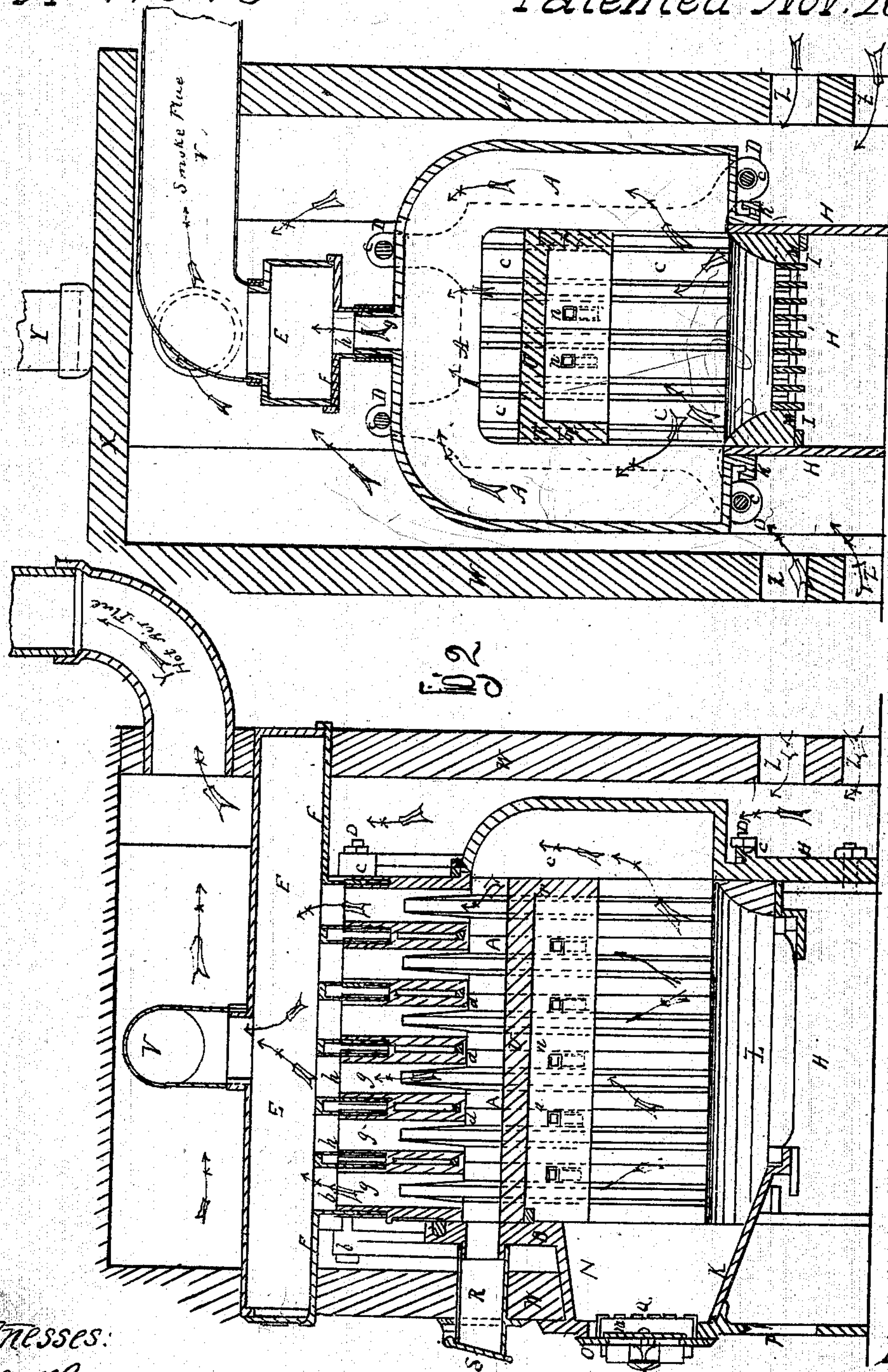


Whitaker & Constantine.

Hot-Air Furnace.

N<sup>o</sup> 71348

Patented Nov. 26, 1867.



Witnesses:

D. C. Remon  
L. A. Pettit

Inventor.

