(No Model.) 4 Sheets—Sheet 1.

S. C. DAVIDSON.

STOVE OR AIR HEATING APPARATUS.

No. 408,402. Patented Aug. 6, 1889.

Fig. 1.

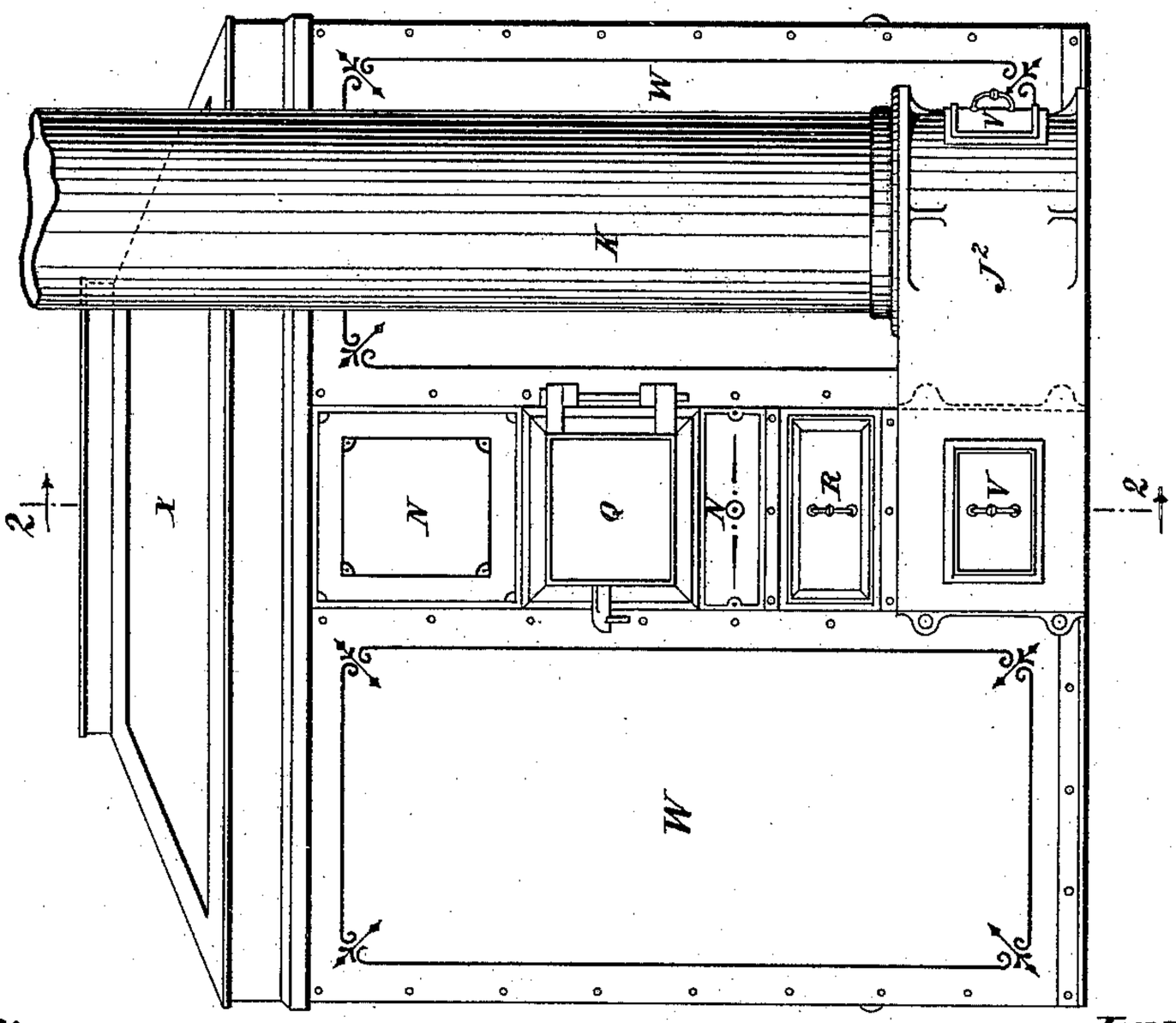

Fig. 2.

