

(No Model.)

2 Sheets—Sheet 1.

J. BERGQVIST.
PUDDLING FURNACE.

No. 275,119.

Patented Apr. 3, 1883.

Fig. 1 y

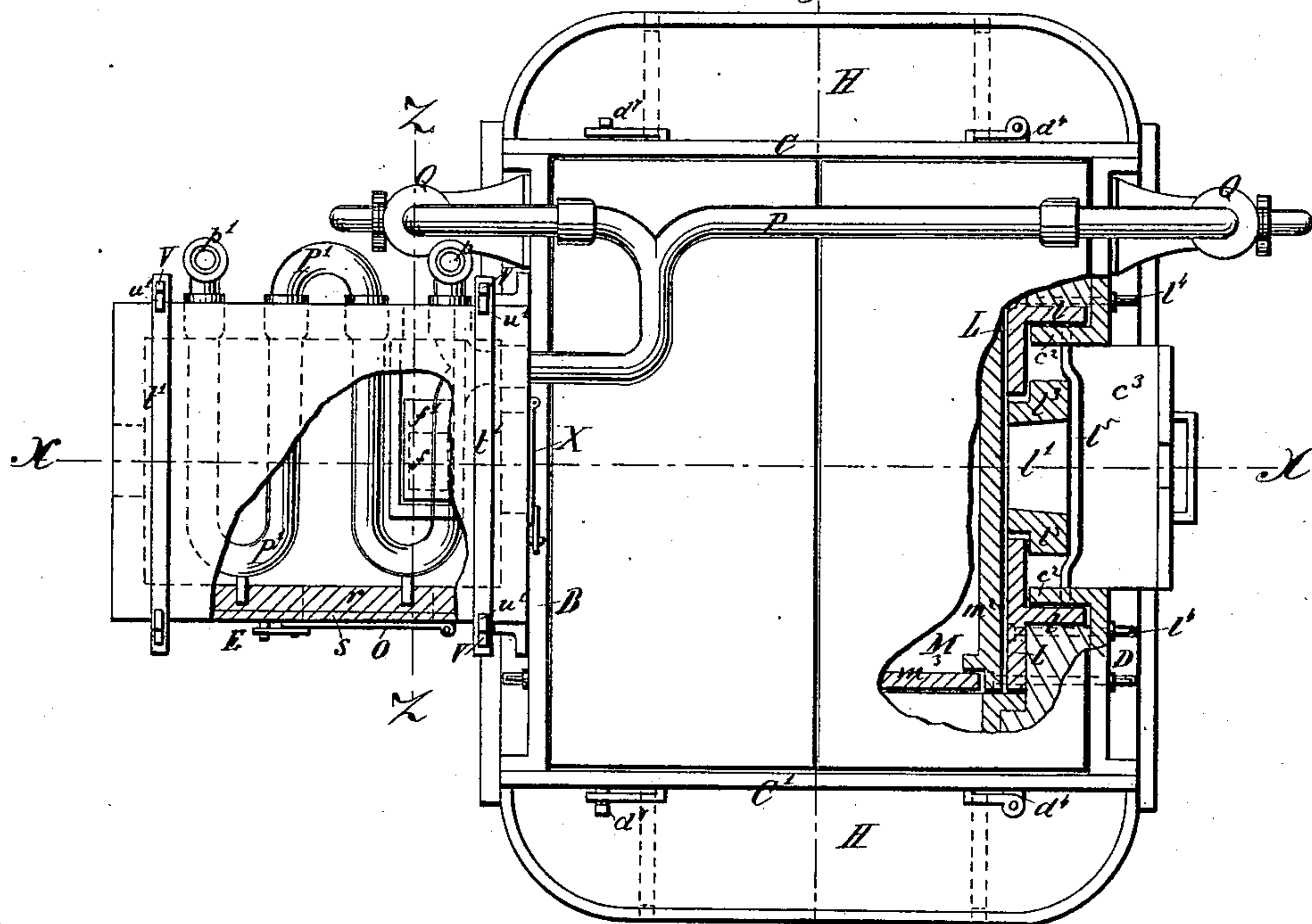
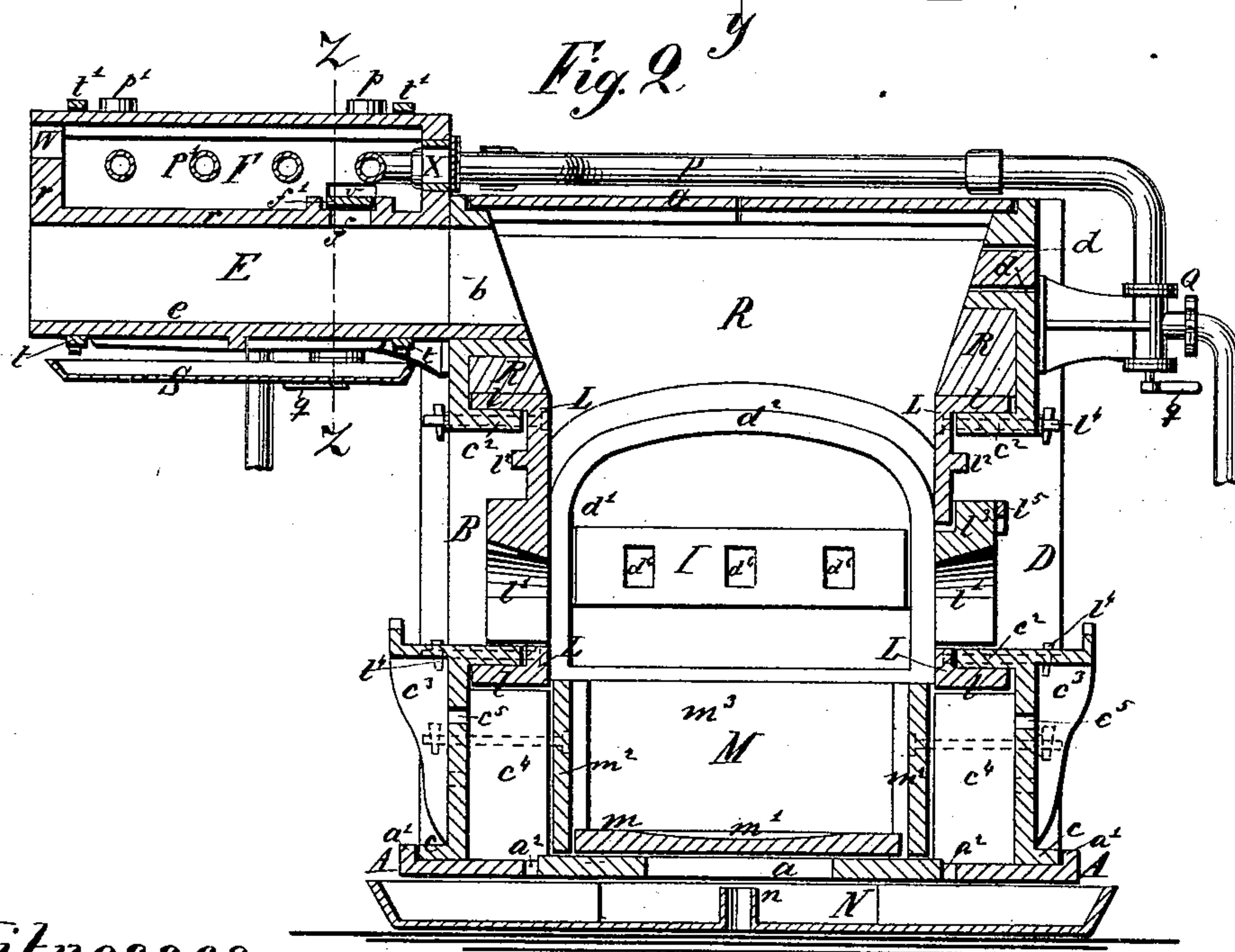