Thomas Whitaker & Joseph Constantine  
By Messrs. H. C. Atkinson



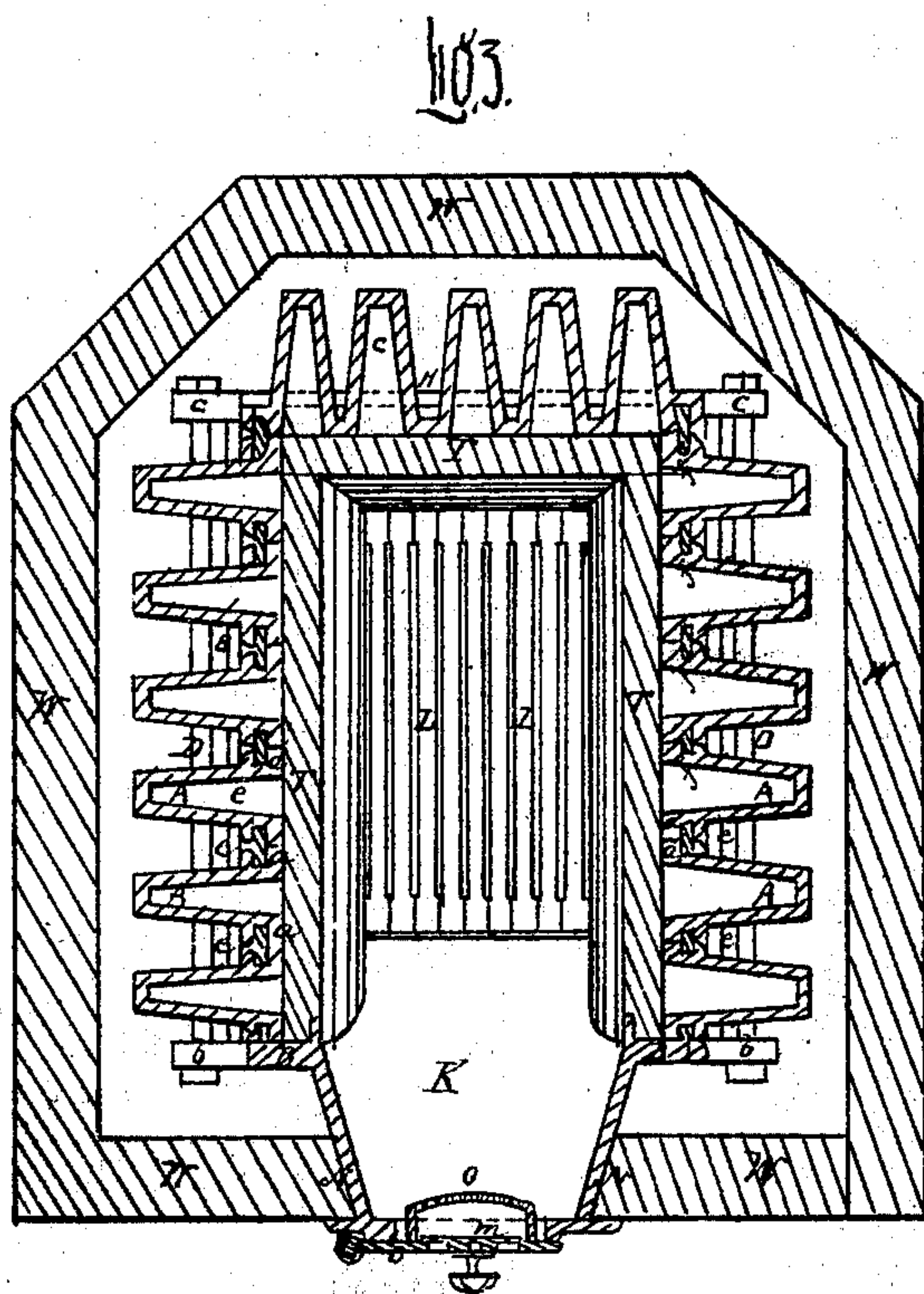
Sheet 2 - 2 Sheets

Whitaker & Constantine.

Hot-Air Furnace.

N<sup>o</sup> 71348

Patented Nov. 26, 1867.



Witnesses:

E. C. Kemmon  
C. A. Pettit

Inventor:

Thos Whitaker & J. Constantine  
By Kemner & Co  
Attorneys



# United States Patent Office.

THOMAS WHITAKER, OF BOLTON, AND JOSEPH CONSTANTINE, OF MANCHESTER, ENGLAND.

*Letters Patent No. 71,348, dated November 26, 1867.*

## IMPROVEMENT IN HOT-AIR FURNACES.

*The Schedule referred to in these Letters Patent and making part of the same.*

### TO ALL WHOM IT MAY CONCERN:

Be it known that we, THOMAS WHITAKER, of Bolton, and JOSEPH CONSTANTINE, of Manchester, in the county of Lancaster, England, have invented a new and useful Improvement in the Construction of Stoves or other Heating Apparatus for Warming and Ventilating Buildings; and we do hereby declare the following to be a full, clear, and exact description of the nature, construction, and operation of the same, sufficient to enable others skilled in the art to which the invention appertains to fully understand and use it, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a longitudinal elevation and section through middle of stove.