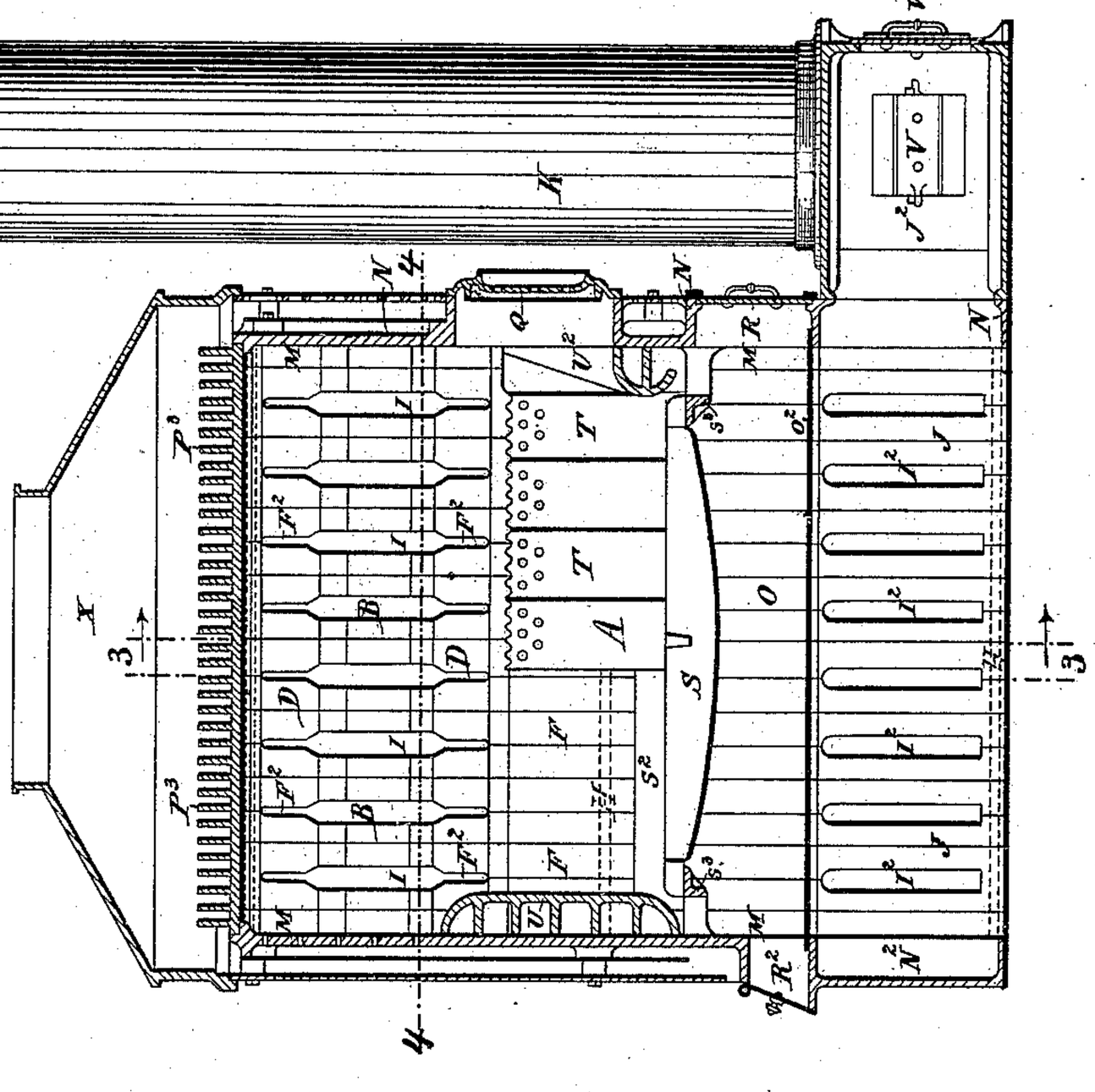

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Fig. 4.

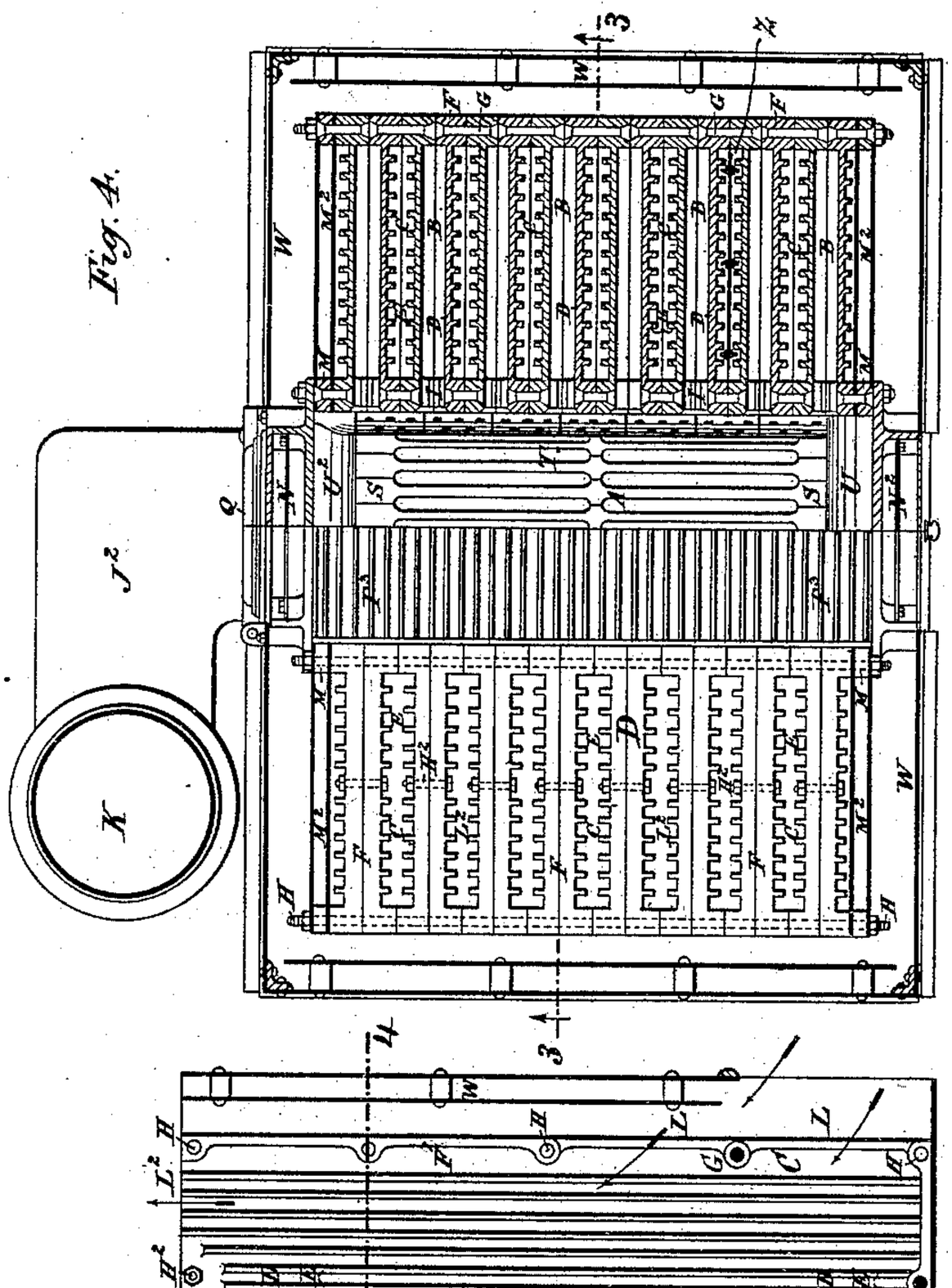

Fig. 4a.