Fig. 2^y



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(No Model.)

2 Sheets—Sheet 2.

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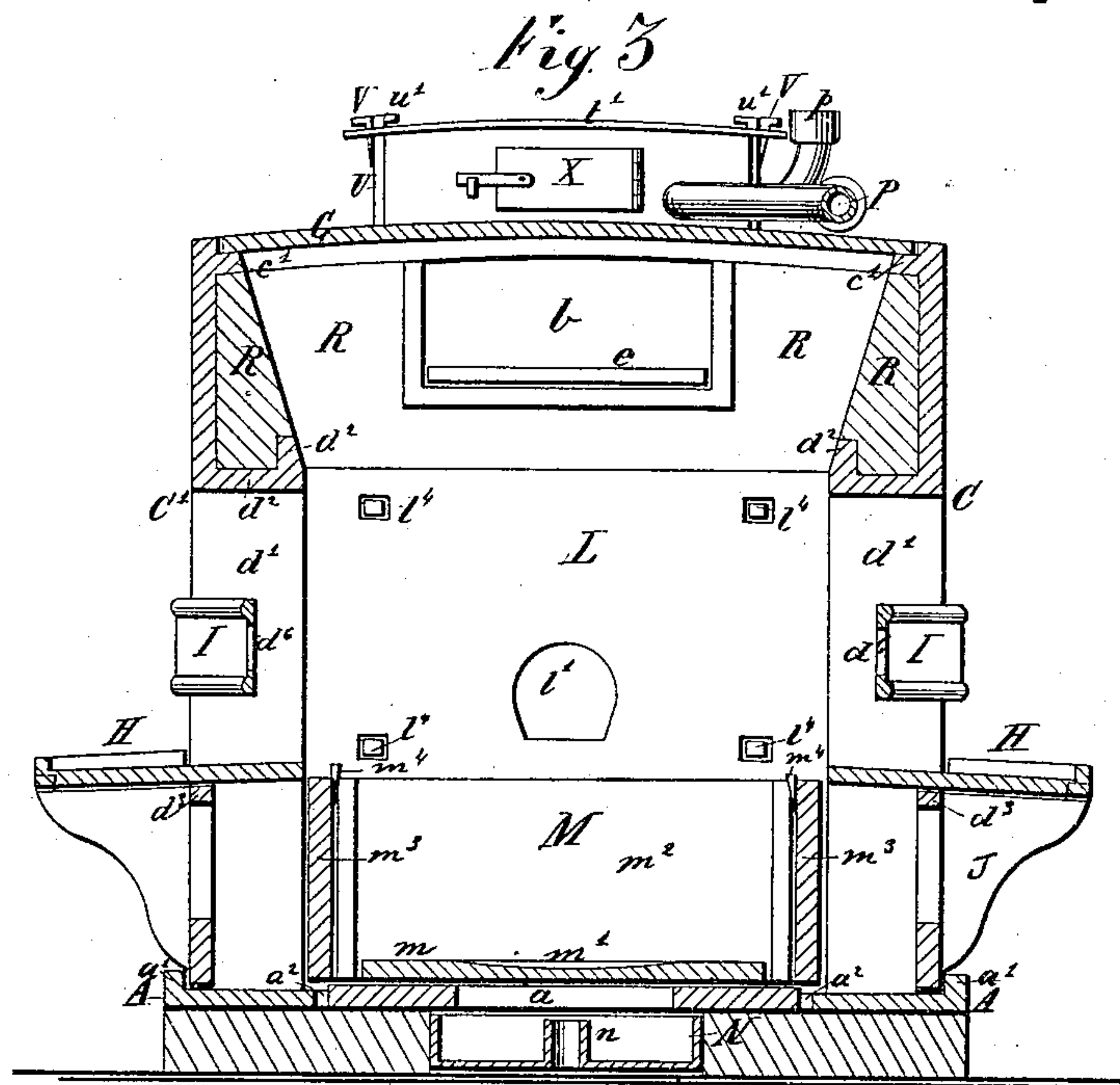


