3. Sheets, Sheet 1.

Nason & Saunders,

Sectional Boiler.

No. 104,188. Patented June 14, 1870.

Fig. 1.

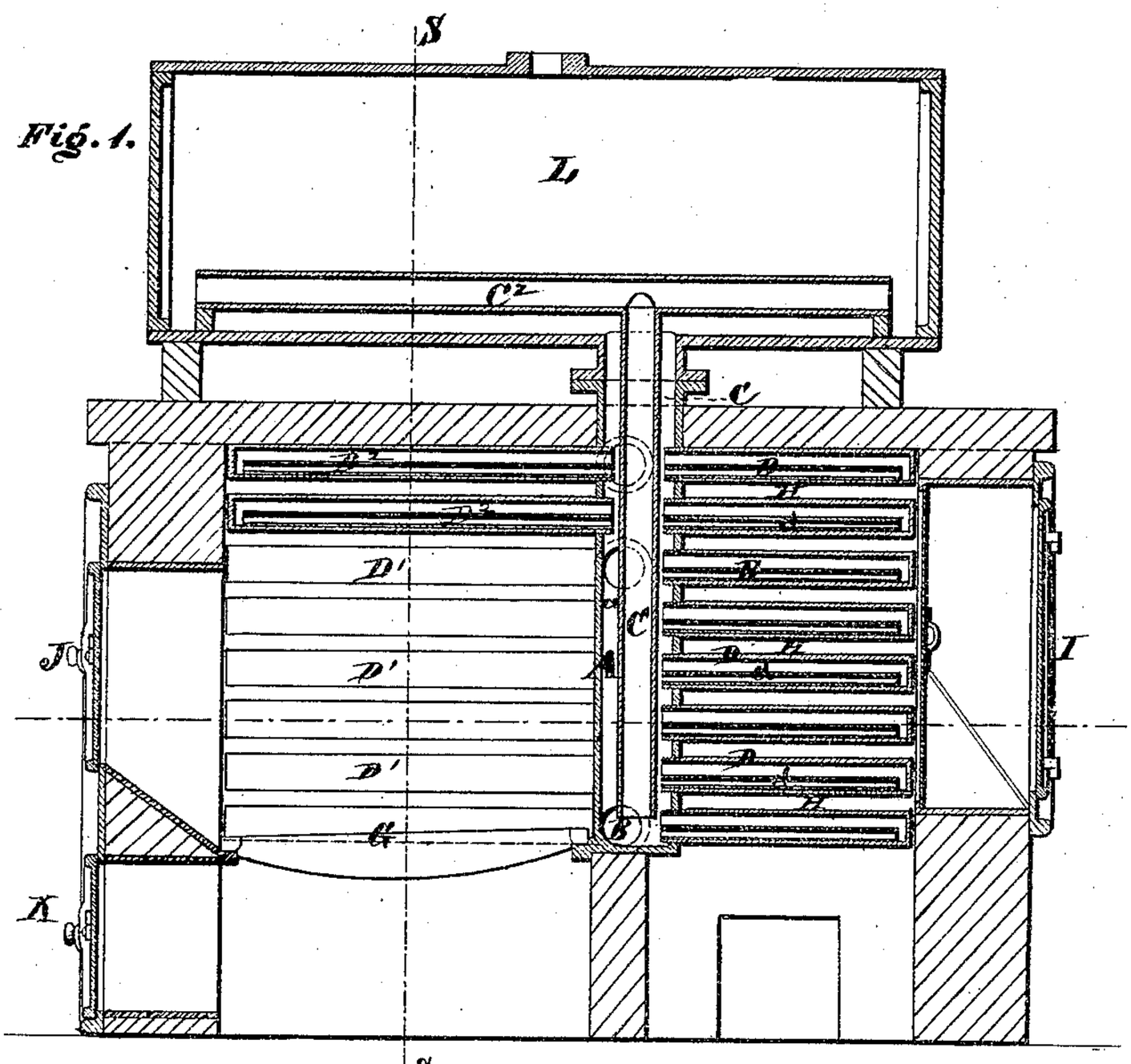
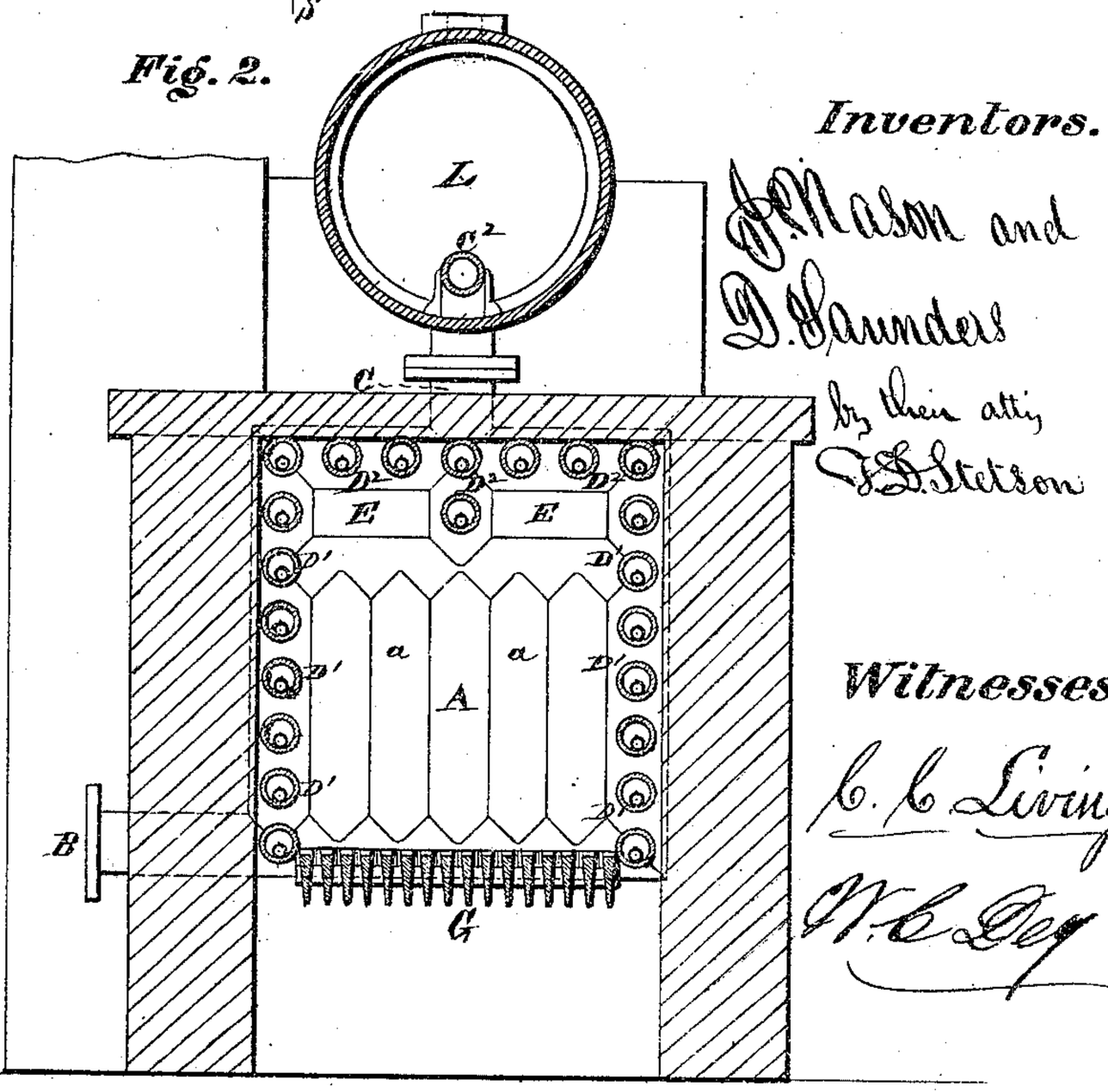