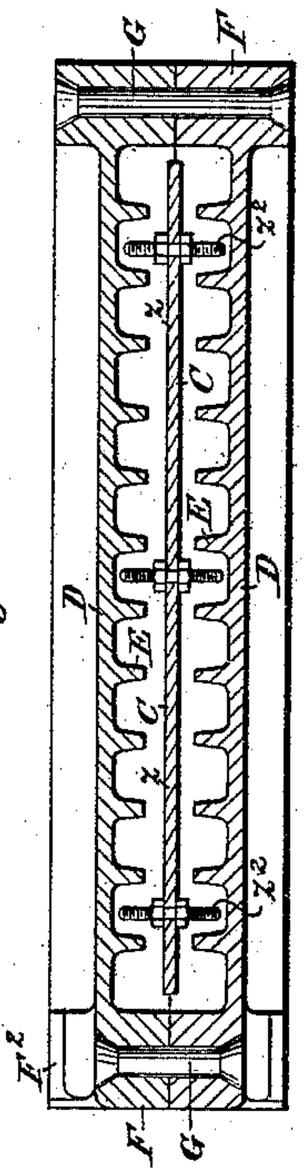

Fig. 3.

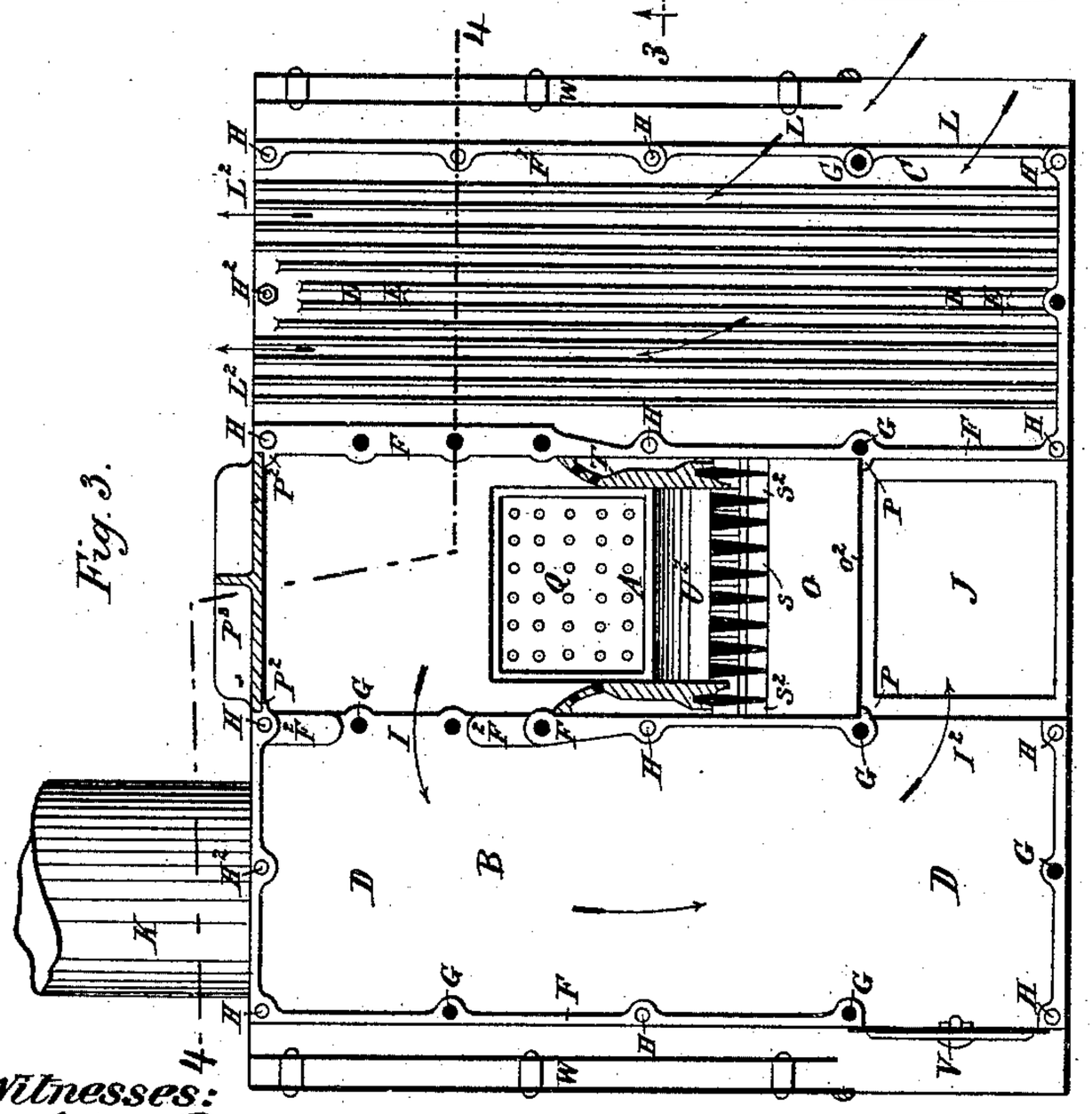

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Fig. 6.

