(No Model.) 3 Sheets—Sheet 1.

J. SMITHLEY.

STEAM BOILER FURNACE.

No. 534,016. Patented Feb. 12, 1895.

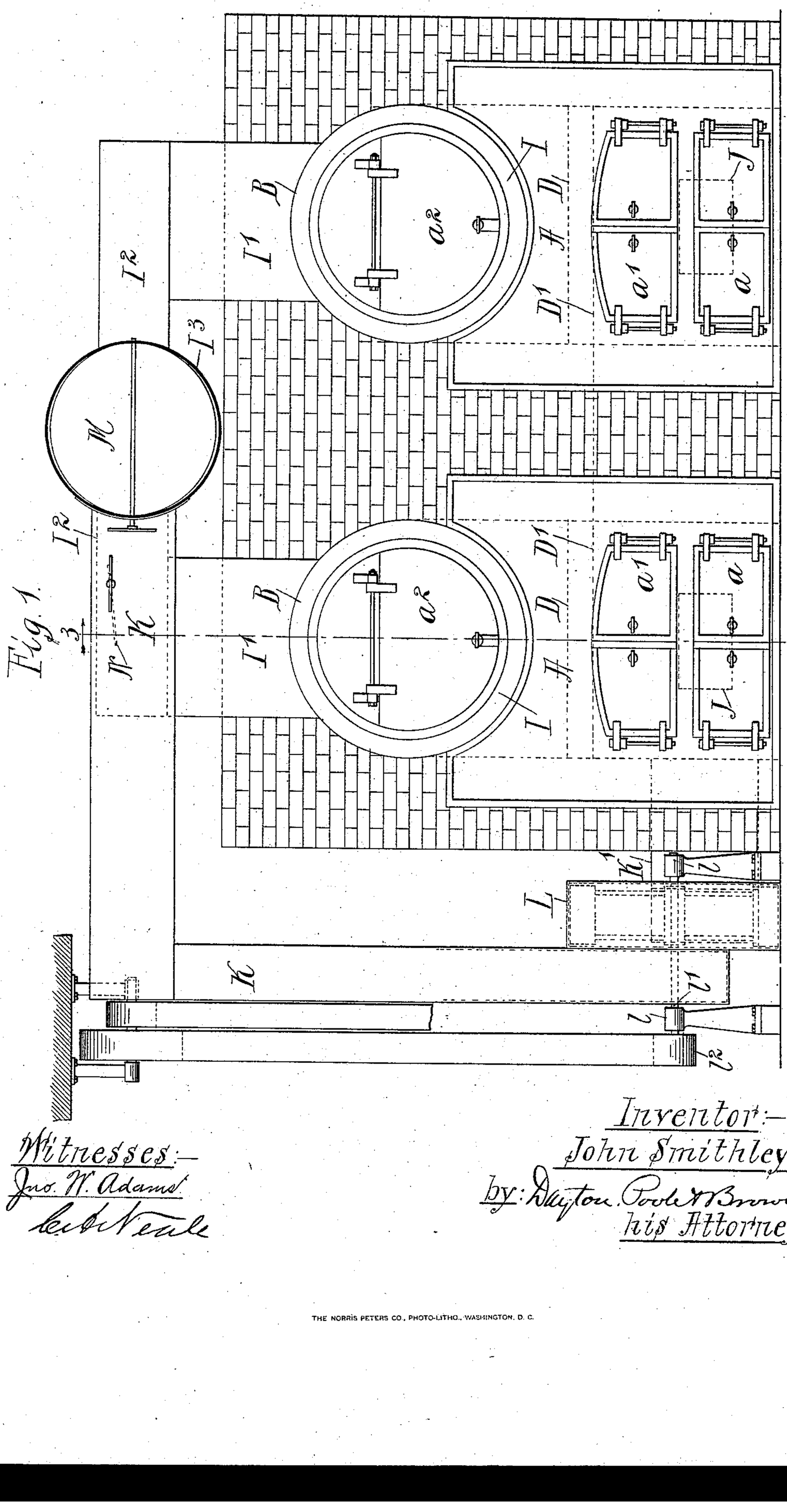

Fig. 1.