Fig. 5

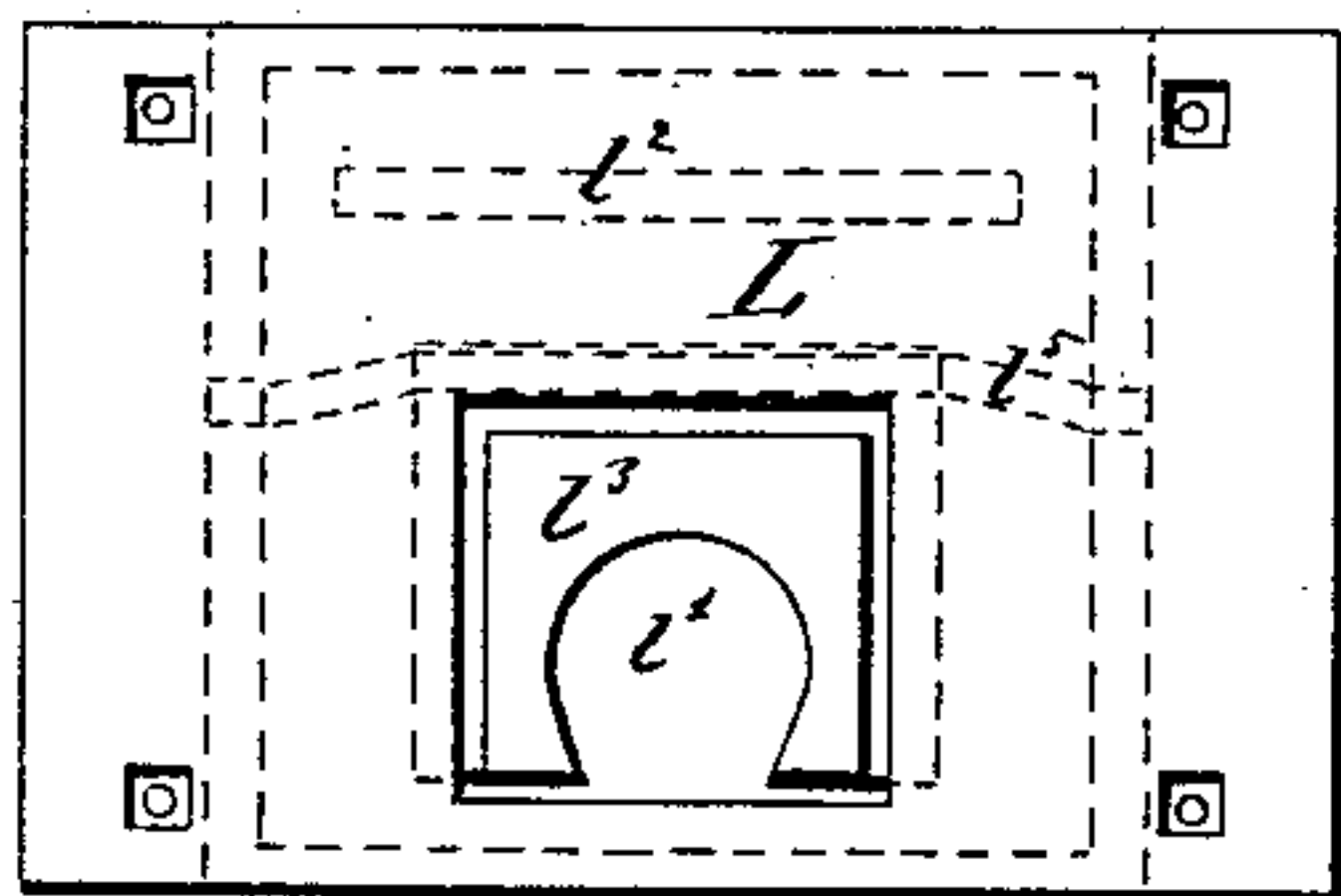
