(No Model.)

2 Sheets—Sheet 1.

J. BERGQVIST.

PUDDLING FURNACE.

No. 248,081. Patented Oct. 11, 1881.

Fig. 1.

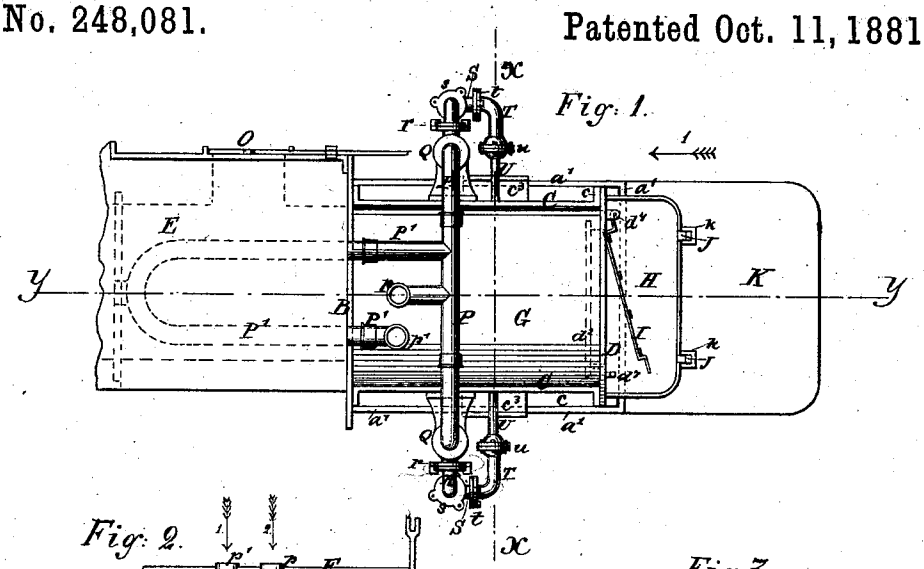


Fig. 2.

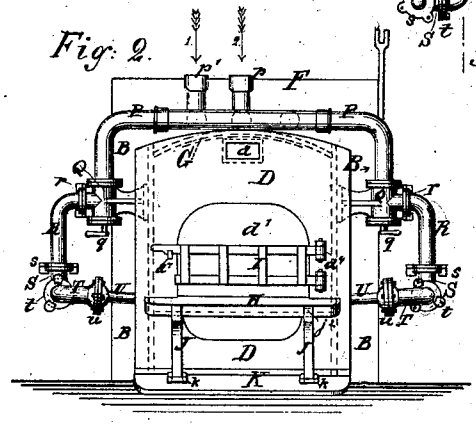


Fig. 3.

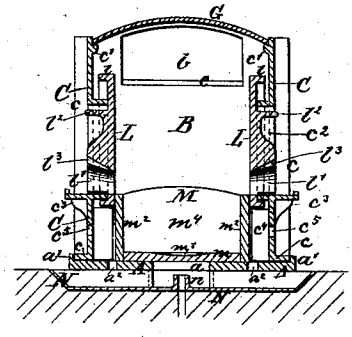
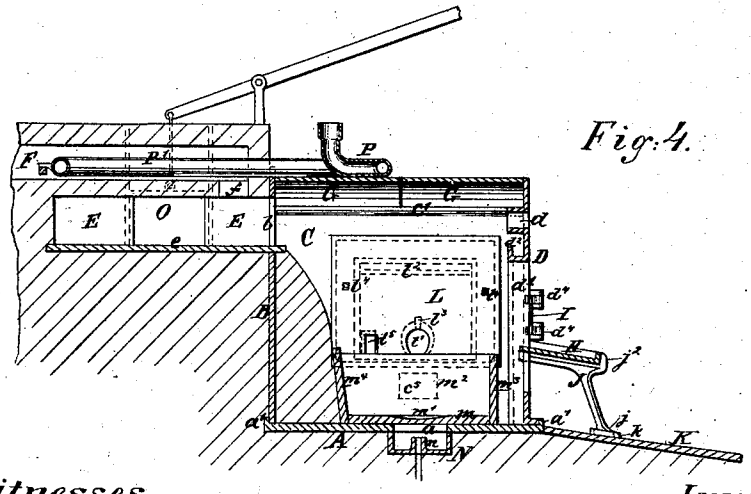


Fig. 4.



