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Patented Mar. 13, 1900.

S. T. WELLMAN, F. H. DANIELS & C. H. WELLMAN.

HEATING FURNACE.

(Application filed June 30, 1899.)

(No Model.)

3 Sheets—Sheet 2.

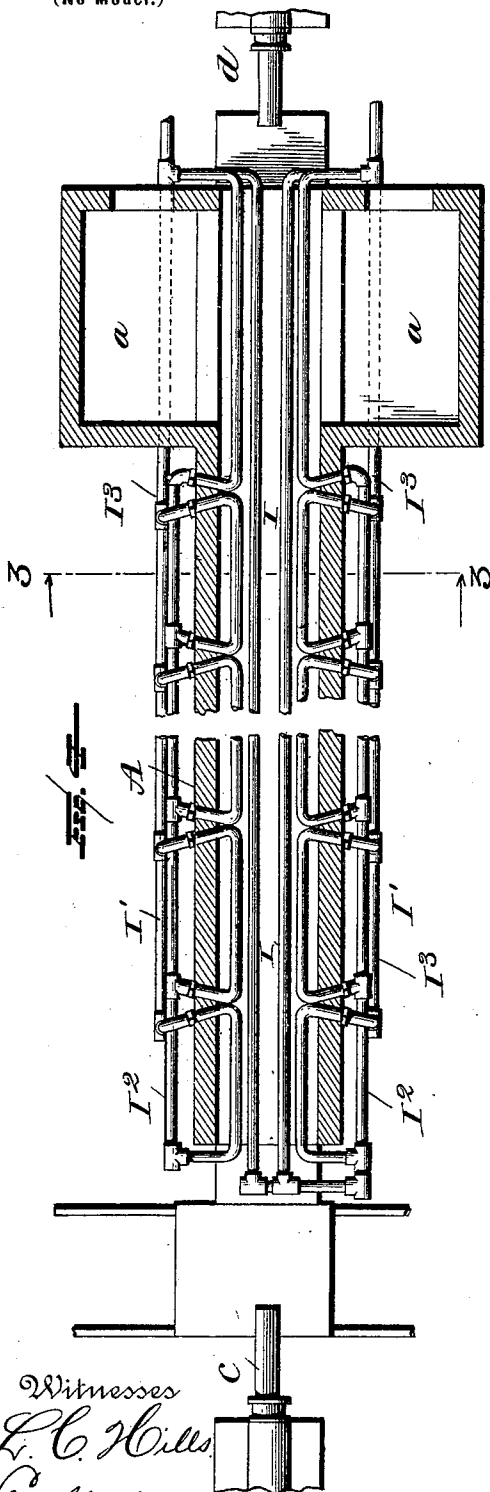
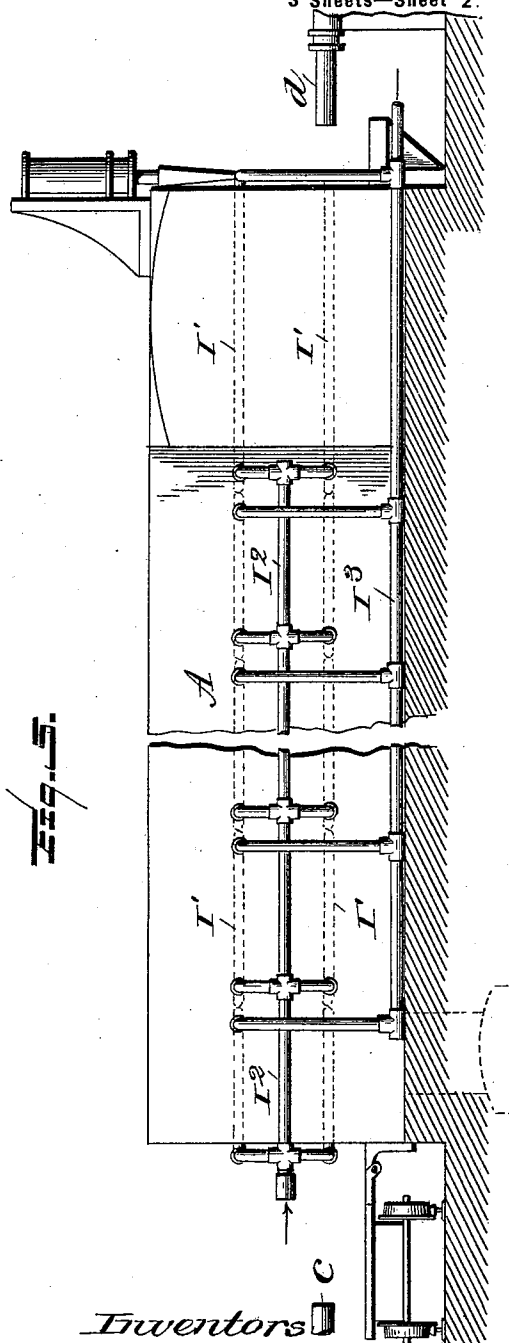