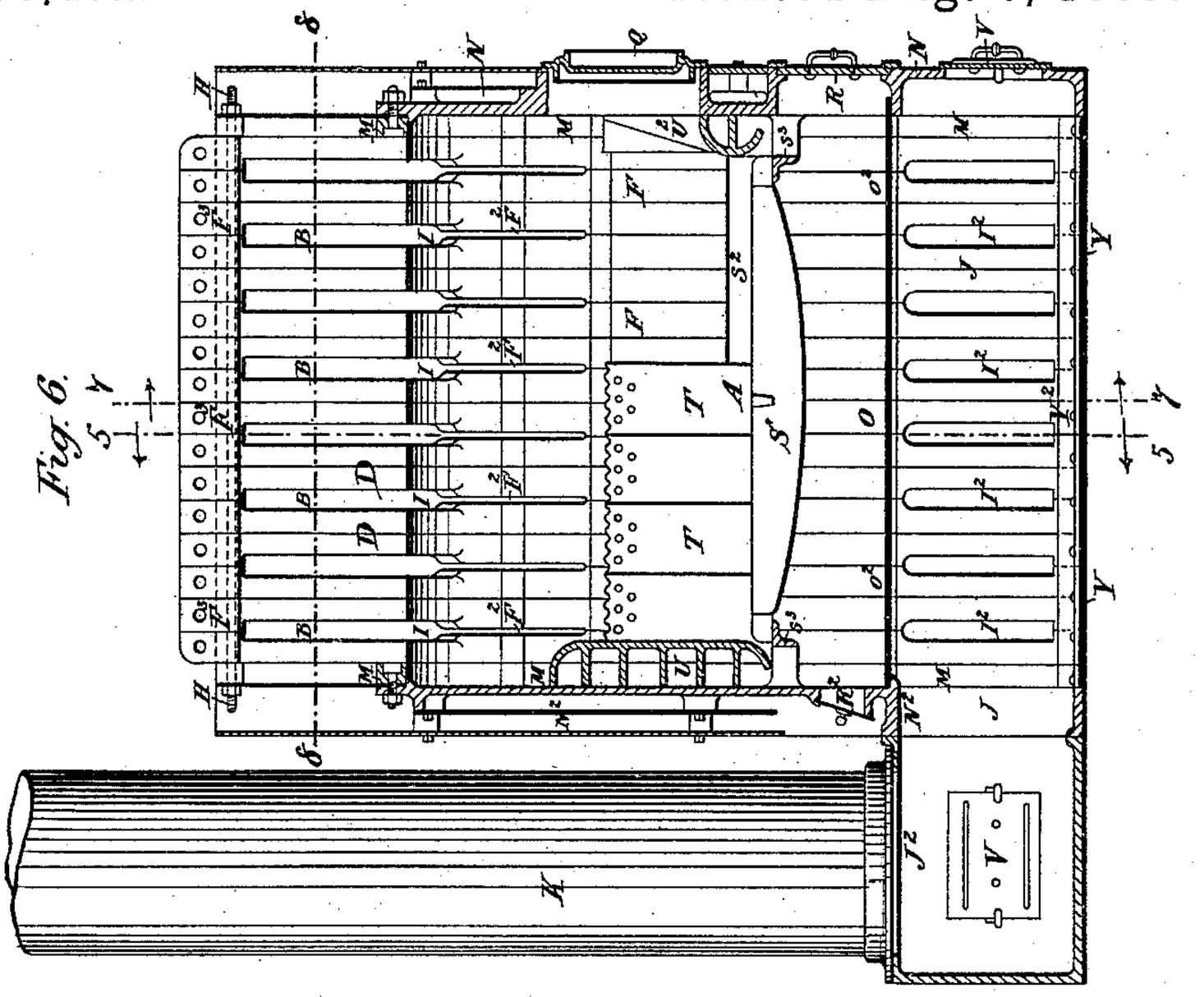

Fig. 5.