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(No Model.) 2 Sheets—Sheet 2.

J. BERGQVIST.

PUDDLING FURNACE.

No. 248,081. Patented Oct. 11, 1881.

Fig: 5.

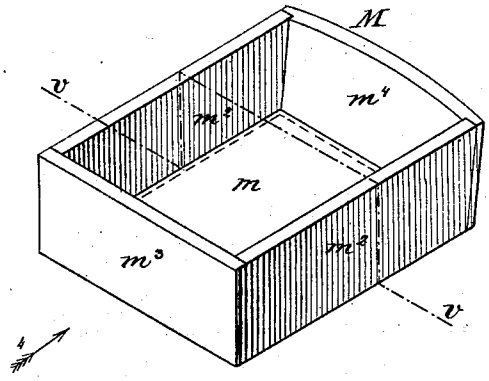


Fig: 6.

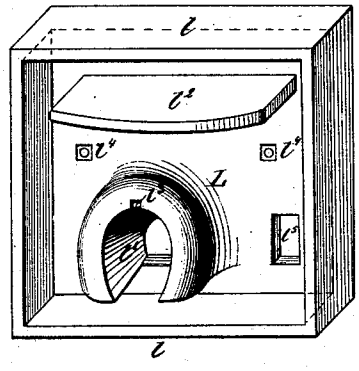


Fig: 7.

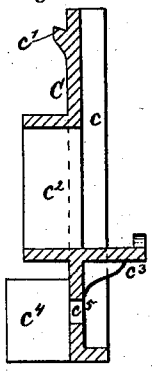


Fig: 8.

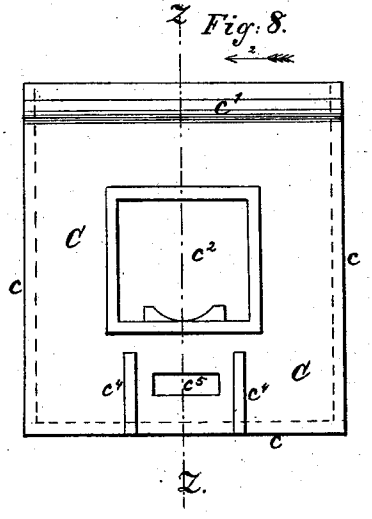


Fig: 9.

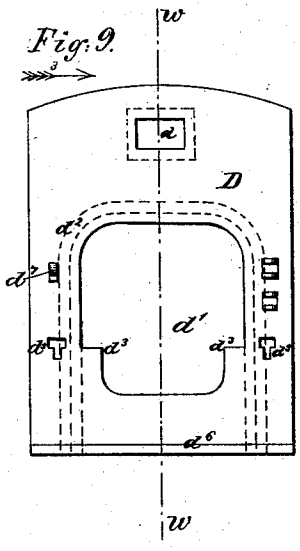


Fig: 10.

Fig: 11.

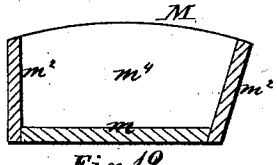
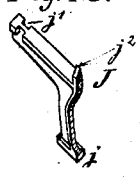


Fig: 12.



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UNITED STATES PATENT OFFICE.

JOHN BERGQVIST, OF TRENTON, NEW JERSEY.

PUDDLING-FURNACE.

SPECIFICATION forming part of Letters Patent No. 248,081, dated October 11, 1881.

Application filed July 30, 1881. (No model.)

To all whom it may concern:

Be it known that I, JOHN BERGQVIST, of Trenton, in the county of Mercer and State of New Jersey, have invented a new and useful Improvement in Puddling-Furnaces, of which the following is a specification.

My invention relates to puddling and smelting furnaces, in which a mass of the material by intense heat and strong blast is kept in a state of fusion, or nearly so, whereby the impurities, easier fusible than the iron, is smelted out of the mass, and the contained quantity of carbon is converted into its oxides and burned out, so as to toughen and improve the iron, the workman constantly turning, shifting, and breaking up with an iron bar the fusing mass, in order to expose every part thereof to the action of the blast. The intense heat soon destroys and necessitates a frequent rebuilding of such furnaces, thereby consuming much extra labor and causing much waste of time.