Fig. 5.



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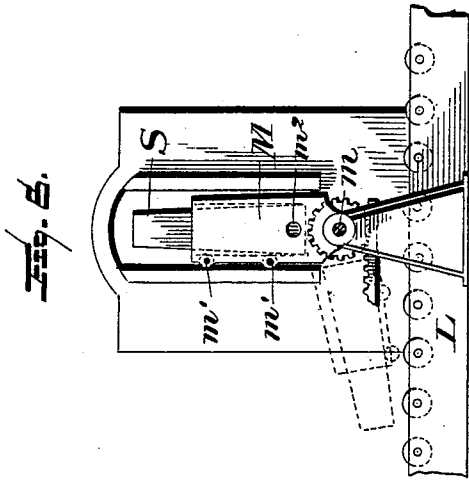
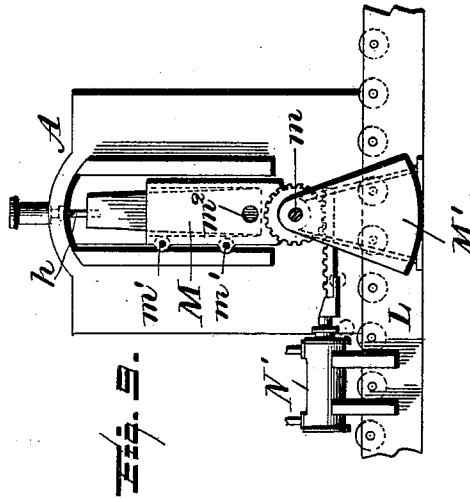
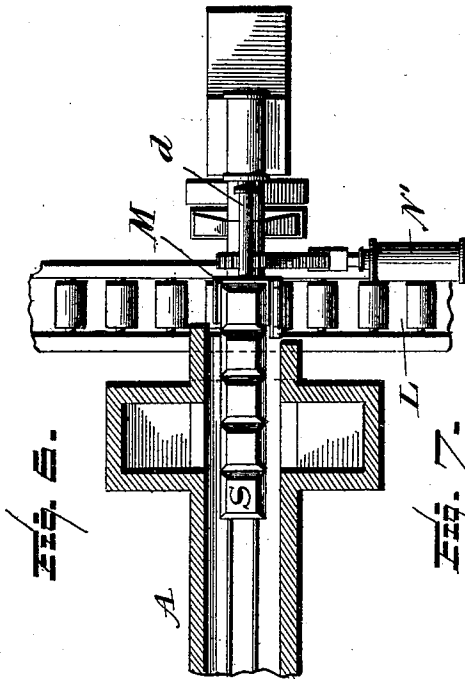
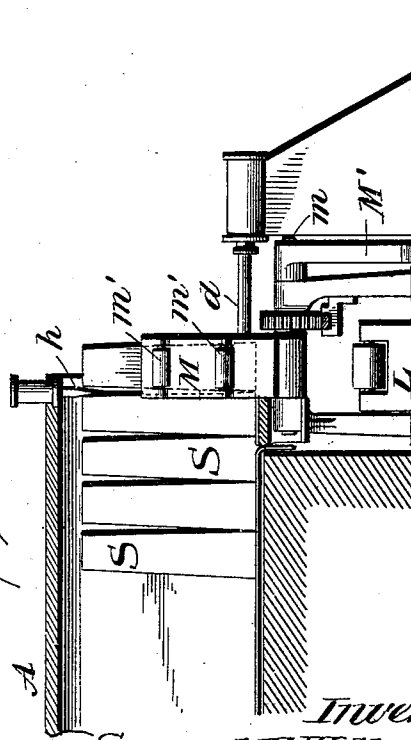
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UNITED STATES PATENT OFFICE.