Fig. 2.



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F. B. Stetson

Witnesses

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W. C. Dey

3. Sheets. Sheet 2.

Nason & Saunders.

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NO. 104188. Patented June 14. 1870.

Fig. 3.

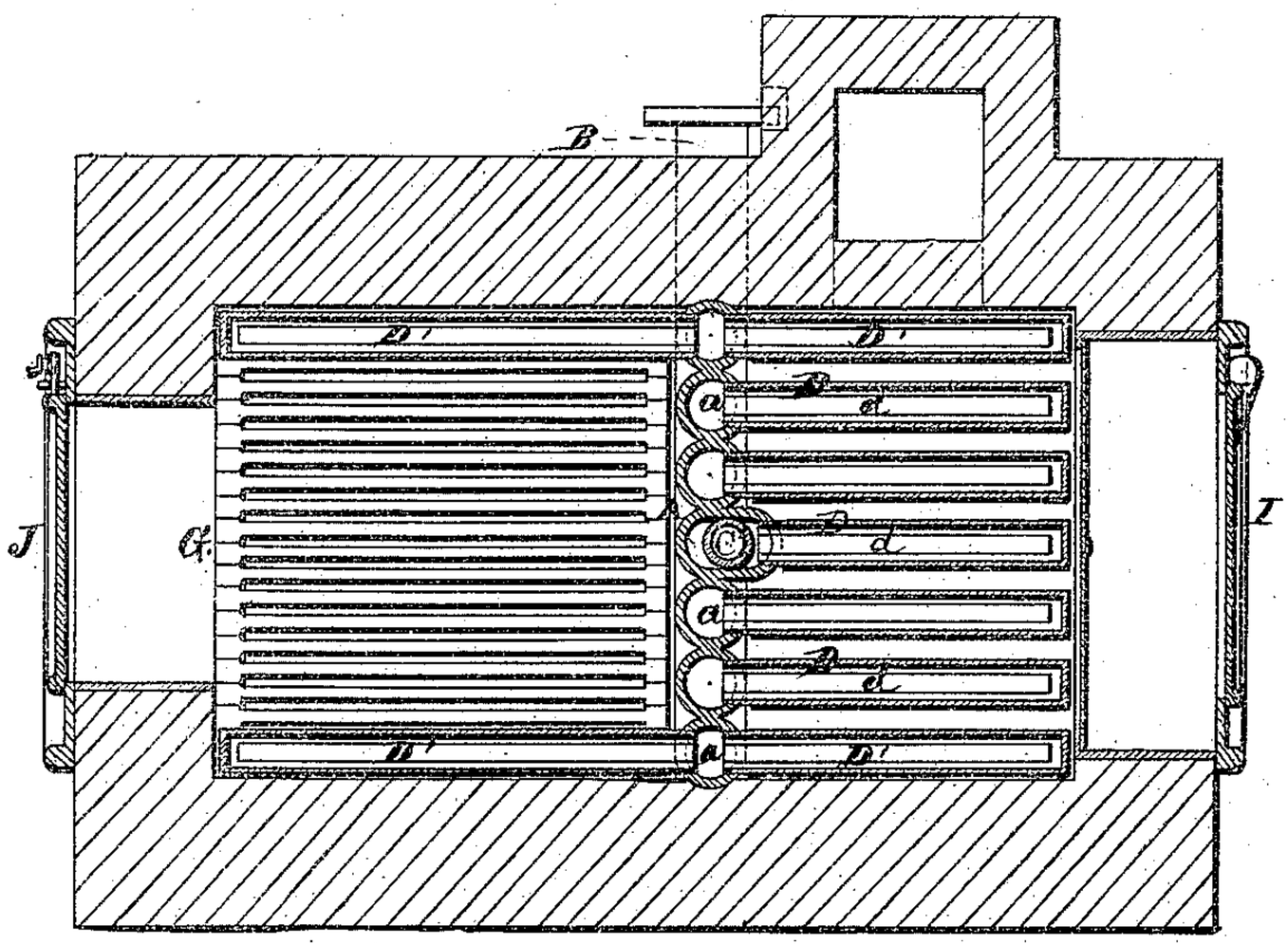


Fig. 4.

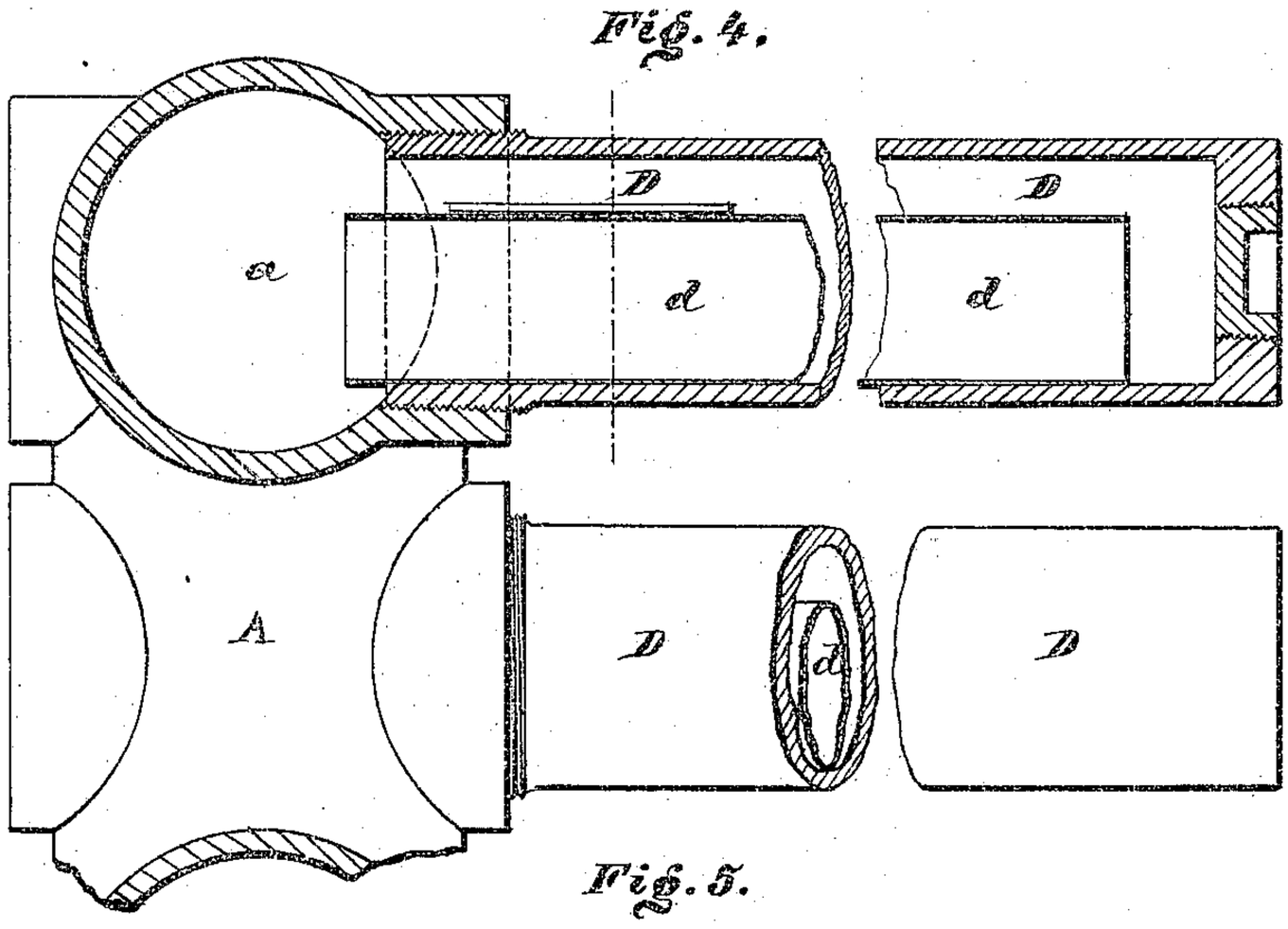
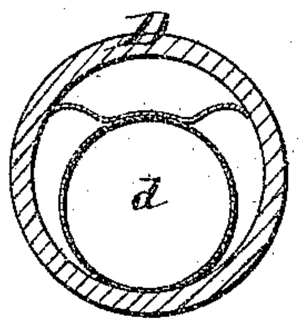


