illustrated in the accompanying drawings, in which:

Fig. I is a fragmentary view in plan of the floor of a mill in front of a car-bottom furnace (not shown), with which the mechanism is organized. The mechanism is installed in a pit in the mill floor, and appears in plan;

Fig. II is a view of the mechanism in side elevation, the pit and the floor of the mill, together with the front end of the car-bottom furnace, being shown in vertical section, on the plane II-II of Fig. I;

Fig. III is a wiring diagram;

Fig. IV is a diagrammatic view, illustrating a modification in the structural organization of the mechanism, and

Fig. V is a fragmentary view, showing in side elevation and to larger scale a portion of the underframe or chassis of the car, and indicating the manner in which a certain roller chain is secured to the frame; and

Fig. VI is a view in bottom plan of the structure shown in Fig. V.

Referring to the drawings, the reference numeral 2 indicates the car (fragmentarily shown in Fig. II) which forms the work-bearing floor of the furnace 3. The front end of the furnace is provided with a doorway that is normally closed by a door 4. The door is provided at its lower edge with blades 5 that nest in a sand seal 6 at the front or outer end of the car. In order to load and unload the work or furnace charge, the door 4 is raised into open position, and the car is moved outward through the furnace doorway to a position where the car is entirely removed from the furnace. The car is in this case adapted to move on rails 7, the car being equipped with railway wheels 8.

The mechanism for shifting the car 2 between its alternate positions comprises a plurality of wheels spaced apart in the linear direction of travel of the car. The wheels are connected to means for powerfully rotating them, and the car is provided with means that engage the wheels in such manner that as the wheels are rotated the car is caused to travel. As shown in Figs. I and II, the plurality of wheels comprises two toothed wheels 9 and 10. The two wheels are journaled in a pit 11 formed in the floor 12 in front of the

furnace. The wheel-engaging means comprise a rack 13 mounted beneath and secured to the frame 14 of the car. The rack 13 extends from one end of the car to the other and on the longitudinal center-line thereof, and the teeth of the wheels engage the rack.

An electric motor 15 is connected through a gear-box 16 and a chain-drive 17 to rotate the shaft on which toothed wheel 9 is mounted, and a chain-drive 18 interconnects the shaft of wheel 9 with the shaft of wheel 10, so that the two wheels 9 and 10 when rotated will rotate in unison. A weighted roller 19 is arranged to keep slack out of the chain 18. The energizing circuit 25 (Fig. III) of motor 15 includes a controller 26 that is subject to push-button switches 27 and 28 and contact arms 23 and 24 of a limit switch 20. The limit switch 20 includes a screw 22 connected by a chain-drive 29 (Figs. I and II) to the drive-shaft of toothed wheel 10. A finger 21 engages the screw 22 as a nut, and as the screw is rotated the finger is caused to travel therealong.

When the car is to be withdrawn from the furnace, the furnace door 4 is opened and the push-button 27 is pressed, closing a circuit 30 through the then closed contact arm 23 of limit switch 20; the closing of such circuit operates the controller 26 which closes the circuit 25 and sets the motor in rotation, rotating the wheels 9 and 10 counter-clockwise (Fig. II), and, by reason of the existing engagement of the wheel 9 with the rack 13, the car moves outward from the furnace. As the car moves outward from the furnace, the rack 13 advances into engagement with the toothed wheel 10 that is rotating in unison with wheel 9, and thus it is that the car may be moved beyond the position where the remote end (right-hand end) of the rack is engaged by the wheel 9. The wheel 10 may be said to pick-up where the wheel 9 leaves off. The car is moved through a distance equal to the length of the rack passing through engagement with wheel 9, plus the distance between the wheels 9 and 10, plus the length of the rack that passes through engagement with the wheel 10. The broken lines 2a in Fig. II indicate the position of the rear end of the car in its outermost position.

The switch 27, once pressed, remains in circuit-closing position and the controller 26 holds the circuit 25 closed until the car reaches fully withdrawn position, whereupon the finger 21, traveling in right-to-left direction (Fig. III) under the effect of the rotating screw 22, engages and swings the contact arm 23 into open position, thereby opening circuit 30 and effecting operation of controller 26 to de-energize the motor 15. The motor 15 immediately comes to rest, with the car fully withdrawn from the furnace.