SAMUEL T. WELLMAN, OF CLEVELAND, OHIO, FRED H. DANIELS, OF WORCESTER, MASSACHUSETTS, AND CHARLES H. WELLMAN, OF CLEVELAND, OHIO.

HEATING-FURNACE.

SPECIFICATION forming part of Letters Patent No. 645,305, dated March 13, 1900.

Application filed June 30, 1899. Serial No. 722,455. (No model.)

To all whom it may concern:

Be it known that we, SAMUEL T. WELLMAN, of the city of Cleveland, county of Cuyahoga, and State of Ohio, FRED H. DANIELS, of Worcester, county of Worcester, and State of Massachusetts, and CHARLES H. WELLMAN, of the city of Cleveland, county of Cuyahoga, and State of Ohio, have invented a new and useful Improvement in Heating-Furnaces, of which the following is a specification.

The heating-furnace in which the invention is embodied is one designed to heat cast-steel ingots, an operation which is preliminary to the operation of rolling them.

It is considered desirable to charge the ingot into a heating-furnace as soon as practicable after it has been cast, before it cools off, and while the metal at the center of the ingot is still fluid. One plan has been to lay the ingot on its side in the heating-furnace, but this plan necessarily delays the charging, inasmuch as if the ingot be put in the furnace too soon after being cast the still fluid and plastic steel in its interior will be disturbed, making hollow and imperfect places in the center of the ingot. By another plan the ingots have been lifted and retained in their vertical positions as originally cast and dropped or lowered in that position into pits called "soaking-pits." The soaking-pit system, however, is very expensive in fuel and possesses other disadvantages which detract materially from its practical value and usefulness. The heating furnace or apparatus which we have devised is not open to any of the objections which attend the heating systems heretofore in use, and it furnishes what is in effect a continuous heating-furnace, into which the ingots are charged in vertical position from one end of the furnace and are discharged or withdrawn from the opposite end and in which during the passage of the ingot therethrough the flame can surround the entire ingot—bottom, sides, and top.

The nature of our invention and the manner in which the same is or may be carried into effect may be explained and understood by reference to the accompanying drawings, in which—

Figure 1 is a sectional side elevation of a heating apparatus embodying our invention.

Fig. 2 is a longitudinal horizontal section of the same. Fig. 3 is a cross-section on lines 3 3, Fig. 4. Fig. 4 is a longitudinal horizontal section of the furnace when empty. Fig. 5 is a side view of the furnace. Figs. 6 to 9, inclusive, are views, hereinafter more particularly referred to, of a discharging device for use at the rear end of the furnace to receive the end ingots and tip them onto a roller conveyor.

The furnace A is very long, so that it will accommodate a considerable number of ingots S, which stand in the furnace upright and in a long row. The furnace is relatively narrow, being preferably only wide enough to accommodate a single ingot and allow sufficient space at its sides for the free play of the flame or heating-gases around all sides of the ingot, which stands on end in the furnace. The form of the interior of the furnace is shown in cross-section in Fig. 3. To prevent the ingots from cutting into the brickwork, they rest upon a single longitudinal pipe I, as represented in Fig. 3, or a plurality of such pipes, as represented in Fig. 5, two being the number preferably used, supported on a raised ledge *i*, extending the length of the furnace, these pipes being kept constantly supplied with running water. Likewise to keep the ingots from tipping sidewise they are supported and guided by similar longitudinal pipes I' on side ledges *i'*, extending the length of the furnace. We prefer that the holding and guiding pipes I' should be arranged as represented in Figs. 4 and 5—that is to say, they are made in sections sufficiently short to overcome the danger of their becoming distorted or moved out of place and are rigidly bolted or otherwise secured in position in the walls of the furnace. It will be understood that these pipes are kept supplied with running water in order that they shall not become overheated. Each section may be provided with an independent source of water-supply, or they may be suitably united, so that the flow shall be continuous through the entire system.

In the drawings, I² designates a main supply-pipe for the several sections of the supporting and guiding pipes, and I³ a main discharge or exhaust pipe.