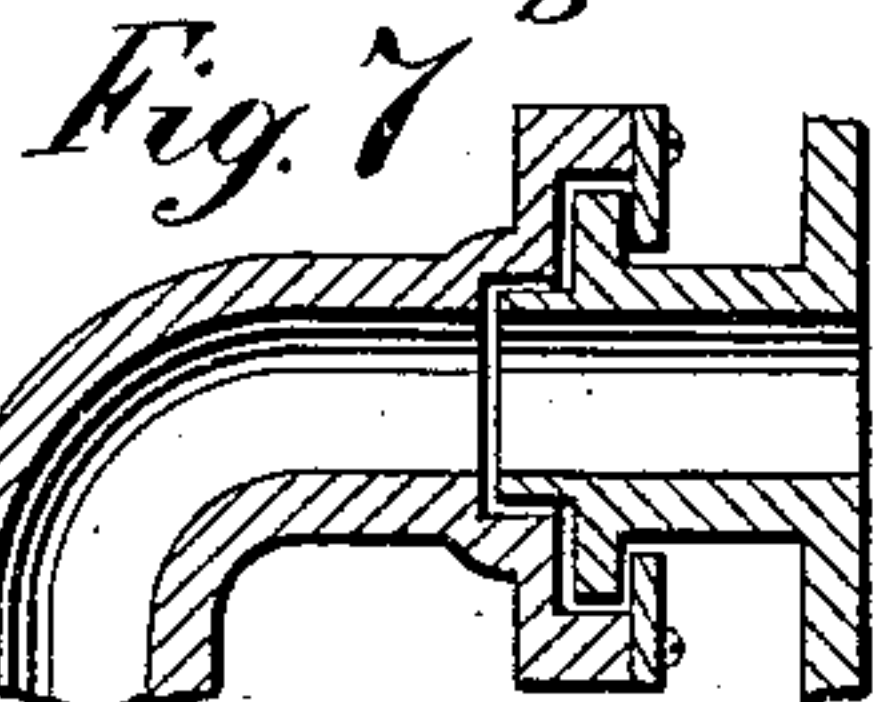
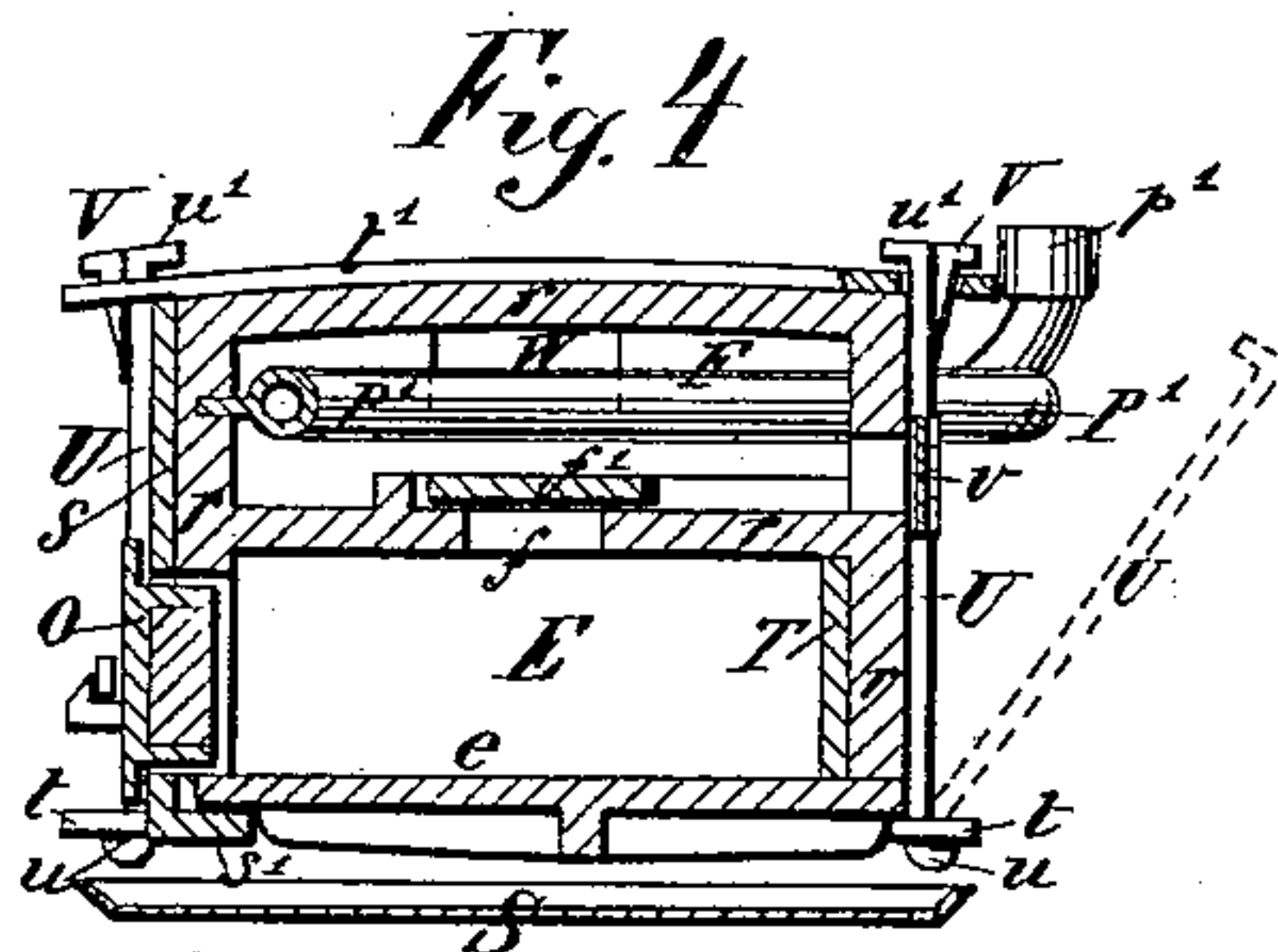