When the car is to be returned to service position in the furnace, the push-button 28 is pressed, closing circuit 31, through contact arm 24, which during the preceding right-to-left travel of the finger 21 moved into circuit-closing position. Thereupon, the controller 26 effects the energization of the motor 15 in alternate direction and the wheels 9 and 10 are driven in clockwise direction, moving the car into the furnace. As the car reaches full entered position in the furnace, the finger 21, then traveling in left-to-right direction engages and swings contact arm 24 into open position. All movement of the mechanism is immediately arrested, with the car in proper position within the furnace.

From the foregoing description, it will be understood that the interval between the wheels 9 and

10 is less than the length of the rack 13, and it is by virtue of this feature that the wheel 9 may be located substantially beneath the door of the furnace, and that the distance to the wheel 10 may be minimized, while affording maximum distance of travel of the car or furnace floor portion that is to be moved into and out of the furnace chamber.

Of course, the organization of the car-shifting mechanism within the pit 11 permits the pit to be covered, as in fact it will be, with only the upper limb or edge of the wheel 10 extending above the exposed mill floor or surface 12 in front of the furnace and over which the car travels.

It is important to note that the rack 13 is formed of a length of roller-chain, and that the toothed wheels 9 and 10 comprise sprocket-wheels whose teeth engage the rollers of the chain. The roller-chain is secured in taut condition to the chassis 14 of the car, the attachment being effected by means of blocks 32 linked to each end of the chain and bolted to the car chassis. The body of the chain may be spot-welded, or otherwise secured, to the chassis at desired points intermediate of its length. In Figs. V and VI, the means for securing the chain at intermediate points are shown as angle clips 32a welded to intermediate links of the roller chain, and secured by means of bolts 32b to the beam 14 of the car chassis. A roller-chain so organized affords many advantages over a machined gear-rack.

Fig. IV illustrates that two (or more) parallel toothed racks 13b and 13c, or two lengths of roller-chain, may be arranged on the bottom of the car or floor portion 2b to be moved. In such structure, toothed wheels 9b, 10b and 10c, all positively driven, will be arranged to be engaged by the racks successively as the car moves. The space between successive wheels is less than the effective length of the racks. Manifestly, by such arrangement of racks and driving wheels, maximum travel of the car or floor portion of the furnace may be obtained with minimum obstruction of the floor in front of the furnace.

Within the scope of the invention defined in the appended claims, certain modifications, refinements and elaborations will occur to those skilled in the art.

We claim as our invention:

1. In a furnace comprising a furnace body and a car movable through the furnace doorway into

and out of the furnace chamber and subject to different temperatures when in the furnace than out, said car having a chassis of metal supporting a refractory deck that forms the floor of the furnace when the car is positioned in said chamber, and means for moving the car into and out of the furnace chamber; the invention herein described in such means comprising a rectilinear length of flexible roller chain extending longitudinally of the car beneath said chassis and attached at spaced-apart points to the chassis, a sprocket wheel journaled beneath the car adjacent to the furnace doorway and engaging said roller chain, and means for selectively driving said sprocket in alternate directions of rotation, whereby the car may be moved into and out of the furnace chamber.

2. In a furnace comprising a furnace body and a car movable through the furnace doorway into and out of the furnace chamber, and subject to different temperatures when in the furnace than out, said car having a chassis of metal supporting a refractory deck that forms the floor of the furnace when the car is positioned in said chamber, and means for moving the car into and out of the furnace chamber; the invention herein described in such means comprising a rectilinear length of flexible roller chain extending longitudinally of the car beneath said chassis and attached at spaced-apart points to the chassis, a sprocket wheel journaled beneath the plane of the surface over which said car travels, with the upper edge of the sprocket wheel extending above said surface and engaging said roller chain, and means arranged below said surface for selectively driving said sprocket in alternate directions of rotation, whereby the car may be moved into and out of the furnace chamber.

3. The structure of the next preceding claim, and a second sprocket wheel journaled below said surface at an interval from the first and in alignment therewith, and adapted to engage said roller chain when the car is moved out of the furnace chamber, and means for driving said second wheel in synchronism with the first, whereby the two wheels successively engaging said roller chain are adapted to move said car through a distance substantially exceeding the length of said roller chain.

FRED H. LOFTUS.
VINCENT R. TROGLIONE.