The object of my present invention is to provide a furnace made in movable sections, so constructed and connected that the interior portions most exposed to the heat may, when rendered useless, be easily removed and replaced by new ones without renewing the exterior portions or walls of the furnace, and also so constructed that they will afford convenience for regulating and applying the blast, and suitable fulcra for applying the puddling-bar with the best leverage and to the best advantage.

The invention has been made more especially with the view of converting cast-iron into such tough and strong wrought-iron as is used to make cable-wire of for the great suspension-bridge between the cities of New York and Brooklyn, N. Y.

In the accompanying two sheets of drawings, Figure 1 represents a top view of my improved puddling and smelting furnace. Fig. 2 is a front view of the same. Fig. 3 is a vertical cross-section on the line *x x* of Fig. 1, (seen in direction of arrow 1.) Fig. 4 is a longitudinal vertical section on the line *y y* of Fig. 1. Fig. 5 is a detail perspective view of the puddling or smelting trough. Fig. 6 is a detail perspective view of one of the breasts or tuyere-plates. Fig. 7 is a detail vertical section on the line *z z* of Fig. 8, and seen in direction of arrow 2, showing one of the two plates which form the two side walls of the furnace. Fig. 8 is a detail vertical view of the said side plate, (seen from the inside of the furnace.) Fig. 9 is a detail front view of the front plate or front wall. Fig. 10 is a vertical section of the same, taken on the line *w w* of Fig. 9, (seen in direction of arrow 3.) Fig. 11 is a cross-section of a modification of the smelting-trough, taken on the line *v v* of Fig. 5, and seen in direction of arrow 4. Fig. 12 is a detail perspective view of one of the legs that support the working-table in the front of the furnace.

Like letters of reference indicate like parts in the several figures.

The furnace-bottom consists of one single flat cast-iron plate, A, having a large square or rectangular opening, *a*, at or about its middle, and a small vertical flange, *a'*, around its entire edge. The rear wall, B, the two side walls, C, and the front wall, D, each consisting of one single cast-iron plate, are erected upon the said foundation-plate A, and confined within its flange *a'* in position with their respective edges in proper inter-contact, as shown in Sheet 1. The rear wall, B, has an arched opening, *b*, beneath the furnace-roof, which opening forms the entrance to a forewarming-oven, E, into which the gases of combustion enter from the furnace, and then ascend through one or more openings, *f*, into a horizontal blast-heating flue, F, leading to the chimney.

Each side plate, C, has an outside flange, *c*, at right angles to the plate-surface and running continuous along its base-edge, and two vertical edges, the vertical flanges serving to receive bolts going through holes in them, and through corresponding holes in the front and rear walls, to secure the furnace-walls together along their vertical corners. The said bolts and holes are not shown in the drawings. Each plate C has also, near its upper edge, an inside horizontal flange, *c'*, to support the roof G, the latter consisting of, preferably, two curved cast-iron plates, which, resting with their edges upon the two opposite flanges *c'*, form an arch over the furnace.

The front wall, D, has a small internally-flanged upper opening, *d*, through which access is gained to rake the forewarmed pig-iron from the oven E into the puddling-trough, and

below the rake-hole d a large working-opening, d', surrounded on three sides, on the inside of the plate D, with an angular or reverted strengthening-flange, d^2, running down to the base-flange d^6, and which serves also to retain the fire-bricks needed to protect the front plate and shield the workman from the intense heat of the furnace.

At about or slightly above the top level of the puddling-trough the opening d' is made a little narrower, forming two shoulders, d^3, on which rests the inward slightly-projecting edge of the working-table H, which fills the width of the opening d', and is thereby prevented from accidental lateral movement.

I is a gate formed of two horizontal wrought-iron bars, united by vertical cross-bars and hinged to lugs d^4 on the plate D, at one side of the openings d', so that it can be swung across the said opening and held closed by being latched on a hook, d^7, at the opposite side of the said opening. The object of the gate I is to afford various fulcra, at different elevations and lateral positions, for applying the puddling-bar.