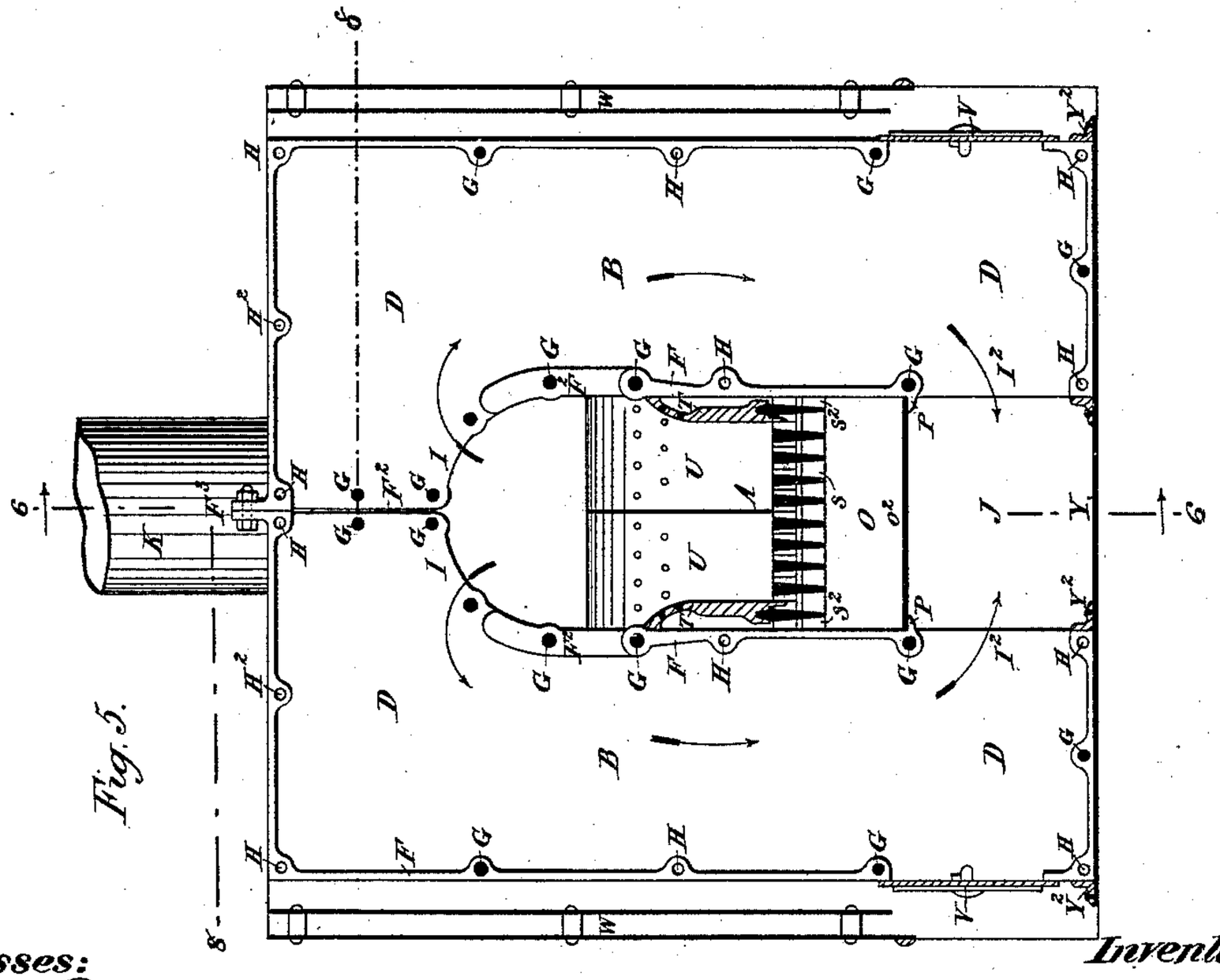

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Fig. 8.

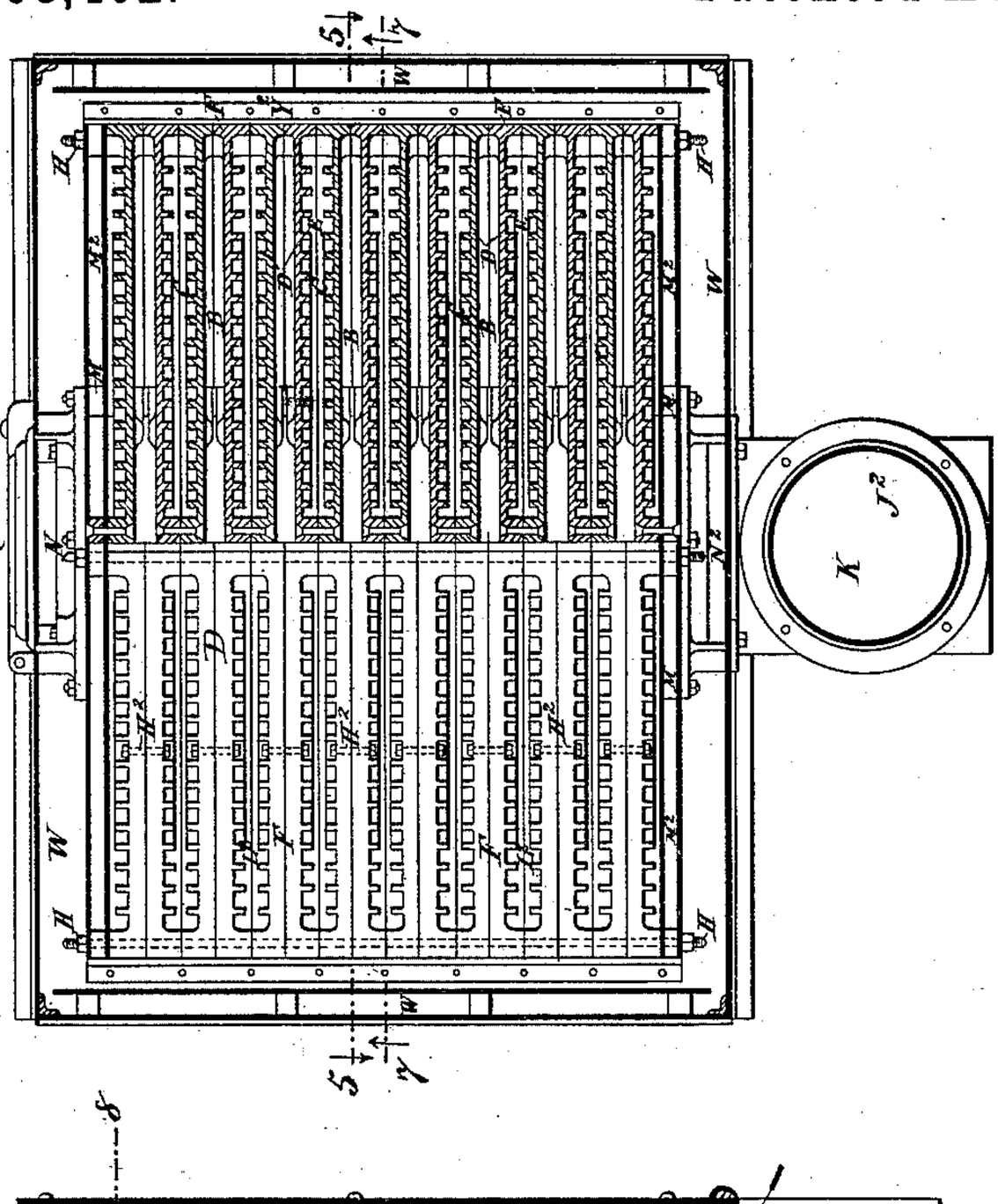


Fig. 8a.