Fig. 5.



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Nason & Saunders, 3. Sheets. Sheet. 3.

Sectional Boiler.

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Fig. 6.

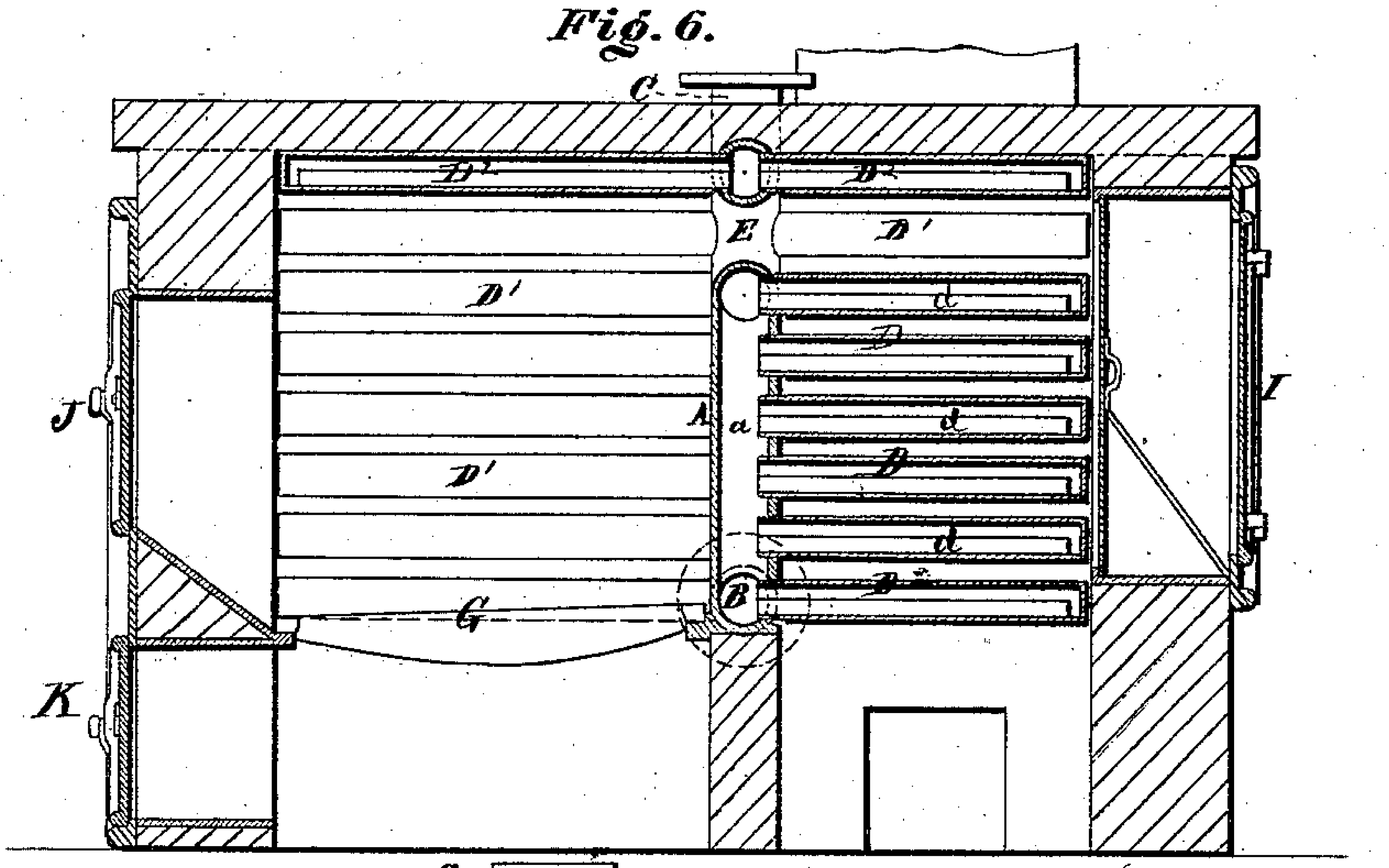

Fig. 7.