The table H is surrounded at its three outer edges with a small vertical flange, and is supported on two angular brackets, J, resting by their feet j in sockets k, formed by cleats cast on the foot-plate K.

The bracket J is formed as shown in Figs. 4 and 12, the inner end of its inclined table-supporting arm T-shaped in cross-section, being notched at j' (see Fig. 12) by cutting into the horizontal arm of the T on both sides of the vertical stem, evenly to the latter.

The notched end of the bracket is secured to the front wall, D, by being inserted in a suitable T-shaped opening, d^5, whose vertical stem of the T is longer than that of the notched bracket-arm, so that (the width of the notches j' being slightly greater than the thickness of the front wall, D) the said arm will sink down in the vertical stem of the hole d^5, entirely below the horizontal arm of the same, and grasp the edges of the plate adjacent to the hole d^5 in the notches j', thereby securing the bracket firmly in position. Stops j^2, formed upon the outer end of the supporting bracket-arm and fitting into little notches in the outer edge of the table H, prevent the latter from sliding out from the furnace endwise.

The side wall, C, is provided with a square opening, c^2, flanged all round on the inside of the wall, to receive from the inside the breast-plate L and support the same.

Flush with the base of the opening c^2 extends outward a bracket, c^3, and on the inside, a little below the flange of the opening c^2, are two vertical flanges, c^4, reaching down to the base of the plate C, and projecting inward far enough to be flush with the inner surface of plate L. Below the bracket c^3, between the two flanges c^4, is a water-hole, c^5, through the plate C.

The breast-plate L is a square cast-iron plate considerably larger than the opening c^2, so that when inserted, as shown in Figs. 3 and 4, its upper portion projects a proper distance above the said opening to protect the wall C from direct contact with the flames. For the same purpose, and also to prevent warping, the breast L is provided around its edge with a flange, l, of about the same depth as the flange around the opening c^2, and the portion of the breast which fills the said opening is much thicker than the rest, which thickness is still more increased downward, to give strength to the sides and top of the conical tuyere-opening l', whose flat bottom is flush with the lower edge of the hole c^2, upon which edge also the side walls of the tuyere-opening rest and support the breast L. The breast L is further supported by its lower edge and edge-flange l, resting upon the upper edge of the two flanges c^4 of the side wall, C. A horizontal flange, l^2, which is cast upon the breast above the tuyere-opening l', and is of about the same length as the width of the opening c^2, projects into or through the latter opening and insures the correct position laterally of the breast L. The tuyere (omitted in the drawings) is secured in the opening l' by a tightening wedge or key inserted in the key-seat l^3 in the upper edge of the latter opening. The breast L is secured in upright position against the side wall, C, by bolts going through the said breast and wall, which bolts are inserted from the inside through countersunk holes l^4. (See Fig. 4.) At the side of the tuyere is a hole, l^5, through the breast, for the purpose of applying the puddle-bar occasionally and for observation needed in regulating the blast.

M is the puddling or smelting trough, consisting of the bottom plate, m, having a slight cavity, m', the two vertical side walls, m^2, the vertical front-end wall m^3, and the backward-inclining rear-end wall m^4. One or both sides, m^2, may be made to incline outward, as shown in Fig. 11. The space between the front end, m^3, of the trough M and the front wall, D, of the furnace is filled with fire-brick, as is also the space between the rear end, m^4, and the rear furnace-wall, B; but the sides m^2 stand up against the flanges c^4 of the side walls, C, without brick covering. The trough M is placed directly upon the opening a in the bottom plate, A, of the furnace, and directly beneath said opening is an iron water-trough, N, running across the full width of the furnace and projecting on both sides thereof. The smelting-trough M is kept cooled by constant streams of water, allowed to enter on opposite sides thereof through the holes c^5, and discharging through the overflow-pipe n. (See Figs. 3 and 4.)

e is the bottom plate of the forewarming-oven E, and rests with its front end upon the lower edge of the opening b in the rear furnace-wall, B.

O is a vertical sliding door, through which the pig-iron is introduced in the oven E and there left to be heated by the escaping gases of combustion before being raked down into the smelting-trough M.