The furnace is fired by fire-boxes *a* or any others suitable gas-producer, the flame passing through the whole length of the interior of the furnace into the chimney-flue *F*. It will be noted that under this system the flame can surround the bottoms, sides, and tops of the ingots. These ingots are made slightly tapering, being smaller at the top than at the bottom, so that when placed in a row with their bases touching there will be a space between the two adjoining sides of any two adjacent ingots, thus allowing the flame to enter also between these sides. In fact, the entire ingot during its passage through the furnace is surrounded by the flame.

The ingots are charged into the furnace at the cooler end—the left-hand end of the furnace in Figs. 1 and 2—and they are discharged from the opposite and hot end of the furnace. Means therefore must be provided for causing the ingots to traverse the furnace. The device which we employ for this purpose is a pusher, which by pushing against the end ingot at the cooler end of the furnace advances gradually the whole row of ingots toward the other end of the furnace. The pushing device shown in the drawings consists of a hydraulic plunger *c*. The plunger *c* may be telescopically constructed in order that it may have sufficient length to fully charge or empty the furnace. Other mechanical means or devices may be made use of for effecting the charging and discharging of the furnace-chamber, the plunger *c* being a mechanism well adapted for that purpose and illustrative of the entire class of such devices.

When the ingots rest upon stationary pipes, as *I*, it is found desirable to provide means for preventing the ingots as they are pushed forward from tipping over endwise, and to this end we provide at the other or discharge end of the furnace a retarder, which is in this instance a hydraulic plunger *d*, which pushes against the end ingot at the hot end of the furnace in a direction opposed to the plunger *c*. Plunger *d*, however, only exerts sufficient pressure to keep the ingots from tumbling forward endwise. It has less power than the pushing-plunger *c* and yields or gives back when the latter is operated to shove along the line of ingots. The plunger *d* may be extensible or telescopically constructed, if found desirable. It will be understood that the rear plunger *d* might be dispensed with, especially should movable supports for the ingots be used. Still another hydraulic plunger *h* is provided, which acts as a gate or cut-off. After the end ingot has been pushed out from the hot end of the furnace the plunger *h* is operated to descend, entering between the end ingot and the line of ingots in rear and holding up those in the line while the end ingot is being removed. The cut-off plunger *h* is shown in this position in Fig. 1. The operation is as follows: The red-hot ingots immediately after they have been cast are brought into position opposite the cooler

end of the furnace by cranes or by a car *C* and are successively pushed into the furnace from that end by the plunger *c*, which gradually advances the line toward the opposite end of the furnace. When the end ingot at the hot end of the furnace has been pushed outside the furnace, (the retarder-plunger *d* yielding to this pushing action,) the cut-off plunger *h* descends and cuts off this ingot from the rest of the line of ingots. The ingot thus segregated from the others is removed by suitable means and taken directly to the blooming-mill. The removal may be accomplished by traveling cranes *N*, as represented in Figs. 1 and 3, or in lieu thereof we can employ a tilting receiver to discharge the ingot upon a roller-conveyer, by which it will be taken directly to the rolling-mill without any further handling. Such a device as that last referred to is represented in Figs. 6 to 9. Fig. 6 is a sectional plan of the rear end of the furnace provided with this device or appliance. Fig. 7 is a sectional side elevation of the same. Figs. 8 and 9 are rear end elevations of the furnace, illustrating to some extent diagrammatically the working of the appliance. The retarder-plunger *d* and the cut-off plunger *h* are the same as in the preceding figures. *L* is a roller-conveyer of usual construction and operated in the usual way, which is arranged below and just beyond and crosswise of the rear or discharge end of the furnace. At said end of the furnace and above the roller-bed is a tilting box or trough-like receiver *M*, mounted to oscillate or tilt upon an axis *m* and provided with a counterweight *M'*. This receiver when in upright position faces the discharge end of the furnace and is open on the side next to the furnace, so that the end ingot can be pushed into it. That side of the receiver which forms its bottom when it is tilted downward is provided with rollers *m'*. The retarder-plunger *d* can work through a hole or window *m*² in the receiver. The receiver itself can be conveniently operated and have its movements controlled by a hydraulic cylinder *N'*, the piston of which through suitable intermediaries is connected with a crank on the shaft or hub of the receiver. Normally the receiver stands upright, as shown in Fig. 7 and in full lines in Figs. 8 and 9, in position to take the end ingot, the retarder-plunger extending through it, so as to bear against the end ingot in the furnace. When a hot ingot is needed, the line of ingots is advanced until the rear one of them is pushed out into the receiver. Then after the cut-off plunger has descended to cut this ingot off from the others and the retarder-plunger has been withdrawn from the receiver the latter, through the instrumentality of the hydraulic cylinder *N'* and its connections, is tipped over to the position shown in dotted lines in Figs. 8 and 9, in which position the ingot will slide out over the rollers *m'* onto the roller table or conveyer *L*, after which the receiver will be returned to its original position, the retarder-

