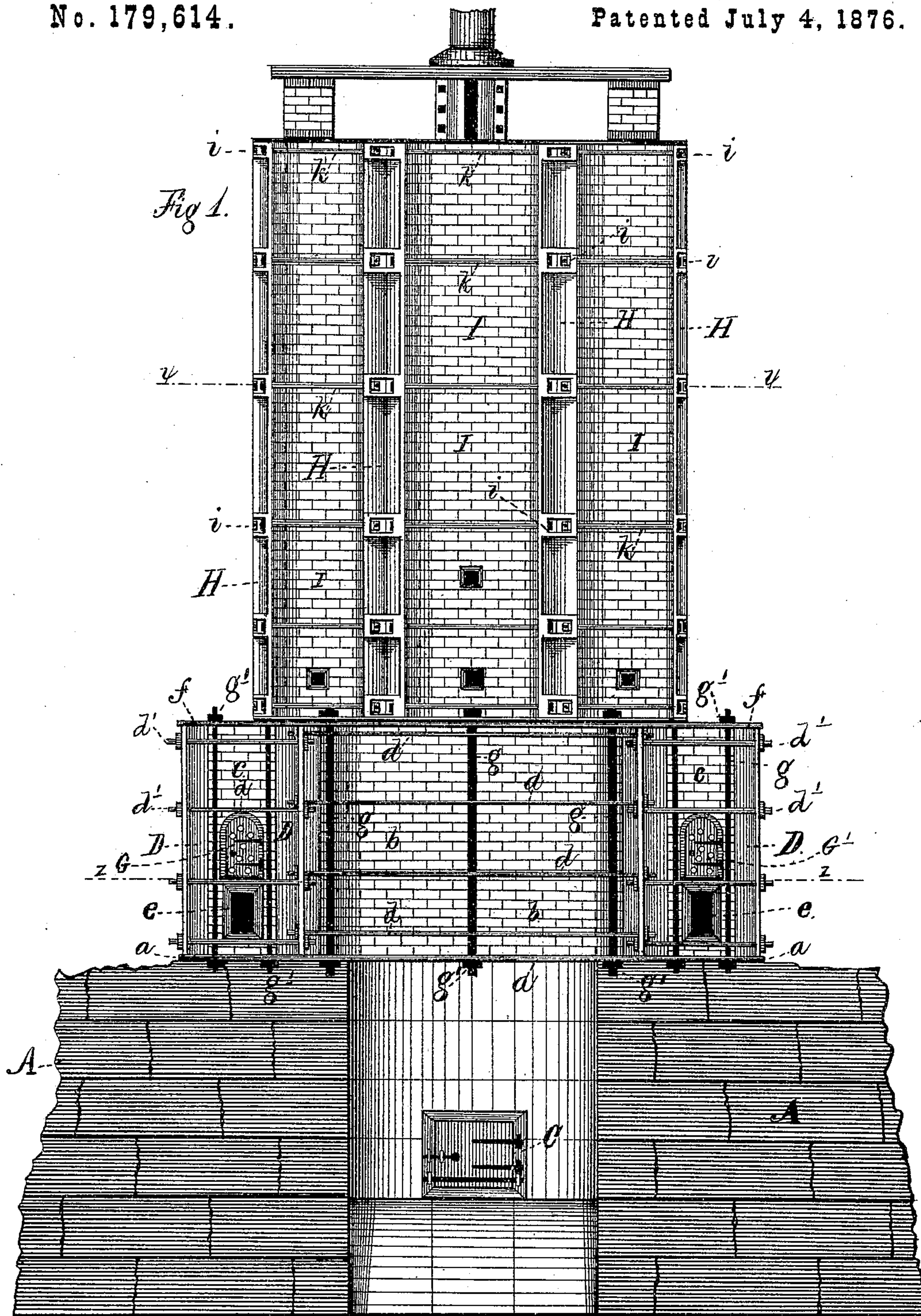


W. S. SAMPSON.
FURNACE OR KILNS.

No. 179,614.

Patented July 4, 1876.