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Inventor:—
John Smithley.
by: Dayton, Poole & Brown
his Attorneys.

(No Model.) 3 Sheets—Sheet 2.

J. SMITHLEY.

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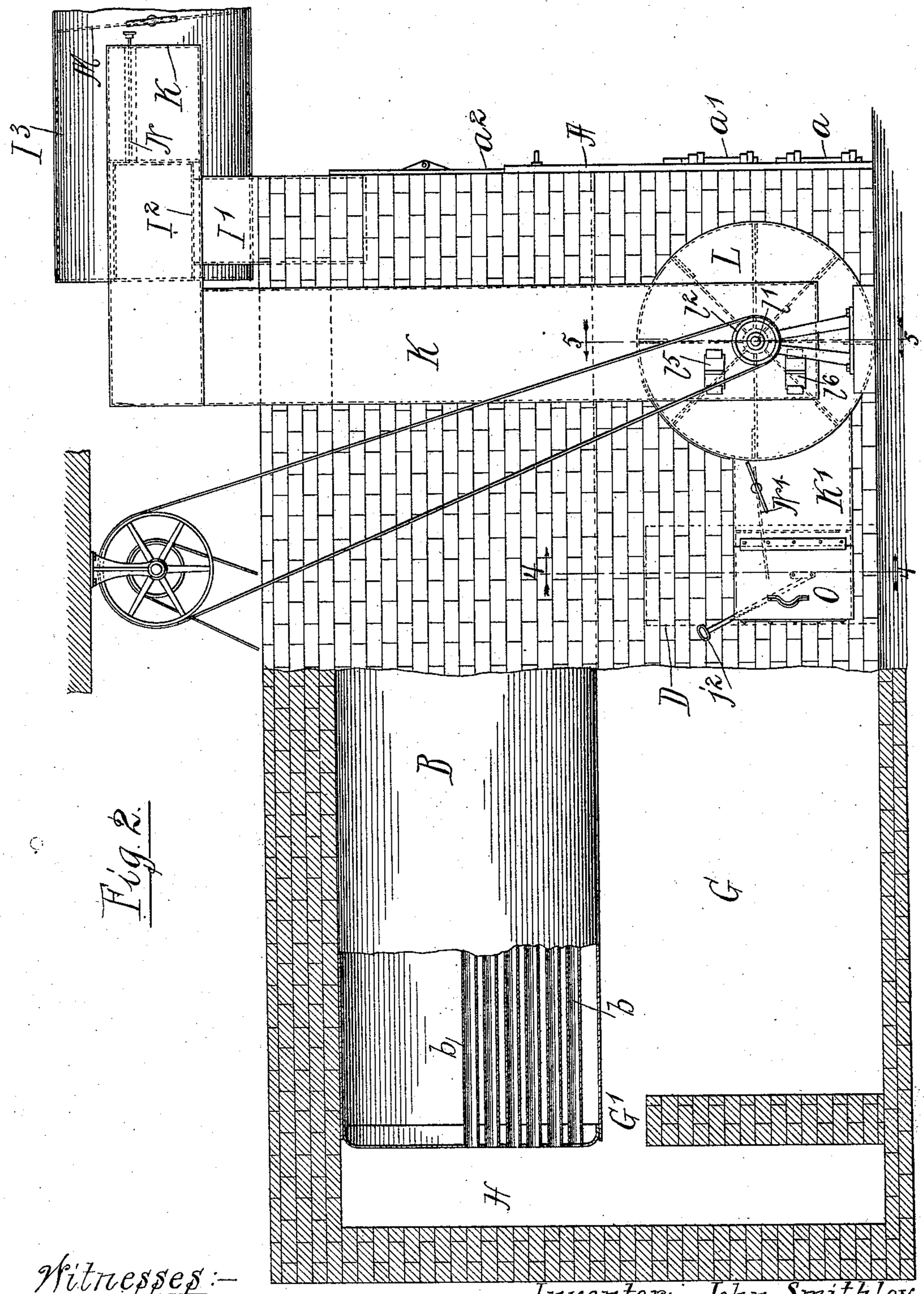

Fig. 2.