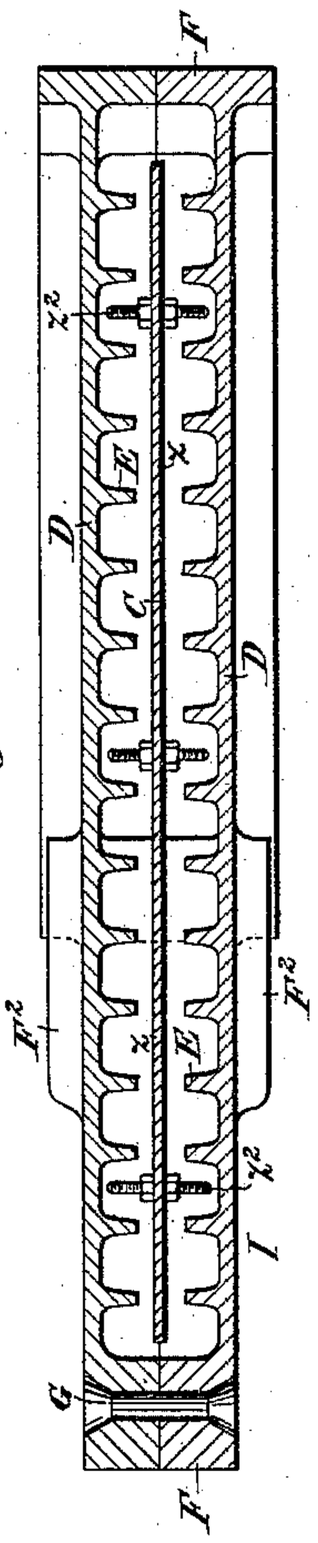
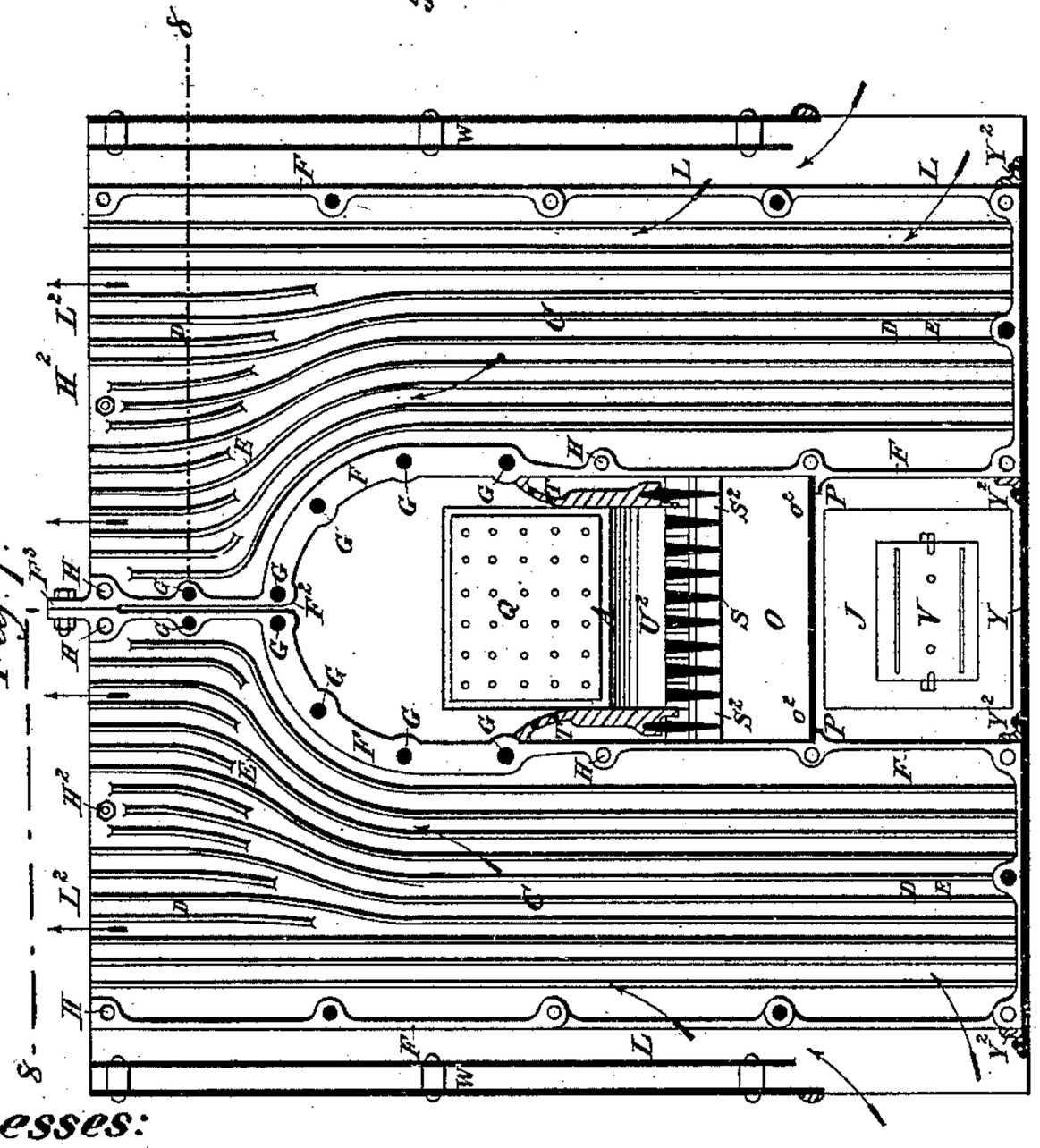


Fig. 1.



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UNITED STATES PATENT OFFICE.

SAMUEL CLELAND DAVIDSON, OF BELFAST, IRELAND.

STOVE OR AIR-HEATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 408,402, dated August 6, 1889.