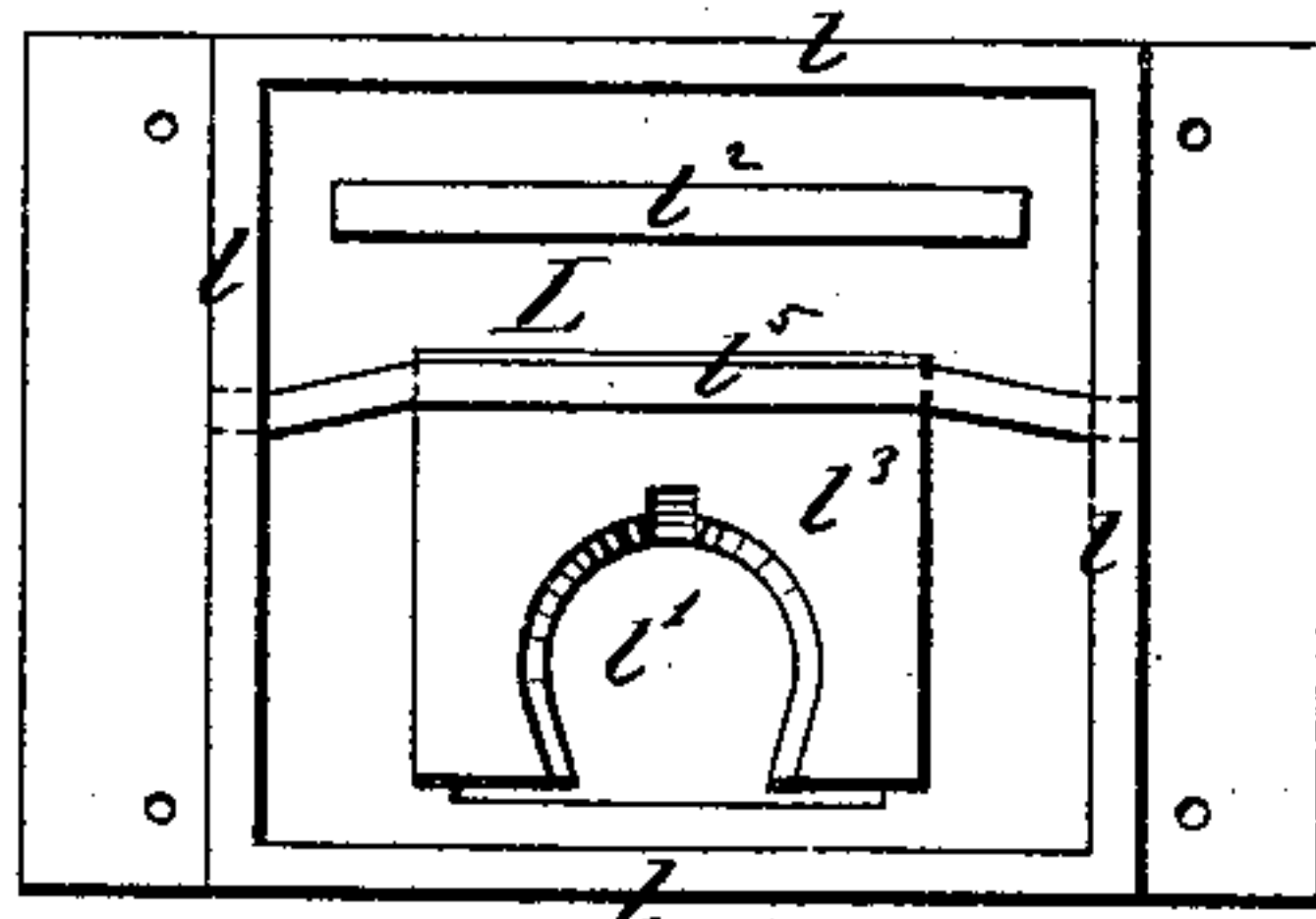