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(No Model.) 3 Sheets—Sheet 3.

J. SMITHLEY.

STEAM BOILER FURNACE.

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Fig. 3.

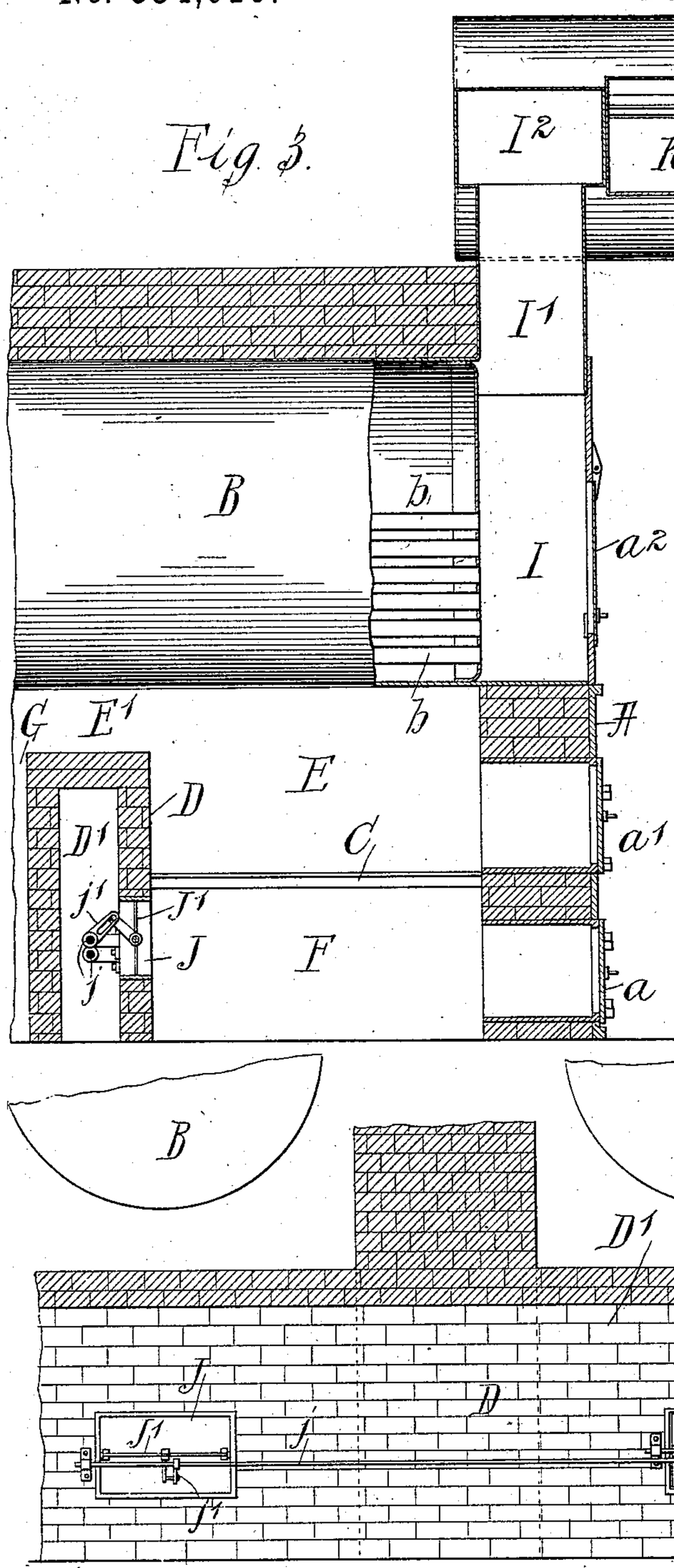

Fig. 5.