plunger returns to bear against the rearmost ingot, the cut-off plunger rises, and the line of ingots is again ready to be pushed forward when a fresh ingot is to be carried off.

5 Having described our improvement and the best way now known to us of carrying the same into effect, we state in conclusion that we do not restrict ourselves to the structural details hereinbefore set forth in illustration
10 of our invention, for manifestly the same can be varied in a number of respects without departure from the invention claimed; but

What we claim as new, and desire to secure by Letters Patent, is as follows:

15 1. A heating-furnace for heating cast-steel ingots of a length and interior height and width to receive the ingots in upright position and in a row, and provided with internal guides which support the bases and sides of
20 the ingots as they move through the furnace from one end thereof to the other leaving within the furnace a clear space around the top, bottom and sides of the ingots for the passage of the flame therethrough, combined with
25 means for pushing the line of ingots through from one end of the furnace, and with retarding means at the opposite end of the furnace for retaining the ingots in upright position and preventing them from tipping endwise as
30 they are shoved along, substantially as and for the purposes hereinbefore set forth.

2. The heating-furnace adapted to receive a line or row of upright ingots, in combination with pushing mechanism at the charging
35 end of the furnace and retarding and cut-off mechanisms at the opposite or discharging end of the furnace—these elements being arranged and adapted to operate conjointly, substantially as and for the purposes herein-
40 before set forth.

3. The heating-furnace adapted to receive a line of upright ingots in combination with pushing mechanism at the charging end of
45 the furnace, retarding and cut-off mechanisms at the discharging end of the furnace, a roller table or conveyer and a tilting receiver and operating appliances therefor whereby the end ingot pushed out from the furnace may
50 therefrom onto the conveyer, substantially as and for the purposes hereinbefore set forth.

4. The combination with the heating-fur-

nace adapted to receive a line of upright ingots and means for advancing said ingots through the furnace, of a tilting receiver arranged at the discharge end in position to receive the ingot discharged from said end, and adapted to be bodily tipped so as to lower the ingot from vertical to horizontal position and discharge the same, and operating means for
60 said tilting receiver, substantially as hereinbefore set forth.

5. The furnace having a longitudinal heating-chamber of a width and height to receive ingots placed in vertical position and in line
65 one after the other, and provided at its bottom and sides with longitudinal water-pipes for the support and guidance of the ingots, substantially as and for the purposes hereinbefore set forth.

6. A heating-furnace for steel ingots of a length, and interior height and width, to receive the ingots in upright position and in a row, there being a flame-space entirely around the ingots, and provided at its bottom and
75 sides with longitudinal supports for holding the ingots in an upright position, combined with means for moving the ingots longitudinally through the furnace, substantially as and for the purposes hereinbefore set forth.

7. A heating-furnace for steel ingots having a longitudinal heating-chamber of a width and height to receive ingots placed in vertical position and in a line one after another and provided with longitudinal water-pipes
85 for guiding or supporting the ingots, such pipes being made in relatively-short sections, suitably supported in the walls of the furnace, substantially as and for the purposes hereinbefore set forth.

In testimony whereof we have hereunto set our hands in the presence of subscribing witnesses.

SAMUEL T. WELLMAN.
FRED H. DANIELS.
CHARLES H. WELLMAN.

Witnesses to the signatures of S. T. Wellman and C. H. Wellman:

C. W. COMSTOCK,
W. G. HILDEBRAN.

Witnesses to signature of Fred H. Daniels:

JOHN D. CURTIS,
G. LAMPSON.