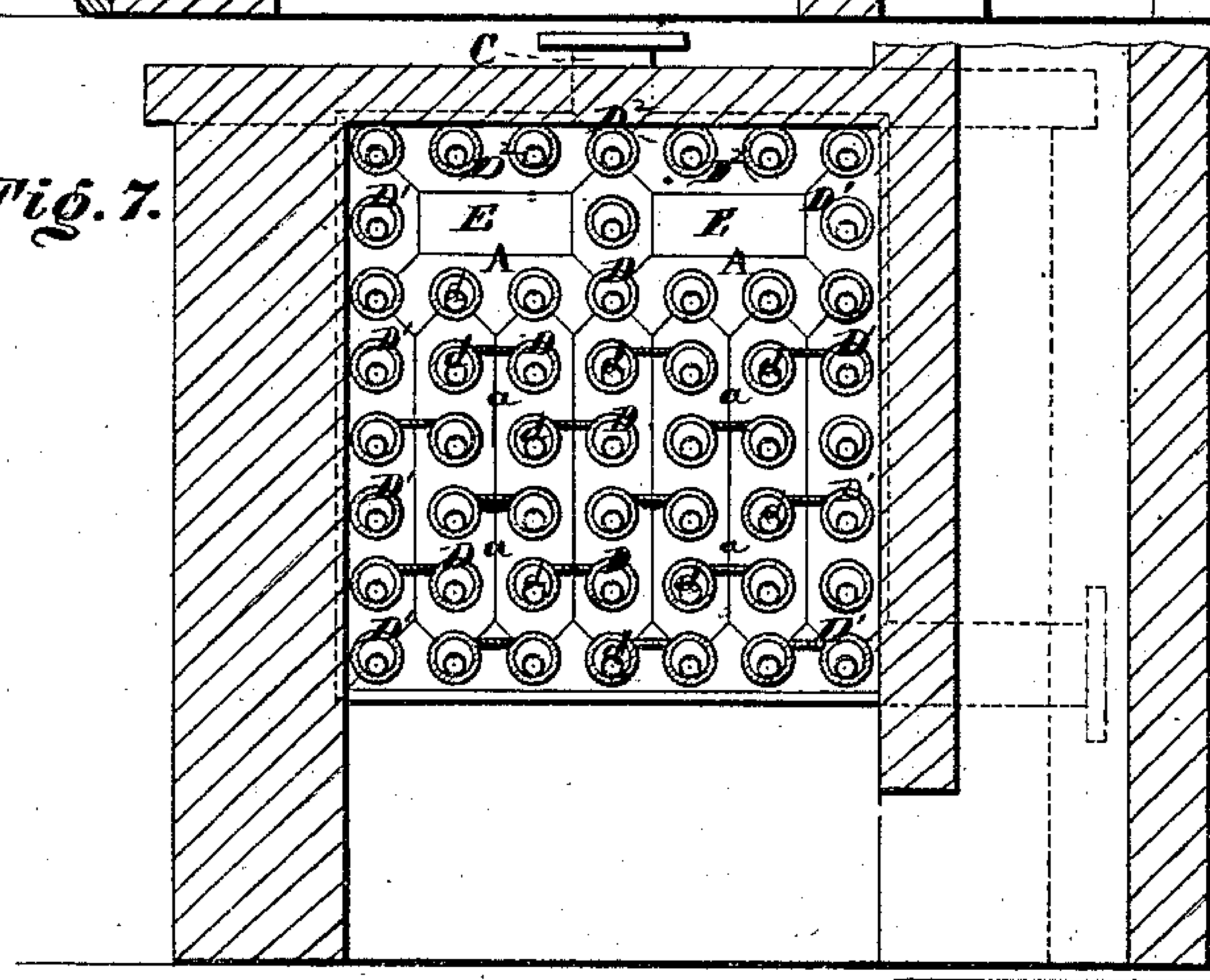

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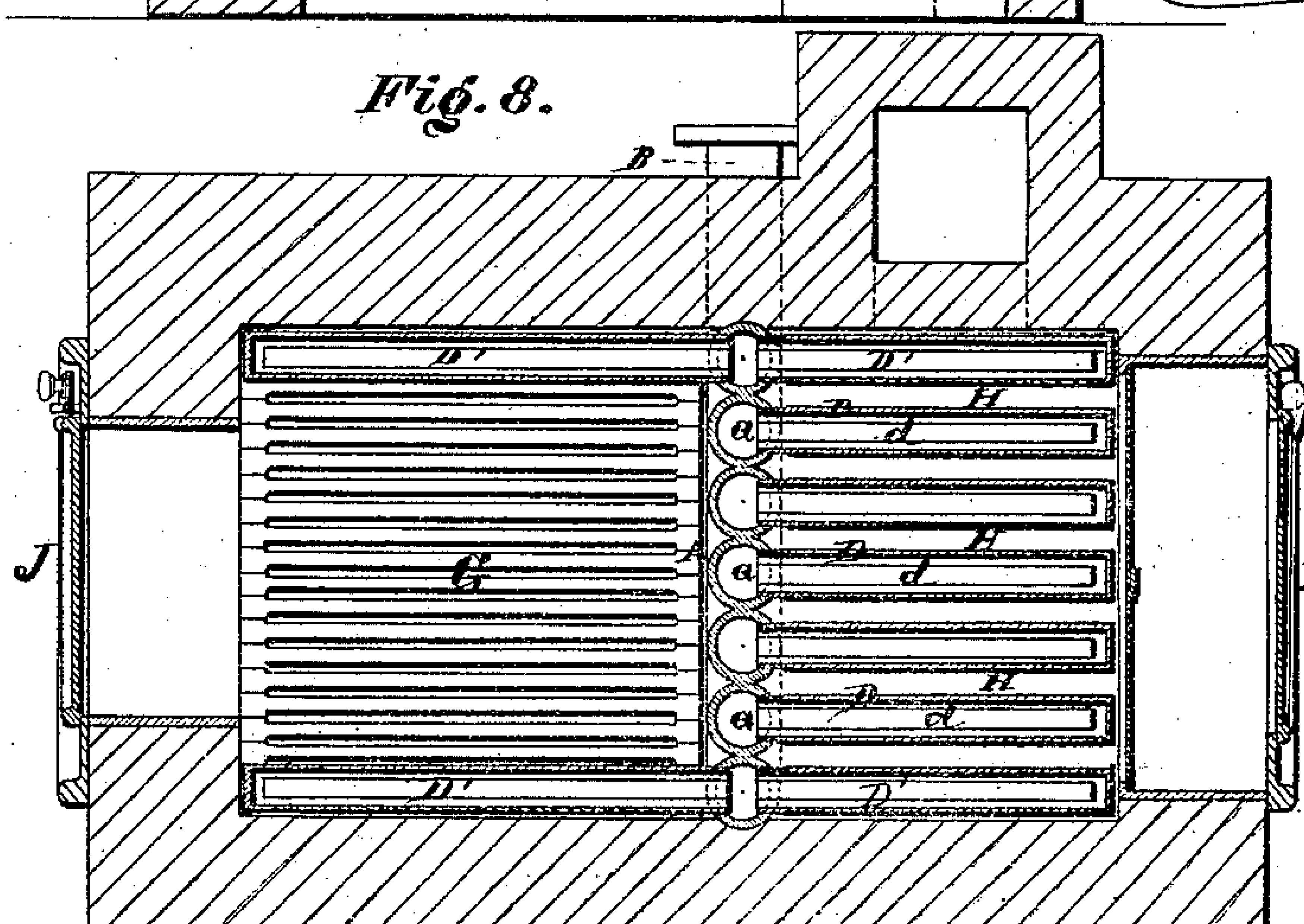
Fig. 8.



UNITED STATES PATENT OFFICE.

JOSEPH NASON AND DAVID SAUNDERS, OF NEW YORK, ASSIGNORS TO JOSEPH NASON AND H. R. WORTHINGTON, OF IRVINGTON, N. Y.

IMPROVEMENT IN STEAM-GENERATORS.

Specification forming part of Letters Patent No. **104,188**, dated June 14, 1870.

To all whom it may concern:

Be it known that we, JOSEPH NASON and DAVID SAUNDERS, of the city and county of New York, in the State of New York, have invented certain new and useful Improvements in Boilers for Generating Steam, Heating Water, or Analogous Purposes; and we do hereby declare that the following is a full and exact description thereof.