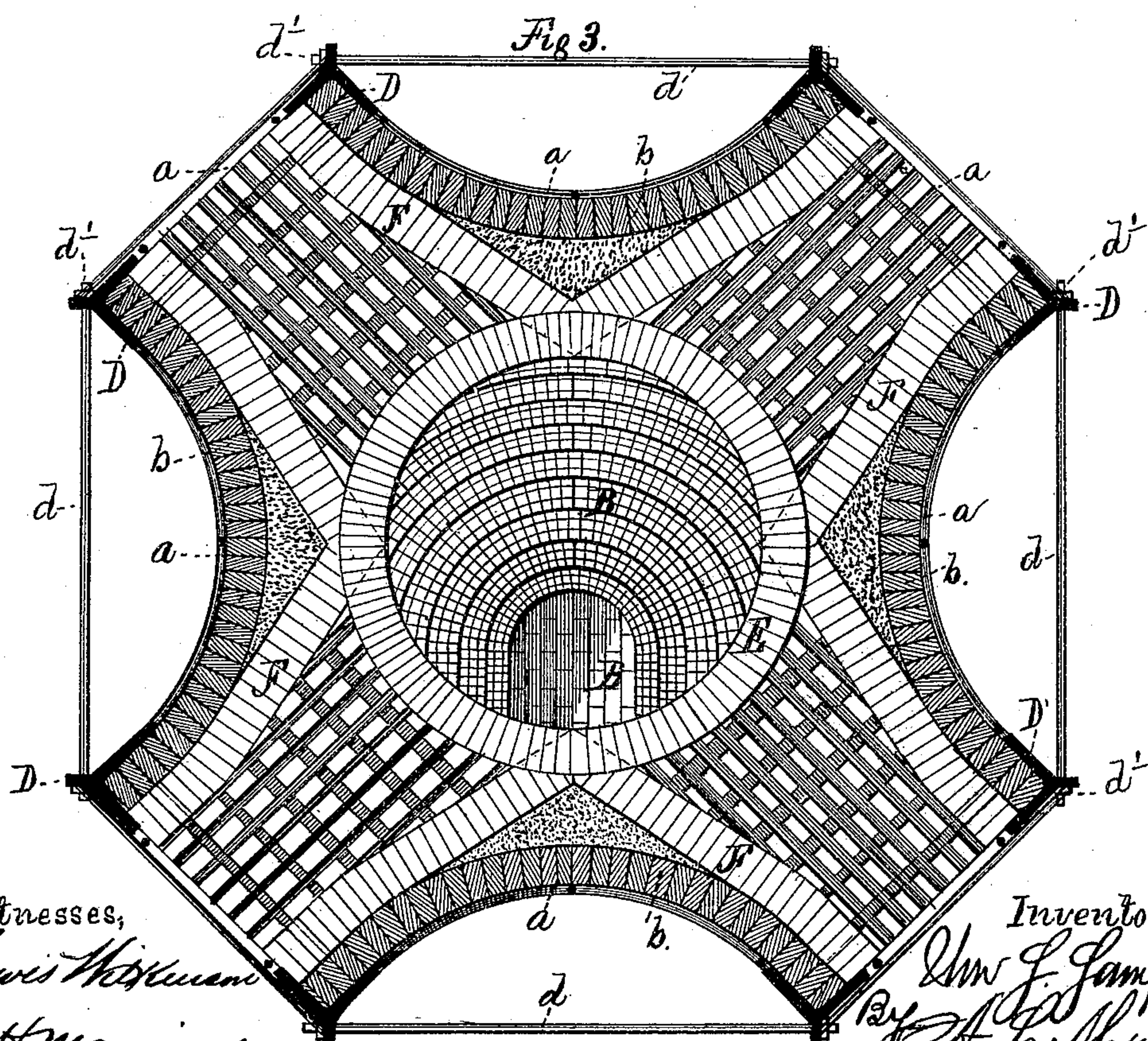
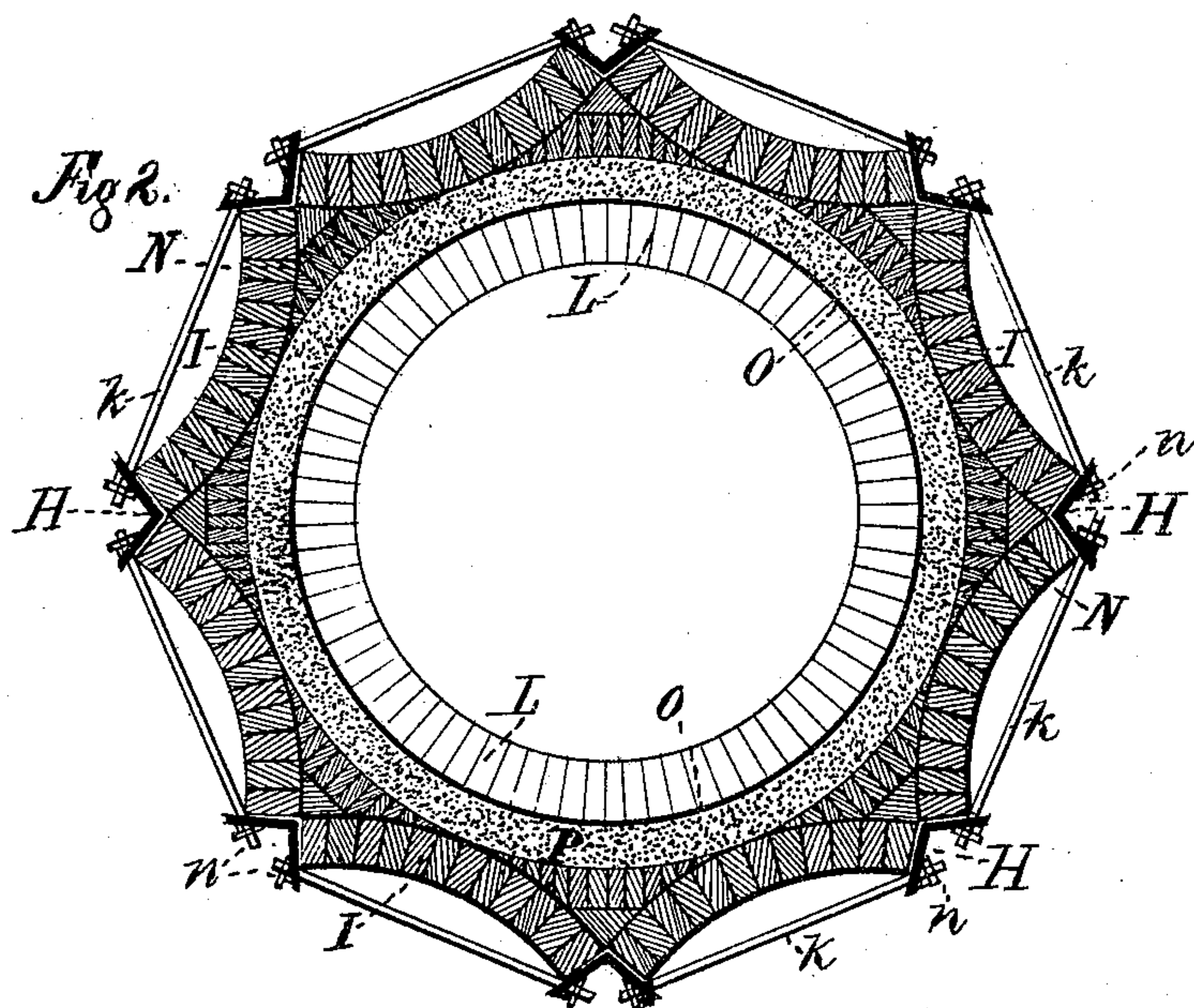
Witnesses,
Lewis Wilkinson
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Inventor,
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UNITED STATES PATENT OFFICE.