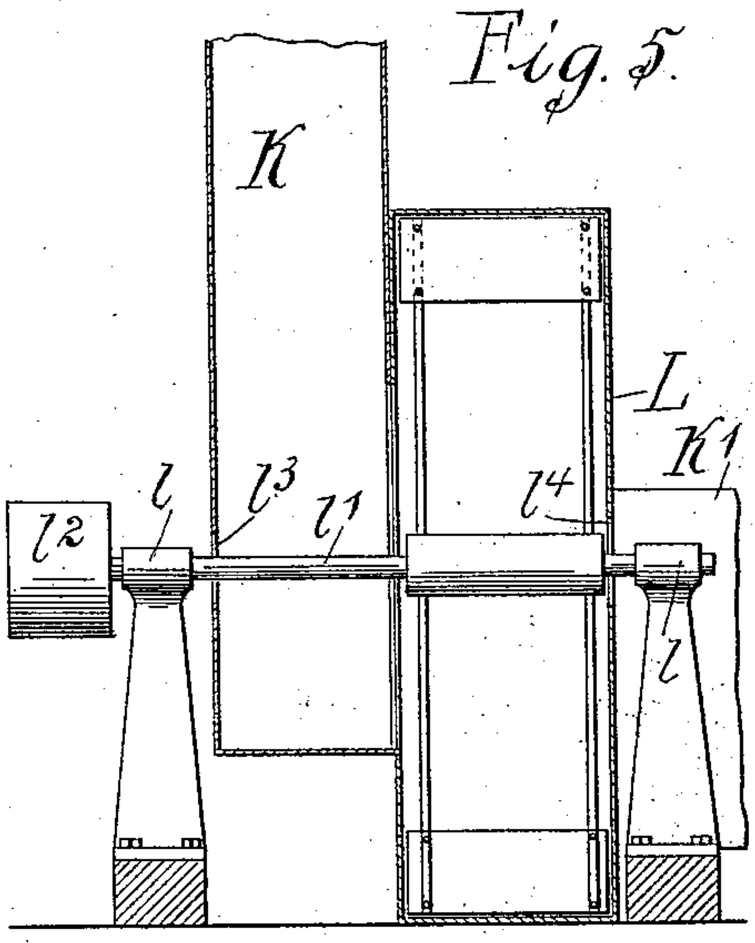

Fig. 4.

Witnesses:—
Jno. W. Adams.
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UNITED STATES PATENT OFFICE.

JOHN SMITHLEY, OF CHICAGO, ILLINOIS, ASSIGNOR OF TWO-THIRDS TO GEORGE LOMAX AND FREDERICK VOSTEEN, OF SAME PLACE.

STEAM-BOILER FURNACE.

SPECIFICATION forming part of Letters Patent No. 534,016, dated February 12, 1895.

Application filed March 29, 1894. Serial No. 505,655. (No model.)

To all whom it may concern:

Be it known that I, JOHN SMITHLEY, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Steam-Boiler Furnaces; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to furnaces of the kind commonly used for heating steam boilers, and more particularly to the air feed of such furnaces.

A primary object of the invention is to secure a more perfect combustion of the fuel gases with a view to the avoidance of smoke, and also with a view to the more perfect utilization of the fuel and consequent economy in running the furnace.

Another and important object of the invention is to effect the heating of the fresh air before its delivery to the fire, while other objects relate to the more perfect manipulation of the passages for air and for the gases returned from the exit flue or chimney to the fire.

The various features of the invention will be understood from the following description of the accompanying drawings, in which—

Figure 1 is a front elevation of a furnace equipped with my improvements. Fig. 2 is a side view thereof, showing parts in section. Fig. 3 is a vertical longitudinal section taken on line 3—3 of Fig. 1. Fig. 4 is a transverse vertical section of the lower part of the furnace, taken on line 4—4 of Fig. 2; and Fig. 5 is an enlarged sectional detail of the blower and of the supply duct thereof.

A A designate the usual cast furnace fronts of a battery of steam boilers, the battery consisting, in this instance, of two boilers, said fronts having the usual doors *a a* opening to the ash-pit and *a' a'* opening into the fire space above the grate. The doors *a* and allowably the doors *a'* are carefully fitted to close tightly, and any dampers in the doors *a* are also adapted to close tightly.