We make our boiler entirely of cast-iron, and so form and arrange the parts that the boilers are successfully and easily constructed, are strong, and give promise of great durability. We introduce circulating-pipes, which may be of sheet-iron or other thin material, so as to provide for a very active circulation of the water and an efficient utilization of all the available heating-surface.

We will first describe what we consider the best means of carrying out our invention, and will afterward designate the points which we believe to be new therein.

The accompanying drawings form a part of this specification.

Figure 1 is a longitudinal section of a boiler and steam-drum adapted to generate steam; Fig. 2, a transverse section of the same on the line *s s* in Fig. 1. Fig. 3 is a horizontal section of the same through the fire-place and smoke-chamber; Fig. 4, an enlarged sectional view of one of the tubes and a portion of the feeder to which it is attached; Fig. 5, a cross-section of the tubes; Fig. 6, a longitudinal section of our boiler adapted for simply heating water, being without the steam-drum; Fig. 7, a transverse section of the same through the smoke-chamber; Fig. 8, a horizontal section through the fire-place and smoke-chamber. It will be observed it is much like Fig. 3, but without the upright circulating-pipe.

Similar letters of reference refer to corresponding parts in all the figures.

We make a boiler for heating water, the constituent parts of which, especially those which are exposed to the action of the fire, are left free to expand and contract by changes of temperature without detriment to each other, and so disposed that each constituent part may be easily joined to or detached from the rest. We also effect a very desirable arrangement of these parts and their disposition around and beyond the fire, and we combine the parts thus arranged and disposed with a steam drum or reservoir in order to adapt them to the generation of steam; but we do not claim these features except in the combinations set forth below.

We will first describe that part of our invention which relates to boilers for generating steam, and which is shown in Figs. 1, 2, and 3.

A is a flat rectangular-chambered vessel, which serves as a general receptacle or feeder. It has an inlet-pipe, B, at the bottom and an outlet-pipe, C, at the top, to which may be joined the appropriate connecting-pipes from any hot-water-circulating apparatus. It is perforated on both sides, as hereinafter described, to receive the tubes D′, and has two openings, E E, through which the gaseous products of combustion pass from the fire-place into the smoke-chamber. In order to insure the requisite strength to resist interior pressure, the feeder is so chambered and shaped exteriorly as to consist, in fact, of a series of parallel vertical tubes, *a a*, having lateral communication with each other and with the inlet and outlet pipes B and C.

D D, &c., are tubes projecting from the feeder A, into which they are inserted by taper screw-joints, their outer ends being closed and their inner ends opening into the tubular spaces *a a*. In each of the tubes D D is an interior tube, *d*, open at both ends, and projecting a little way beyond the tube D into the feeder A. The tubes D and *d* are more clearly shown in the enlarged section, Fig. 4. Being thus rendered self-circulating, they may be inserted in any of the tubular spaces in the feeder A; but the ends which we have in view are best accomplished by disposing them in the manner shown.

There is a large cylindrical vessel or drum, L, which serves as a separator, a reservoir for water and steam. In order to insure a proper circulation of water between the drum L and the feeder A, two separate channels of communication—one for the upward and another for the downward current—are obviously necessary, and these are provided in the manner shown in the figures. The outlet-

pipe C is, in effect, extended downward by the enlargement of a portion or an increase in the thickness nearly to the bottom of the feeder. Within the pipe C is an interior pipe, C′, open at the bottom and extending upward into the drum L, where it branches into the horizontal pipe C^2, the open ends of which are near the ends of the drum. The drum is furnished with a safety-valve, water-gage, and the usual accessories of a steam-boiler, and the water-surface may be at any desired height above the pipe C^2, according as the supply of water is varied.

Upon the front side of the feeder is the furnace or fire-place G, the sides and roof of which are inclosed by tubes D′ D^2, placed near enough together to intercept most of the radiant heat of the fire and protect the surrounding brick-work. Similar tubes may also be introduced under the fire, so as to form a water-tube grate; but in general we prefer to use grate-bars of the ordinary kind, as shown. Into the back and opposite side of the feeder are introduced other tubes, D D, which occupy the greater part of the space H (which for convenience' sake we call the "smoke-chamber") behind the feeder. These tubes in the rear constitute the major part of the boiler-surface and very effectively abstract the heat from the gaseous products of the fire, which pass between and among the tubes on their downward passage toward the chimney-flue. The door I at the rear end of the boiler gives easy access to the tubes for the purpose of inspection or for the removal of soot. The fire-door J and ash-pit door K are not in any way peculiar.

The other details of construction do not require further description; but as regards the inclosure of the boiler we remark that, although we have shown the manner of setting in brick-work, (which is generally preferable,) we intend in certain cases to substitute a covering of metal plates.