Figure 2 is a side elevation and cross-section through middle of stove.

Figure 3 is a plan and horizontal section through middle of one of our improved stoves suitable for heating a church, large hall, Turkish bath, or other public building.

The object of our invention is to obtain a heating-apparatus for air or other liquids, which, though comparatively occupying but a small space, presents not only a very large surface to the medium which is to be heated, but also exposes a very large absorbing surface to the fire and the hot gases, which by our arrangement are compelled to come in contact with all the available absorbing surface in such a manner that nearly all the heat obtained by the combustion of the fuel is given off to the apparatus, and produces useful effect, instead of escaping for the most part through the chimney, as is usually the case.

We construct our stoves of hollow segments, which, when put together, form the sides of the structure, and at the same time with the internal linings also the flues. These segments we make of a V or U-section, and their outer form we make according to the shape the stove is to have; as, for instance, for a stove with square sides and a vaulted top, the segments would be of a horse-shoe form. The segments are cast hollow, and open towards the inner side. On the inner edges there are ribs projecting sideways, to form the parts of contact between each two adjoining segments. We form the centre of the top part of each of these segments, where the hollows or flues from both sides meet, into a short pipe, which leads the smoke into a general smoke-box or flue running over the whole length of the stove. This smoke-flue, supported by the front and back walls, consists of a loose bottom plate with raised edges all round, and short tubes projecting downwards along its centre, fitting loosely over the outlet-pipes of the segments, and an inverted box or trough with a soot-door at the front end, and an opening in the top, with a raised edge to receive the smoke-pipe or flue leading to the chimney. This smoke-box may also be made open at its back end, to lead off the smoke into a flue or direct into the chimney. To make the joints between the outlet pipes of the segments and the tubes in the bottom plate of the smoke-box we use short tubes of sheet metal encasing both of them, and resting on a rim cast round the lower part of the pipe on the segment, and fill the annular space between the three tubes with sand or clay. In order to make good joints between the segments we cast on the top part, close behind the ribs, at the inner edges, taper indentations, forming with the ribs and the corresponding indentations of the adjoining segments dovetail grooves, which will securely retain clay, cement, or other similar substance which has been rammed in. For the vertical joints at the sides we cast, a short distance from the inner rib, a second rib, which will retain, with the one of the adjoining segment, a strip of sheet metal, and into the space left between the latter and the inner rib we ram cement, clay, or other suitable substances. As we make the segments of considerable radial depth, and the thickness of the metal not great, and as much as possible uniform throughout, the whole being at the same time uniformly heated, our stoves possess great elasticity, and the pressure and motion from expansion and contraction cannot easily lead to breakage. If, from some cause or other, a segment should break, it can easily be replaced without disturbing the other parts, and at a very small expense. The front and back of the stove we form of separate pieces, and by passing bolts from the former to the latter, outside the segments, the whole structure is held together.

In the front plate are the necessary openings for firing and cleaning the flues at the top. The back plate we make of such a section as to present an appearance similar to that of a number of adjoining segments at the sides, in order to obtain a larger number of flues and additional heating surface. Instead of holding all the segments together by the front and back plate, we also propose to fasten each segment to the two adjoining ones by bolts, pins, and cotters, or hoops, round small projections, the front and back plates being fastened to



the first and last segments respectively. This arrangement will allow of a very free movement of all the parts in expanding and contracting. The segments, front and back plates are mounted on a foot-framing formed by three plates bolted together, and having a flange all round the outside of the top edge, and preparations supporting the cross-bars and dead-plate carrying the grate-bars. The segments and back plate rest with their inner edges only on the foot-frame, so that their sides overhang the latter, and the cold air has a free passage upwards between the segments. Bolted to the front plate of stoves which are built in, we have a frame reaching through the front wall, and carrying the fire and ash-pit doors. In the fire-door we usually have a regulator for the admission of air, and also a perforated box at the back of it for equal distribution of the same. For open stoves this front framing may be dispensed with, and the doors may be fixed to the front plate and foot-framing. The inside of the stove we line with slabs of fire-proof substance fitting close to the inner edges of the segments and of the back plates. These slabs are supported by small brackets cast with the segments, and reach to within a few inches of the top and bottom of the segments. Slabs are laid across the top of the side linings, and leave a clear space below the top of the segments. The hollow parts of the segments and back thus form with this lining a number of flues through which the hot gases and smoke have to pass, and are brought into close contact with the whole inner or absorbing surface of the stove, after which they are led through the short pipes in the top of the segments to the smoke-box, and from there to the chimney.