B B represent two boilers, shown as of the common "locomotive" type, arranged side by side and incased and supported in a brick setting of the usual or suitable construction.

C is a horizontal grate arranged transversely beneath the front end of each of the boilers, said grate being composed of any desired form of bars which are separated from each other so as to afford ample air passages between them from the ash-pit F beneath the grate to the fire-box proper E above said grate.

D is a transverse box or hollow wall extending from side to side of the furnace or of the battery of furnaces and serving the purpose of an air or air and gas heater, and allowably also serving the usual purposes of a bridge wall, as in the construction shown. In the case of a battery the furnaces for the several boilers are separated by vertical division walls in the ordinary way. The grate C of each furnace extends from the front of the setting to the bridge wall and serves to completely divide the fire-box E from the ash-pit F. Back of the bridge wall is the usual combustion chamber G from which a contracted opening *g'* leads to the space H at the rear end of the boiler, which space communicates with the boiler flues *b b*. The opposite or front ends of said boiler flues communicate with the space I at the front end of the boiler (accessible through the door a^2), which space I communicates, by means of short vertical trunks I' I' and a cross header pipe I^2 or otherwise, with a main flue I^3 leading to the stack.

The interior chamber D' of the box D, which chamber may be continuous throughout the length of the box, whatever the number of boilers in the battery, communicates with the ash-pit or space F below each of the grates C through an opening J and, in the case of a battery of boilers, each of said openings J is controlled by a valve or damper J' which, in this instance, is pivoted and is operated by a rod *j* that is mounted in suitable bearings and is provided with a slotted crank arm *j'* that engages with a similar crank arm upon the damper. Said rod *j* of each damper extends out at the side of the furnace and is there provided with a notched handle or lever j^2 which engages with the casing or other stationary part where it emerges, as clearly indicated in Figs. 3 and 4. By this means

communication between the heating chamber D′ and either of the ash-pits F of a battery furnace may be separately opened or closed at will. It will thus be seen that the furnaces of the battery, separated from each other by the usual division wall or walls, may be separately disused so that repairs on either furnace of the battery may be effected while the others are in operation.

K is a pipe that is connected with the chimney flue (as with the flue I^3) and leads thence to an inlet of a fan blower L, which blower is also arranged to take air from without the furnace. To this end air inlet openings l^3 l^4 are provided, preferably, as herein shown, at the center of the blower and around the axle of the latter in order that the entering cool air may prevent the journals of the blower from being overheated by the hot gases upon which said blower is also operating. Slides l^5 l^6 serve to regulate the amount of fresh air admitted to these passages. From the blower L a discharge pipe K′ leads through the side wall of the furnace and opens into the retort or heating chamber D′.

By means of the pipe K and the pipe K′ connected with a fan blower substantially as shown and above described, gases which would otherwise pass off through the stack may be returned to the ash-pit and forced upward thence between the grate bars into the burning fuel, so that any unconsumed gases or material thus returned to the fire will be burned and utilized. By means also of the blower fresh air is introduced to the ash-pit along with such gases and supplying added quantities of oxygen needful to the proper combustion of the combustible elements returned from the chimney flue as well as of those present in the fuel upon the grate.

M N are dampers arranged respectively in the main pipe I^3 and the blower pipe K which serve to regulate the relative quantities of the products of combustion and gases which proceed from the fire that shall be allowed to escape to the chimney or drawn off by the blower and caused to again pass through the furnace, such regulation being controlled by the attendant in accordance with the condition of the fire. These dampers M N are arranged and operated in any familiar manner, but are desirably adapted to fit and tightly close the pipes to which they are respectively applied. As an additional means of regulating the blast from the blower L a damper N′ is shown as being placed within the pipe K′.

In the operation of the blower at full force, the ash-pit doors *a a* and their dampers, if any are present therein, will remain securely and tightly closed. The doors *a′* may be opened for the admission of fuel or for other purposes without inconvenience and without interruption of the full action of the blower since, owing to the draft caused by the chimney and the blower through the pipe K, there will be no tendency of the fire to blow out through these doors.