Fig. 6



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UNITED STATES PATENT OFFICE.

JOHN BERGQVIST, OF McKEESPORT, PENNSYLVANIA, ASSIGNOR OF ONE-HALF TO CHARLES FUNKE, OF SAME PLACE.

PUDDLING-FURNACE.

SPECIFICATION forming part of Letters Patent No. 275,119, dated April 3, 1883.

Application filed April 12, 1882. (No model.)

To all whom it may concern :

Be it known that I, JOHN BERGQVIST, a citizen of the Kingdom of Sweden, and a resident of McKeesport, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Puddling-Furnaces, of which the following is a specification.

My invention relates to that class of puddling-furnaces known as "bloom-furnaces," using charcoal-fire, in connection with strong air-blast, to keep the material by intense heat in a state of fusion, or nearly so, whereby the impurities are removed from the iron and the excess of carbon is converted into its oxides and passes off; and the novelty consists in the construction and arrangement of parts, as will be more fully hereinafter set forth, and specifically pointed out in the claims.

In operation the workman constantly turns, shifts, and breaks up with an iron bar the fusing mass in order to expose it to the action of the air-blast, so as to toughen and improve the quality of the resulting iron.

My present invention is an improvement on the sectional furnace patented to me October 11, 1881, by Letters Patent of the United States No. 248,081.

In the accompanying two sheets of drawings, Figure 1 represents a top view of my improved furnace partly broken out. Fig. 2 is a sectional elevation of the same, taken on the line *xx* of Fig. 1. Fig. 3 is a sectional elevation taken on the line *yy* of Fig. 1. Fig. 4 is an inside view of one of the breasts and tuyere-plates. Fig. 5 is an outside view of the same. Fig. 6 is a cross-section of the forewarming-furnace, taken on the line *zz* of Figs. 1 and 2. Fig. 7 is a detail section of blast-pipe coupling.

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

The furnace-bottom consists of one single flat plate, A, having a large square or rectangular opening, *a*, and a small vertical edge flange, *a'*, as in my previous patent. The two side walls, B D, and the end walls, C C', each consisting of one single plate, are erected upon the said foundation-plate A, and confined within its flange *a'* in position, with their respective edges in proper intercontact, as shown in

the drawings. The side wall B has an opening, *b*, beneath the furnace-roof, which opening forms the entrance to forewarming-oven E, into which the gases of combustion enter from the furnace, and then ascend through one or more openings, *f*, provided with dampers *f'*, into a superadjacent horizontal blast-heating flue, F, leading to the chimney. Each side plate, B D, has an outside flange, *c*, at right angles to the plate-surface, running continuous along its base edge and its vertical edges, the vertical flanges serving to receive bolts going through holes in them and through corresponding holes in the end walls to secure the furnace-walls together along their vertical corners. The said bolts and holes are not shown in the drawings. Each plate B 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 side wall D has a small opening, *d*, through which access is gained to rake the forewarmed pig-iron from the oven E into the puddling-trough. The rake-hole *d*, when not used, is fitted with a suitable plug of fire-clay, as shown in Fig. 2.

Both end walls, C and C', have oppositely-placed large working-openings *d'*, surrounded on three sides of the inside of the plate D with an angular reverted strengthening-flange, *d''*, running down through their base-flanges, and which serves also to retain the fire-brick needed to protect the front plate and shield the workmen from the intense heat of the furnace. In my former patent referred to these working-openings were arranged in the front plate, and the flange *d''* did not serve the same functions as in this construction. The working-tables H fill the width of the openings *d'*, and are thereby prevented from lateral accidental movement, while their inner edges project to the edge of the puddling-trough.