The operation is as follows: The tubes in front of the feeder A are exposed to the radiant heat of the fire, and those behind it to the hot gaseous products passing from front to rear through the openings E E. The water to be heated flows into the feeder through the pipe B and upward and outward through the pipe C, its upward movement through the feeder being interrupted and retarded by its lateral deflection and circulation through the tubes *d d* into the tubes D D, the water in which, in consequence of its higher temperature and lesser gravity, flows into the feeder, its place being supplied by the cooler water, which flows back from the feeder through the interior tubes, *d d*. In this manner, flowing first through the lower tubes and then through the next above, and so on successively to the top, it receives new increments of heat at every deflection until it flows outward through the pipe C.

It will be seen in Figs. 1 and 2 that the drum L is protected from the action of the fire by a considerable thickness of brick-work. This precaution removes any liability to accident in case the water in the drum should fall too low, as the only parts which would be thus exposed to overheating and fracture are the tubes C′ C^2 and the tubular water-chambers of the feeder, none of which are large enough to cause an injurious explosion. As thus applied to the generation of steam, the movement of the water through the feeder and tubes is accelerated at or above the point of ebullition by bubbles of steam, which lessen the gravity of the upward current. In this state of dilatation the water flows upward from the feeder through the pipe C into the drum, where the steam-bubbles disengage themselves and rise to the upper part of the drum, while the water, subsiding toward the ends of the drum, flows back through the pipes C^2 and C′ to the lower part of the feeder, and so on continuously, the direction of the currents being indicated by arrows.

The form which we prefer when our apparatus is only used for heating water is shown in Figs. 6, 7, and 8; but the form shown in the preceding figures, with the entire provision for separating the steam, can be used for heating water, if preferred; but the drum and its connections will be of little, if any, service.

Our method of fastening the tubes to a common receptacle by taper screw-joints at one end (their opposite ends being free) is remarkably simple and expeditious, allowing each tube to be screwed into place independently, to be afterward tightened if necessary, or removed if found defective.

Our boiler is not liable to injury from the unequal expansion of any of its parts. With a feeder of given dimensions the size and capacity of the boiler may be largely varied without increasing the number of parts or joints by simply varying the length of the tubes. So, also, by a change of proportions it may be readily adapted to the conditions or peculiarities of the service to which it is to be applied—as, for example, the fire-place may be made longer or shorter without altering the length of the tubes in the smoke-chamber; so, also, the tubes in the smoke-chamber may be indefinitely extended (to obtain a more or less perfect abstraction of heat from the gaseous products) without regard to the dimensions of the fire-place. When employed as a steam-boiler, the main receptacle for water and steam is not exposed to the action of the fire, and is consequently not liable to injury in case the water should fall too low. Nothing more hurtful could happen than the rupture of one of the tubes, or one of the small tubular chambers in the feeder. None of these features are believed to be novel or peculiar to our boiler when considered separately, but only in our combinations defined below.

The boiler is peculiarly adapted to be made wholly of cast-iron, which, on account of its ability to resist corrosion in cellars, greenhouses, and other damp places where boilers this class of are usually placed, is a more suitable material than wrought-iron.

Having thus described our invention, we do not claim as new the use of water-tubes in combination with a common receptacle or feeder for the purposes herein set forth, when such receptacle consists of a single vessel without subdivided water spaces or channels. Nor do we claim the use of one tube within another for the purpose of causing a circulation of water in the tubes; but

We claim—

1. The water-wall or feeder A, having interior passages adapted to convey water to and from the tubes D D, with strong connections between such passages, giving strength to endure pressure, in combination with tubes free to expand and contract, connected substantially in the manner and for the purposes herein set forth.

2. The tubes D D′ D², arranged on opposite sides of the feeder A—that is to say, those tubes which are designed to inclose the fireplace and receive the radiant heat of the fire fixed into the front side, and those tubes which are to be acted upon by the gaseous products of the fire into the back side of the feeder, as specified.

3. In combination with a cast-iron boiler substantially of the character herein specified, the internal circulating-pipes, *d d*, arranged in the horizontal pipes D D, and adapted to serve relatively to the other parts and connections, as herein set forth.

4. The combination of the feeder and tubes with the drum or receptacle L, adapted for joint operation, as specified.

5. The entire apparatus as shown, consisting of the cast-iron boiler, herein described, composed of pipes of small diameter, united to a common chamber, A, with liberty to expand and change their directions within wide limits, the separating-vessel L, and the thin internal tubes, or their equivalents, *d*, C′, and C², for facilitating the circulation in every part, all combined and arranged as specified.

In testimony whereof we have hereunto set our names in presence of two subscribing witnesses.

JOSEPH NASON.
D. SAUNDERS.

Witnesses:
C. W. NASON,
C. C. LIVINGS.