Application filed March 18, 1889. Serial No. 303,707. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL CLELAND DAVIDSON, merchant, a subject of the Queen of Great Britain, residing at Sirocco Works, Belfast, Ireland, have invented certain new and useful Improvements in Stoves or Air-Heating Apparatus, of which the following is a specification.

The invention has reference to the stoves or air-heating apparatus of the kind in which the fire-place is situated between two series of flat vertical chambers, which chambers are end onto and extend right and left of the fire, into each alternate chamber of which the products of combustion from the fire are admitted at the upper end and are drawn down through the same into a chamber or general flue beneath the ash-plate of the fire-place, while in the other alternate chambers air is admitted below, and, becoming heated by contact with the sides of the chambers, ascends in the reverse direction to the currents of the products of combustion and escapes from these chambers at the upper end. In these stoves as hitherto constructed the plates which form the partition-walls of the flat vertical alternate air and smoke flue chambers have been held apart by flanges or ribs around the edge of the plates, and the parts of these flanges which form the sides of the fire-place have been constructed to abut against one another the whole length of the fire from front to back. When those parts of the flanges which are quite close to the fire become red-hot, they expand considerably, while the other parts, remaining at a black heat, expand comparatively little, the result of which is that the ends and center of the stove have bulged so much out of shape opposite the red-hot parts that sometimes this expansion has caused breakage of the furnace-door frame and back plate of the fire-place, and the plates themselves have twisted and suffered an undue wear and tear in consequence.

Now, one object of the present improvements is to obviate the defects caused by this unequal expansion of the plates and flanges, as above described; and the invention for this purpose consists of a certain novel construction of said plates and their separating flanges or ribs, so that those parts which get red-hot have free room for lateral expansion individually and without affecting the adjoining plates or bulging one another out of shape.

The invention further consists of improvements whereby the plates have greater strength and durability, and there is a greater air-heating surface in the air chambers or flues, and a saving of fuel is effected in heating the air.

I make the improved plates of cast metal, with the flanges cast on them; but instead of the flanges being entirely on one side of the plate, as has hitherto been the case when they have been cast on the plates, I now cast them on both sides. The improved plates are of two patterns, to suit the right and left sides, the flanges on which are so arranged that when these two patterns are put together as a pair they inclose an air flue or chamber between them, and when riveted or otherwise fastened together they form a flat-shaped tubular air-heating flue or pipe with inlet and outlet openings for the air. I cast ribs or gills on the sides of the plates next the air-flue to increase the surface area of the air-chamber and give it a greater air-heating capacity as well as greater strength and durability. In the preferred arrangement I also insert a flat or corrugated thin metal plate in the air-flues as an intermediate diaphragm between the plates, so as to divide the space between them lengthwise and increase the heating-surface. These diaphragms are preferably put in loose, with suitable pins or studs secured to them and projecting on both sides, so as to keep them midway between the plates which form the air-flue itself.

When a pair of the tubular air-flues formed as above described are placed side by side, their projecting or outside flanges so meet that a chamber is formed between them, which acts as a smoke-flue. Where the flanges are liable to get red-hot from their close proximity to the fire, I cut more or less of them away, so as not to touch. The openings which are thus made act as inlets (in combination with the ordinary inlets) for the smoke from the fire to the smoke-flue, and at the same time allow for the free lateral expansion of the red-hot parts of the plates. Flanges and exit-openings are also formed for the smoke

to pass out from the smoke-flue on its way to the chimney. When the requisite number of the above-described tubular air-heating flues are placed side by side, so as to make up the required length of stove from front to back, they are held up against one another by bolts passing through them, as in the construction hitherto adopted, a set of these flues thus formed being set on each side of the fire-place, and in order that the furnace front and back plates may be conveniently bolted to the body of the stove special ribs are attached to the outer plates of the row of air and smoke flues, and the front and back plates are bolted to these ribs. The stove thus formed may be set on a wrought iron or metal base-plate with suitable stoppers to hold the bases of the air and smoke flues in correct position, and also to facilitate building them together.

The accompanying drawings illustrate my invention.

Figure 1 is a front elevation of a stove or air-heating apparatus. Fig. 2 is a vertical section through the center from front to back on the line 2 2, Fig. 1. Fig. 3 is a vertical section across the fire-place through a smoke-flue on one side and through an air-flue on the other side and cut on the lines 3 3 in Figs. 2 and 4. Fig. 4 is a plan half in section, cut on the line 4 4 in Fig. 3. Fig. 4ª is a horizontal section, on a larger scale, through one of the air-flues in Figs. 2, 3, and 4, showing the intermediate diaphragm-plate hereinbefore described in position. In the apparatus shown in these figures the air and smoke flues do not extend over the top of the fire-place, but are at the two sides thereof only. The main smoke-flue to the chimney is formed between the bases of the sections and below the ash-plate. The smoke box and chimney are shown as connected to the front of the main smoke-flue. A top casing is shown; but of course any other suitable form of air-duct may be applied to suit special circumstances. Fig. 5 is a vertical section through the smoke-flues on the line 5 5, Figs. 6 and 8, of a modification of the improved stove, which differs from that shown in Figs. 1 to 4 chiefly in that the air and smoke flues extend over the top of the fire-place as well as down each side of it, and that the smoke box and chimney are connected to the back of the main smoke-flue. Fig. 6 is a vertical section through the center of the fire-place, from front to back, of the stove shown in Fig. 5 and cut on the line 6 6 in Fig. 5. Fig. 7 is a vertical section through the air-flues on the line 7 7, Figs. 6 and 8. Fig. 8 is a plan half in section on the line 8 8, Figs 5, 6, and 7. Fig. 8ª is a horizontal section, on a larger scale, through one of the air-flues in Figs. 5, 6, 7, and 8, showing the intermediate diaphragm-plate in position.