II are gates, formed of sheet-iron, riveted to two horizontal wrought-iron bars hinged to lugs *d'* on the plates C and C', at one side of the openings *d'*, so that the thus formed gates can be swung across the said opening and held closed by being latched on the hook *d'* at the opposite side of said opening. The object

of the gates I, which are also provided with small openings d^6 , is to afford various fulcrums at different elevations and lateral positions for applying the puddling-bar. In my former patent referred to but one gate I was employed, and that in the front plate, D. I attach importance to this latter arrangement, as it allows a more complete manipulation of the iron. The tables are also similarly arranged, and are supported by brackets J on the end plates, C C'.

The side walls, B and D, are each provided with a square opening, c^2 , and flanged all around on the inside of the wall to receive from the inside the breast-plate L and support the same. Flush with the base of each opening c^2 extends outward a bracket, c^3 , and on the inside, a little below the flange of each opening c^2 , are two vertical flanges, c^4 , reaching down to the bases of the plates B and D and projecting inward far enough to be flush with the inner surfaces of the respective plates L below the bracket c^3 . Between the two flanges c^4 is a water-hole, c^5 , through the plates B and D. The breasts L are square cast-iron plates, considerably wider than the opening c^2 , so that when inserted, as shown in Fig. 1, they project laterally a proper distance beyond the said opening to protect the said walls from direct contact with the flames. For the same purpose, and also to prevent warping, each breast-plate 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 L 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 breasts L are further supported by their lower edges and edge flanges, l , resting upon the upper edges of the flanges c^4 of the side walls. 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 of the breast-plate L. The tuyeres (omitted in the drawings) are secured in the openings l' by tightening wedges or keys inserted in the key-seats shown in the upper edge of the latter openings. The breasts L are secured in upright position against the side walls, B D, by bolts going through the said breasts and walls, which bolts are inserted from the inside through countersunk holes and tightened by wedges inserted through cross-slots in the bolts outside of the wall. (See Figs. 1, 2, and 3.) The tuyere-opening at the side wall D is not formed in the breast L direct, but in a separate tuyere-plate, l^3 , rabbeted along its top and vertical edges, said rabbeted inner portion being inserted in a square hole in the breast L, sufficiently larger than the rabbeted portion of the tuyere-plate

to allow the latter, and with it the tuyere, to be adjusted vertically and laterally in juxtaposition to the stationary tuyere in the opposite wall, B, so as to enable the workmen to direct the blast evenly from both sides upon the same point of the "bloom." The movable tuyere-plate l^3 is held in any adjusted position by a cross-bar, l^5 , pressing upon its outer surface, said cross-bar being inserted with its ends in suitable sockets in the flange surrounding the opening c^2 . In my former patent referred to the breasts L were arranged in the end walls, C C', while in this construction they are arranged in the side walls, B D.

M is the working-trough, consisting of the bottom plate, m , having a slight cavity, m' , the two vertical side walls m^2 , and the two end walls m^3 , the said end walls m^3 fitting loosely in vertical rabbets in the edges of the side walls m^2 , and are tightened by wedges m^4 , as shown in Fig. 3. The spaces between the ends of the trough M and the end walls, C C', are filled with fire-brick, but the sides m^2 stand up against the flanges c^4 of the side walls without brick covering. The trough M is placed directly above 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 beyond both sides thereof. The smelting-trough M is kept cold by constant streams of water allowed to enter at opposite sides thereof through the holes c^5 , and discharged through the overflow-pipe n . (See Figs. 2 and 3.) The construction of the smelting or puddling trough M as herein described I find to be far superior in practice to that set forth in my former patent referred to.

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 side wall B.

O is an iron door, through which, when the furnace is not connected with a "run-out" furnace, the pig-iron is introduced into the oven E, and there left to be heated by the escaping gases of combustion before being raked down into the trough M. The means for affording hot or cold blast at will is described in my former patent.

In the present invention it will be seen that the oven E F is arranged to issue or extend at a distance above the breast-plate L and tuyeres from the side wall B of the furnace, instead of from one end, as heretofore, thereby allowing access for one workman from each end wall, C and C', to apply the puddling-bar to the bloom, while the blast plies upon it adversely from the opposite side walls, B D, and consequently enabling them to work much larger lumps of iron than heretofore.

To protect the men from the heat radiating from the bottom of the oven E while adjusting the blast-nozzle on that side of the furnace, a shallow water-trough, S, provided with suitable supply and overflow pipes, is placed directly underneath the said oven, as shown in Figs. 2 and 6, the ovens E and F consisting

of brick walls *r*, placed on a cast-iron bottom plate, *e*, beneath which latter there is no brick-work.