WILLIAM S. SAMPSON, OF NEW YORK, N. Y.

IMPROVEMENT IN FURNACES OR KILNS.

Specification forming part of Letters Patent No. **179,614**, dated July 4, 1876; application filed April 26, 1876.

To all whom it may concern:

Be it known that I, WILLIAM S. SAMPSON, of the city of New York, county of New York and State of New York, have invented certain new and useful Improvements in Furnaces or Kilns, of which the following is a specification:

This invention relates to that class of furnaces, kilns, or ovens usually constructed from masonry, and known and designated as perpetual furnaces or kilns, and adapted and used for calcining lime, burning of cement or plaster, roasting ores; also for blast-furnaces, and ovens for stoneware, brick, and glass.

The invention consists in a novel and peculiar form of constructing the masonry-walls of the furnace proper above the foundation, also the tower, and binding and tying the same together by means of metal abutments, or braces and tie-rods, so that when once built it is impossible for the walls to rupture from the effects of expansion, by reason of the heat from the furnaces, the structure in fact being practically indestructible, the details of the arrangement, application, and construction of which will be hereinafter fully pointed out and described.

In the drawings, which form an essential part of this specification, Figure 1 represents an elevation of a furnace, in which is fully embodied my invention. Fig. 2 is an enlarged cross-section taken on line *xx* in Fig. 1, and Fig. 3 is an enlarged cross-section taken on line *zz* in Fig. 1.

Similar letters of reference found in the various figures of the drawings will locate and point out corresponding parts.

As is well known to those who are thoroughly versed in the construction and use of furnaces and kilns, blast-furnaces, and ovens, great difficulty is found in constructing the masonry-walls so that they will not rupture or deteriorate from the effects of the intense heat to which they are constantly subjected. Many efforts have been made in various ways to construct furnaces to obviate this difficulty, but thus far with but partial success.

The object of my invention is to provide a furnace or kiln, adapted to all the purposes heretofore named, that shall possess the vital element of cheapness in construction, yet at the same time possess immense strength, and

by the peculiar method of construction adopted be radically free from that serious defect—rupture—now so universal in all classes of kilns and furnaces.

In carrying out my invention I adopt, in constructing the exterior walls, the principle of reverse arches of masonry, the base of the arches resting in vertical metal seats, which seats are held in their position by means of tie-rods and nuts, and by means of which the strain upon all of the various arches is equalized and evenly distributed.

The reverse arches supporting the expansive strain of the heat, and their compactness, is in proportion to the pressure thereon caused by the heat. The entire superstructure is divided into three distinct sections: first, the base or foundation; second, the furnace proper; and, lastly, the tower.

A represents the stone masonry, forming the base or foundation upon which the furnace proper is built. It may be varied in its exterior shape and conformation according to the circumstances in each particular case. In the center there is formed a self-acting draw, a plan of which will be seen distinctly in Fig. 3, and is marked B. This self-acting draw is formed from fire-brick laid in a series of curvilinear steps, retiring at an angle from the base of the draw-door C, and terminating near the rear and top of the foundation-masonry A. The diameter of the space occupied by this self-acting draw corresponds with the inside diameter of the furnace proper, which is constructed directly above it. The construction and operation of this form of draw, and of the draw-door C, are not new, but are in use in the old form of kilns; hence they need no specific description herein.

The second division of the structure, or the furnace proper, is constructed entirely above the foundation of stone masonry, and rests thereon. This section contains the fire-chambers and ash-pits, and, in the present instance, it is represented as having four fire-chambers, (shown distinctly in Fig. 3;) but it is plainly evident that six or eight fire-chambers might in the same way be applied, and the walls and braces and tie-rods varied to suit the case. In the process of constructing this lower section a metal bond-plate, *a*, of suitable thickness, is first laid upon the top of the stone founda-

tion. This bond-plate may be made in a number of sections, corresponding in shape with the form of the walls to be laid upon it, and bolted together when laid in place. Upon this bond-plate are laid the brick walls *b b* and *c c*, the walls *b b* being in the form of reverse or concave arches, as shown, while the walls *c c* are laid with a straight face, and at right angles with the foot of the walls *b b*. Prior to laying the brick walls *b* and *c*, a series of Y-shaped metal seats or abutting plates, *D D*, are erected vertically upon this bond-plate, and may be bolted thereto, and are securely held in position by a series of tie-rods, *d d*, which extend horizontally from one abutment to the other. These tie-rods are retained and adjusted by means of suitable nuts *d' d'*. The base of the reverse arches *b b* rest in these abutting plates, as shown plainly in Fig. 3, while the ends of the parallel walls *c c* rest against and between the base of the arched walls *b b*. The fire-brick lining *E* is laid at the same time in a circular wall directly upon the top of the stone foundation, and the three walls carried up at the same time until the base of the ash-pits *e e* is reached. At this point the lateral walls *F F* of fire-brick, which form the sides of the ash-pits and fire-chambers, are commenced. These walls extend from the exterior to the center of the kiln, as shown, the spandrels or space between these walls and the reverse arches being filled with ashes or other non-conductor of heat. The frame of the ash-pit and fire-chambers may be cast of metal, and inserted and anchored in the masonry, or they may be formed of masonry, as may be preferred, the grate-bars being of the usual form, and inserted and withdrawn in the ordinary manner.