In some smelting-furnaces cold blast is ex-

clusively used, in others heated blast only; but as the quality of pig-iron varies considerably, frequently even in the small quantities used for two consecutive smeltings, and as it is found that the temperature of the blast has a decidedly different influence upon the different qualities, it is desirable that heated blast should occasionally be substituted for cold blast, and vice versa, in the same furnace. To this end, and also for the purpose of conveniently removing the blast-nozzle and adjacent pipes out of the way when fixing the tuyeres and for other reasons, I have constructed and arranged the blast apparatus in the following manner:

The main blast-pipe P is arranged above and across the furnace, as shown in Figs. 1 and 2, its ends bending down at opposite sides thereof, and terminating with an air-valve, Q, bracketed to each side wall, C, the valves being operated by means of the handles *q* to admit or shut off the blast from the tuyeres.

Near the entrance *p* of the pipe P is the entrance *p'* of an equally large pipe, P', which, in the form of a long U, is placed horizontally in and returns from the heating-oven F, ending into the cold-air pipe P. By an ordinary two-way valve, (not shown in the drawings,) the blast is led to the pipe P either through the entrance *p'* and heated pipe P', when warm blast is desired, or directly through the entrance *p* when cold blast is required.

From each valve Q the blast reaches the tuyeres by means of three elbow-pipes, R S T, and a nozzle, U, which are interconnected in their respective order by movable flange-joints *r s t* and the ball-and-socket joint *u*. By this construction the blast-nozzles U can be adjusted to act in any direction desired, and can be easily withdrawn from the tuyeres without being detached from the pipe T, and, together with the pipes T S R, may be conveniently raised or lowered or moved laterally along the side walls, C, or outward from the same, according as may suit the purpose of such positions.

With this general construction the outer walls of the furnace will stand in working order for a very considerable length of time, no other repairs being needed than occasionally replacing the trough M with new plates, and, less frequently, the breast-plate L. The bottom plate, A, has water-holes a^2 between the trough M and the side walls, C.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A puddling or smelting furnace made in movable iron sections, mounted upon a common platform, and provided with detachable puddling or smelting trough and detachable breast-plates, substantially as and for the purpose set forth.

2. In a puddling or smelting furnace, the combination of the foundation-plate A, having perimetric flange *a'*, the side plates, C, having flanges *c c'*, the curved roof-plates G, the rear plate, B, having opening *b*, and the front plate, D, provided with the openings *d d'*, substantially as specified.

3. The combination, in a smelting-furnace, of the front plate, D, having working-opening *d'*, shoulders d^3 in or about the said opening, and holes or notches d^5 at the sides of said opening, with the angular brackets J, having catch *j'* to engage in the said notches, and shoulders j^2 to retain the table H, and with the foot-plate K, having sockets *k* to receive the feet of the said brackets, substantially as specified.

4. The combination, with the front plate, D, having working-opening *d'*, of the hinged grate iron gate I, arranged across the said opening, substantially as and for the purpose set forth.

5. The foundation-plate A, having central opening, *a*, and water-holes a^2, arranged as described, in combination with the subjacent water-trough N, the superjacent smelting-trough M, and the side plates, C, having water-holes c^5, substantially as and for the purpose set forth.

6. The combination of the side plate, C, provided with the flanged opening c^2 and flanges c^4, with the breast-plate L, provided with the perimetric flange *l*, retaining-flange l^2, tuyere-opening *l'*, and side holes, l^5, and with the smelting-trough M, substantially as specified.

7. The combination, with the smelting-furnace, of the horizontal forewarming-oven E, arranged opposite to the rake-hole *d* in the front wall, D, and the superjacent oven or flue F, containing the blast-pipe P', substantially as specified.

8. The combination of the blast-pipe P, arranged above and across the furnace in free exposure to outer air, with the air-valves Q, arranged at the sides of the furnace, and with the recurved pipe P', having separate inlet *p'*, and arranged within the heating flue or oven F, substantially as and for the purpose set forth.

9. In combination with the air-valves Q, secured at opposite sides of the smelting-furnace, the elbow-pipes R S T, interconnected by movable flange-joints *r s t*, as shown and described, and for the purpose set forth.

10. In combination with the stationary air-valves Q and the movably interconnected elbow-pipes R S T, the blast nozzle U, connected to the lower elbow-pipe, T, by a ball-and-socket joint, *u*, as and for the purpose set forth.

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