On that side of the oven which has the door *O* the brick wall is covered with a protecting iron-plate, *s*, having a bottom flange, *s'*, on which the nearest edge of the bottom plate, *e*, rests, and is allowed space to slide in expanding and contracting by the heat without affecting the brick walls *r*. The inside of the opposite wall of the lower oven, *E*, is covered with an iron plate, *T*, (see Fig. 4,) to protect it from damage by concussion with the pig-iron pushed in through the door *O* in charging the forewarming-oven *E*.

The oven structure is held together by iron bands or bars *t* and *t'*, connected by vertical bars or bolts *U*, headed at both ends, the heads being one-sided and turned in opposite directions. In attaching them the head *u* is first entered through the end slot of the bottom band, *t*, in the manner indicated in dotted lines in Fig. 6, then moving in upright position, and the top band, *t'*, placed with its end slot down over the upper head, *u'*. The wedge *V* is then driven in the slot where shown, causing the head *u'* to engage with the upper surface of the band *t'* at the edge of its slot. The brick damper *f'* through the opening *f* is accessible through the small side door, *v*, of the blast-heating oven.

W is the escape-flue of the said oven, and *X* is a door to the same, opening above the furnace-roof, the purpose of which is to lessen the draft and also the heat, (when the damper *f'* is open,) and to suddenly cool the blast-pipe *P'* and oven *F*, if desired, the damper *f'* being then closed.

In the foregoing description I have explained the entire device, including the features already protected by the patent to me, hereinbefore referred to, in order that the construction and arrangement would be clearly presented.

The features of novelty in this invention over those already protected are specifically referred to in the claims, and may be briefly stated as follows: first, the flue or forewarming-oven *E*, arranged above one of two tuyere-openings situated upon opposite sides of the furnace, and working-openings on opposite ends of the same; second, a stationary tuyere-opening and an adjustable tuyere-opening arranged upon opposite sides of the furnace; third, the rabbeted tuyere-block *l³*, the breast-plate *L*, having an enlarged tuyere-plate opening and a retaining-bar for adjustment; fourth, the water-trough *S*, arranged below the forewarming-oven; fifth, the flanged wall-plate *s*, arranged exterior to the brick structure *r* in the chamber or flue *E*; sixth, the specific construction of the chamber *E*.

I claim—

1. A furnace for working iron, having side

walls, *B D*, provided with tuyere-blocks placed opposite each other, and end walls, *C C'*, provided with working-holes, as described, and flue *E*, connected with the furnace by means of an aperture, *b*, in the upper portion of wall *B*, as and for the purpose set forth.

2. In an iron-working furnace, the combination of a stationary tuyere-plate arranged at one of its sides, *B*, an adjustable tuyere-plate arranged at the opposite side, *D*, and working-openings, as described, as and for the purposes set forth.

3. In an iron-working furnace, and in combination with the stationary tuyere-plate in the wall *B* and working-openings, the adjustable tuyere-plate *l³* and adjusting-bar *l⁵*, as and for the purposes specified.

4. The adjustable tuyere-plate *l³*, as described, combined with the breast-plate *L* of the wall *D*, having an opening larger than the rabbeted inner surface of the said block *l³*, and with the retaining-bar *l⁵* for adjusting the position of the block *l³* relative to the tuyere-block at the opposite wall, *B*, as set forth.

5. In combination with the brick structure *r*, forming the blast-chamber *F* and flue or forewarming-oven *E*, said ovens or chambers being connected by opening *f*, provided with valve *v*, the exterior wall-plate, *s*, provided with the bottom flange, *s'*, the bottom plate, *e*, adapted to accommodate expansion and contraction, as described, and the interior wall-plate, *T*, substantially as set forth.

6. The combination of the brick structure *r*, exterior plate, *s*, and bottom plate, *e*, the top and bottom bars, *t t'*, having slots at their ends, the clamping-bars *U*, having heads *u u'* at opposite ends, as shown, and the wedge *V*, as and for the purposes set forth.

7. In an iron-working furnace, the hinged working-gates *I I*, arranged in the opposite ends, *C C'*, formed of solid iron, and adapted to cover the width of the opening *d'*, and having openings *d⁶* to afford fulcrum at different angles for the puddling-bars, as set forth.

8. In an iron-working furnace, the end plates, *C C'*, having inwardly and upwardly turned flanges *d²*, combined with the fire-brick *R* and breast-plate *L*, as set forth.

9. The duplicate working-tables *H*, arranged on opposite ends, *C C'*, and supported on brackets *J*, secured thereto, the said tables projecting through the openings *d'* in the ends *C C'*, forming a floor therefor, and extending inwardly to the end wall, *m³*, of the trough *M*, as specified.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 25th day of March, 1882.

JOHN BERGQVIST.

Witnesses:

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FRANK ANKARBERG.