The apexes of the fire-chambers *o* are formed by springing an arch from the walls *F F*, as in other furnaces. The construction of the walls *b b*, *c c*, and *E* is then continued, as first described, until the desired height is reached. A second bond-plate, *f*, of the same form and construction as the bond-plate *a* at the base, is then laid upon its top; the two bond-plates are then connected together by means of a series of tie-rods, *g g*, which are provided, both above and below the two bond-plates with the nuts *g' g'*, which, when tightened, in connection with the tie-rods *d* and Y-shaped abutting-plates *D*, rigidly bond and tie the masonry in place, both laterally and vertically.

It is important to note that the abutting-plates *D* and tie-rods *d* are so located in the construction of the walls as to be far removed from the intense heat; hence they are subject to little or no change by expansion or contraction.

The bond-plates *a* and *f*, with their tie-rods *g*, serve to maintain the vertical position of the reverse or concave arched walls, and to tighten the longitudinal seams in proportion as the nuts *g'* are set up.

G and *G'* are the fire-doors. They are con-

structed of metal, in two parts, leaving an air-space between the outer and inner plates, and both of these plates are perforated with a number of holes, by means of which a current of air is constantly kept passing through them. In the use of single-plate doors, with or without fire-brick backing, as in ordinary kilns, they soon burn out, while by the form of construction as herein described their life is prolonged to an indefinite period.

The third section of the structure, usually termed the tower, is preferably octagonal in its exterior form, though this form may be varied. The outer wall is composed of a series of reverse or concave arches, and the inner wall or lining of fire-brick, circular, as in the case of the lower section.

H represents a series of vertical V-shaped abutments or abutting plates, which plates are made of cast or wrought metal and erected upon the top of the lower section, their inner faces being formed at such an angle as will meet the requirements of the arches the bases of which rest upon each plate. These plates are provided at suitable intervals with cross-stays *i i* (see Fig. 1) within their outer surfaces, for the purpose of adding strength. They are held together and in position by means of a series of tie-rods, *k*, and nuts *n*, the ends of the rods entering between the stays *i i*. After these abutting plates are adjusted in position the brick masonry of the walls is laid, as shown in Fig. 2. *I I* represent the exterior walls, which are in the form of reverse arches, and resting between the abutting plates, as previously mentioned. *L* is the circular interior wall or lining of the furnace, and is usually built of fire-brick, and its interior diameter corresponds with that of the circular wall *E* in the lower section, of which it is practically a continuation. This fire-brick lining or wall is incased by a metal jacket, *O*, which is constructed from sheet-iron of suitable thickness. Surrounding this inner wall of fire-brick and its iron casing, and resting against the arches *I I*, another wall of ordinary brick is constructed, leaving a space, *P*, between it and the metal jacket *O* of several inches, which space is filled with ashes or other suitable non-conducting material, which is compactly tamped into place. The provision of the metal jacket *O* for incasing the interior wall of fire-brick is an important feature in the construction of furnaces, and of great value in respect to facilitating repairs of the lining-wall.

As kilns are now constructed, the backing of ashes runs out at the instant an opening is made through the fire-brick wall, no matter whether it be occasioned by burning through, or by the removal of any one or more bricks. This backing once broken or out, the kiln is practically inoperative, as it will then "leak heat" rapidly, and, in addition, the loss of this backing permits the fire-brick lining to push out against the masonry construction. This fact not only enlarges the kiln beyond the

limit of safety to other working parts, but increases the heat of the surrounding masonry to such a degree that the prevention of rupture is practically impossible, and, as a consequence, the kiln must be blown out, the masonry taken down, and the structure rebuilt at a cost not far below the original outlay. The use of the metal jacket prevents all such disasters, and, although apparently simple in its conception and inexpensive in its application, it is absolute in its defence during the life of the furnace in which it is applied.