A is the fire-place.

B B are the vertical smoke-flues.

C C are the vertical air-flues.

D D are the cast-iron plates forming the partition-walls between the air and smoke flues.

E E are the gills or ribs on the air-flue sides of the plates D.

F F are the flanges on the plates D.

F^2 F^2 are the parts where the flanges of the plates are cut away to allow for lateral expansion when red-hot.

F^3 F^3, Figs. 5 to 8, are small flanges for fastening the two sides of the stove together at top.

G G are rivets for holding together the plates which form the air-flues.

H H are long horizontal bolts that hold the flanges of the air-flues C against one another, so that they thus form the smoke-flues.

H^2 H^2 are short bolts securing a close joint at top of each smoke-flue.

I I are openings from the fire to the smoke-flues.

I^2 I^2 are openings from the smoke-flues to the main smoke-flue.

J is the main smoke-flue leading to the chimney K.

J^2 is the smoke-box.

K is the smoke-chimney.

L L are the openings at the foot of the air-flues for the admission of cool air.

L^2 is the open top of the air-flue for the exit of heated air.

M M are ribs for bolting the front and back plates to the sides of the air-heater.

M^2 M^2 are plates to protect the stove-casing, also forming an air-space.

N is the front plate.

N^2 is the back plate.

O is the ash-pit.

O^2 is the ash-plate.

P P are snugs cast on the flanges of the plates D for carrying the ash-plate.

P^2 P^2, Figs. 2, 3, and 4, are snugs cast on the flanges of the plates D for carrying the radiator-plate.

P^3, Figs. 2, 3, and 4, is a ribbed radiator closing in the top of the fire-place.

Q is the fire-door.

R and R^2 are, respectively, the front and back ash-pit doors, with which the amount of air supplied to the fire can be regulated.

S S are fire-bars.

S^2 S^2 are tile-rails for carrying the side tiles T.

S^3 S^3 are bearers for the fire-bars and tile-rails and are fixed to front and back plates.

T T are the side tiles.

U is a cast-iron back tile.

U^2 is a cast-iron front tile.

V V are cleaning-doors on the smoke-flues.

W is the stove-casing.

X, Figs. 1 and 2, is the top casing.

Y, Figs. 5 to 8, is a sheet-iron base-plate to carry the sections.

Y^2 Y^2 are angle-irons riveted to the base-plate Y to hold the sections in correct position.

Z, Figs. 4ª and 8ª, is the intermediate diaphragm-plate, which may be either flat, as shown, or corrugated.

Z^2 Z^2 are stops on the diaphragm-plate for keeping it in an intermediate position.

The arrows on the smoke-flues indicate the flow of hot gases from the fire to the main smoke-flue and thence to the chimney, and those on the air-flues show the flow of the air through them.

What I claim, and desire to secure by Letters Patent, is—

1. In a stove or air-heating apparatus having two series of flat vertical chambers on the right and left sides of the fire-place, said chambers presenting their edges to the fire-place and said chambers constituting alternate air and smoke flues, the combination of metal plates each having on both vertical edges two oppositely-projecting flanges, (each plate thus having four projecting flanges,) said plates being fastened together in pairs with their adjacent flanges in contact, whereby the vertical air-chambers are formed between the two plates forming a pair of plates, and said pairs of plates being fastened together with the adjacent outer flanges of adjacent pairs of plates in contact, whereby the smoke-chambers are formed, the flanges, however, which constitute the end walls of the smoke-chambers next the fire-place being cut wholly or partially away above the grate, substantially as set forth, whereby openings are formed for the passage of smoke from said fire-place into said smoke-chambers and space is provided for the expansion of said metal plates.

2. In a stove or air-heating apparatus, a fire-place, with its grate and ash-plate, in combination with metal plates D D, fastened together in pairs, and said pairs of plates being also fastened together, said plates being arranged vertically on opposite sides of said fire-place with their edges next to the fire-place, each plate having on each vertical edge oppositely-projecting flanges F F, the flanges on adjacent plates being in contact with each other, whereby air-chambers are formed between the plates constituting a pair and smoke-chambers are formed between the adjacent pairs of plates, the said flanges constituting the end walls of said air and smoke chambers, the flanges, however, which constitute the inner walls of said smoke-chambers next the fire-place being cut away to form openings I I above the grate for the passage of smoke from said fire-place into said smoke-chambers, and being also cut away below the ash-plate to form openings I^2 I^2 for the passage of the smoke from said smoke-chambers to the chimney, substantially as set forth.

3. In stoves or air-heating apparatus which comprise two series of flat vertical chambers at the respective sides of the fire-place, such chambers being end onto the fire-place and forming alternate air and smoke flues with inlet and outlet openings, the combination, with the plates which form the flues, of thin metal plates or diaphragms which divide the air-flues vertically, whereby the air-heating surface in same is increased, substantially as set forth.

4. In a stove or air-heating apparatus, the combination, with the fire-place A, cast-iron plates D D, flanges F F on said plates, bolted together so as to form with said plates alternate smoke-flues B B and air-flues C C, openings I I at upper part of said flanges, openings I^2 I^2 at lower part of said flanges, and air-inlets L L, of the thin metal plates or diaphragms Z in said air-flues C C, dividing the same vertically, substantially as and for the purpose set forth and shown.

5. In a stove or air-heating apparatus, the combination of the following parts, viz: the fire-place A, cast-iron plates D D, flanges F F, cast on said plates, bolts H H, securing said flanges together, openings I I, F^2 F^2, and I^2 I^2 in said flanges, air-inlets L L, ribs or gills E E, vertical diaphragms or plates Z, and smoke-flue J, substantially as set forth and shown.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

SAMUEL CLELAND DAVIDSON.

Witnesses:
JNO. M. SAVAGE,
JNO. D. COOKE.