In some cases we also make the inner lining of cast iron or wrought iron. We generally make the grate narrower than the inner width of the segments, place it a little beneath their lower end, and put a lining of fire-brick along the sides and end of the grate, which reaches up to the flues, and is rounded off towards them. Where it is not convenient to have the stove or heating apparatus in the room which has to be warmed, it is necessary to surround it with walls a short distance off the sides and covered over the top. Openings are left all round in the walls near the bottom to admit fresh air, which in rising up between the walls and segments gets heated and collects in the space over the stove, from where it is conveyed through pipes or flues to the rooms which have to be warmed and ventilated. A trough or evaporating-pan supplied with water may also be introduced at the top of the apparatus to moisten the hot air if required. We sometimes enclose our stoves in an iron casing, with suitable openings for the admission of the fresh and the emission of the hot air.

A A are the hollow segments of a V-section, forming a square stove with rounded top corners. *a a* are the inner ribs projecting sideways, forming the part of contact between the adjoining segments A A, the front plate B, and the back plate C. The segments are held together by the bolts D D, passing through the lugs *b b*, on the front plate, and *c c*, on the back plate. The sections of the segments A and the back plate C are clearly shown in fig. 3. *d d* are the taper indentations forming dove-tail grooves, filled with clay or cement, to form the joint over the top. *e e* are small ribs retaining the metal strips *f f*, the space between the latter and the ribs *a a*, being filled with clay or cement. *g g* are the small tubes leading the smoke into the smoke-box E. F is the bottom plate of the smoke-box E, and rests with its ends on the walls; G is a small door to allow the smoke-box to be cleaned; *h h* are the short tubes cast with the plate F, and fitting loosely over the tubes *g g* of the segments; *i i* are short tubes of sheet metal, enclosing the tubes *g g* and *h h*, and rest on the top of the segments. The annular space left between these tubes is filled with sand or clay. The segments, front plate, and back plate are mounted on a foot-framing, consisting of three plates H H, bolted together, and having flanges *k k* all round the outside of the top edge, and preparations *l l*, supporting the cross-bar I, and the dead-plate K, carrying the grate-bars L L, and the plates M M, which support the fire-brick lining round the grate. Bolted to the front plate B is the frame N, fitted with the fire-door O and the ash-pit door P. To the back of the fire-door O a perforated box, Q, is fixed to distribute the air admitted by the regulator *m*. In the top of the front plate there is an opening corresponding with a box, R, going through the front wall, and covered with a lid, S, to allow the top slab of the lining and the upper part of the segment to be cleaned. The inside of the stove is lined with slabs of fire-brick T T, supported by small brackets *n n*, cast on the segments and back plate. A large slab, U, of fire-brick, is laid across the top of the side linings, leaving a clear space below the top of the segments. The course of the hot gases and smoke is indicated by a number of arrows. From the smoke-box E the smoke is conveyed through the pipe V to the chimney. The whole apparatus is surrounded by brick walls W W, having openings Z Z all round the bottom for the admission of fresh air, and covered by a flag, X. The hot air which has collected at the top is led off through the pipe Y to the rooms to be warmed and ventilated. The course of the air used for heating is indicated by arrows marked thus, X.

Having now described our said invention, and the manner in which the same may be carried into effect, we wish it to be understood that we do not confine or restrict ourselves to the precise details and arrangements hereinbefore described and shown in the drawings; but

What we do claim as our invention, and desire to secure by Letters Patent, is—

1. Constructing stoves of hollow segments, open towards the inner side, forming, with the lining-slabs, flues presenting a large absorbing surface for the heat, and a large outer surface for heating the air or liquids, and possessing great elasticity, substantially as described.
2. Forming joints of stoves by ramming clay or other substances between ribs at the inner edges of the segments and metal plates retained by outer ribs cast on the sides of the segments, substantially as described.

THOS. WHITAKER,  
JOSEPH CONSTANTINE.

Witnesses to the signature of THOMAS WHITAKER:

THOS. PARKER,  
A. HOLLINGWORTH.

Witnesses to the signature of JOSEPH CONSTANTINE:

THOS. PARKER,  
A. HOLLINGWORTH.