It is obvious that the lower section of the furnace might be carried up in the same form of construction, so as to form the entire superstructure; also, that the entire kiln above the foundation might be constructed in the same form as the tower-section herein described, and provided with suitable fire-chambers and ash-pits.

I therefore do not confine myself to the combination of the two forms of construction in all cases, as it may be found, in some classes of furnaces, either form of construction will answer the purpose. Further, the tower-section above the furnace-section may be of any ordinary construction, or a simple jacketed tower, lined with fire-brick. All of these changes are obviously modifications of the construction as herein specifically described.

I therefore claim as new and useful, and desire to secure by Letters Patent—

1. A furnace or kiln adapted for burning lime, cement, or plaster, roasting ores, smelting metals, and for other kindred purposes, constructed in three sections: first, a masonry foundation or base having centrally therein a self-acting draw, and provided with suitable draw-doors; second, a furnace-section, constructed of a series of exterior walls in form of reverse or concave arches, interior circular wall of fire-brick or stone, and provided with a series of fire-chambers and ash-pits, the whole secured vertically by bond-plates at both apex and base, and tie-rods, and laterally by a series of perpendicular Y-shaped abutting plates and horizontal tie-rods; third, an upper section or tower, constructed of a series of exterior brick walls laid in reverse arches, the bases of which rest in a series of vertical V-shaped abutting plates, and an interior circular wall of fire-brick or stone, the whole rigidly secured together in place by a series of horizontal tie-rods attached to the abutting plates, the entire structure arranged, applied, and operating substantially as and for the purposes as herein shown and set forth.

2. In a furnace, kiln, or oven adapted for the burning of lime, cement, or plaster, roasting of ores, fusing of metals, and other similar purposes, a series of outer masonry walls, constructed in the form of reverse or concave arches, in combination with a series of

vertical metal abutting plates or seats, and a series of horizontal tie-rods provided with adjusting and retaining nuts, arranged, applied, and operating substantially as and for the purposes as herein shown and set forth.

3. In a furnace, kiln, or oven adapted for the purposes herein specified, the combination of a series of outer masonry walls laid in reverse arches, a series of vertical metal abutting plates provided with horizontal tie-rods having adjusting and retaining nuts, and a horizontal bond-plate at both apex and base of walls, provided with perpendicular tie-rods and adjusting and retaining nuts, the whole applied and operating substantially as and for the purposes as herein shown and set forth.

4. In a furnace or kiln, the combination of a series of vertical walls, I I, laid in the form of reverse arches, V-shaped metal abutting plates or seats H, tie-rods *i i*, and retaining-nuts *n*, arranged, applied, and operating substantially as and for the purposes as herein shown and set forth.

5. In a furnace or kiln, the combination of the circular fire-brick or stone wall L, metal jacket O, non-conducting packing P, arched exterior walls I I, V-shaped abutting plates H, and tie-rods *i i*, the whole arranged and operating as and for the purposes as herein shown and set forth.

6. In a furnace or kiln, the combination of a series of vertical walls of masonry, *b b*, laid in the form of reverse arches, parallel walls *c c*, Y-shaped abutting plates D, and cord-rods *d d*, provided with adjusting-nuts *d'*, arranged, applied, and operating substantially as and for the purposes as herein shown and set forth.

7. In a furnace or kiln, the combination of a series of vertical walls of masonry, *b b*, laid in the form of reverse arches, parallel walls *c c*, Y-shaped abutting plates D, horizontal tie-rods *d d*, having adjusting-nuts *d'*, bond-plates *a* and *f*, and vertical tie-rods *g g*, having adjusting-nuts *g'*, the whole arranged, applied, and operating substantially as and for the purposes herein set forth.

8. In a furnace or kiln, the combination of the circular fire-brick or stone wall E, lateral walls F, forming the sides and top of the fire-chambers and ash-pits, arched exterior walls *b b*, parallel walls *c c*, Y-shaped abutting plates D, horizontal tie-rods *d d*, having adjusting-nuts, bond-plates *a* and *f*, and vertical tie-rods *g g*, the whole arranged, applied, and operating substantially as and for the purposes as herein shown and set forth.

WILLIAM S. SAMPSON.

In presence of—

A. L. MUNSON,
LEWIS WILKINSON.