For convenience of access to the interior of the retort or heating chamber D′, a sliding door O is provided in the pipe K′ where it enters the wall of the furnace.

The apparatus constructed and arranged substantially as described is operated as follows: Fuel having been supplied to the grate, the fire is ignited with the damper M open and the damper N closed. The door or doors *a* are then closed and the blower started, the dampers J′ of course being opened to admit air from the blower and retort to the ash-pit. As soon as the fire has been well started the damper M is partly closed and the damper N opened so as to permit the blower to draw off unconsumed gases and carbon which would otherwise escape to the chimney and be lost and to send them back to the closed ash-pit F. These partly consumed hot gases and carbon, as they pass from the blower into the retort or heating chamber D′, are thoroughly commingled with fresh air and thus reinforced with oxygen, and after the fire has burned for a time, the retort D becomes highly heated, so that said air and gases are raised to a high temperature preparatory to their passage to the ash-pit and thence to the fire.

When a part only of a battery of boilers is in use those dampers leading from the retort D to the disused furnaces will be closed, thus confining the blast from the blower to the furnaces in use.

From the foregoing it will be observed that the cold air sent to the fire by the blower is first forced, with the returned gases from the chimney flue, to the heating chamber or retort D and that, as a consequence, such fresh air is therein effectively intermingled with the returned gases while both the fresh air and the gases are heated to a high temperature before being delivered into the ash-pit. It will also be observed that the ash-pit, into which the air and gases pass from the retort preliminary to entering the fire, constitutes a pressure-equalizing chamber from all parts of which the mingled air and gases rise between the grate-bars and into the interstices of the burning fuel with equal or substantially equal pressure, thus insuring a uniform supply of uniformly mixed air and gases to all parts of the burning fuel.

While I have herein shown my invention as applied to the furnace of a stationary boiler of a particular type, it is obvious that it may be applied with equally beneficial results to other forms of boilers and furnaces, both stationary and portable. I therefore do not wish to be limited in the scope of my invention to the particular details of construction or arrangement herein shown or to the use of any particular number of boilers.

I claim as my invention—

1. The combination, in a furnance, of an opened intersticed grate separating a closed ash-pit from a superjacent fire-box a combustion chamber immediately in rear of said fire-box, a hollow bridge wall or heating chamber

interposed between said fire-box and combustion chamber and exposed to the direct action of the flame at both front and rear sides thereof, a discharge opening therein communicating with the closed ash-pit, a return flue leading from the chimney flue to the interior of the heating chamber, and a blower connected with said return flue and also adapted to take in fresh air, whereby the fresh air and the contents of the return flue are first forced into the heating chamber, and thoroughly intermingled, thence into the closed ash-pit below the grate, and finally, at uniform pressure, to all parts of the fire.

2. The combination, in a furnace, of an open intersticed grate separating a closed ash-pit from a superjacent fire-box, a combustion chamber immediately in rear of said fire-box, a hollow bridge wall partially separating the fire-box from the combustion chamber and exposed to the direct action of the flame at both front and rear sides thereof; said hollow bridge wall constituting a heating chamber provided with a discharge opening communicating with the closed ash-pit, a return flue leading from the chimney flue to said heating chamber, a blower connected with said return flue and also adapted to take in fresh air, whereby the air is commingled with the contents of the return flue within the heating chamber, and means for controlling the flow through the return flue.

3. The combination in a furnace, of an open intersticed grate separating a closed ash-pit from the superjacent fire-box, a combustion chamber immediately in rear of said fire-box, a hollow bridge wall partially separating the fire-box from the combustion chamber and exposed to the direct action of the flame at both front and rear sides thereof; said hollow bridge wall constituting a heating chamber, having an exit opening leading to the closed ash-pit, a damper arranged to control said exit opening, a return flue leading from the chimney flue to said heating chamber, a blower connected with the return flue and also adapted to take fresh air, and means for controlling the passages leading to the blower.

4. The combination, with a battery of steam boilers, a plurality of laterally separated furnaces provided with separate grates which severally separate a closed ash-pit from a superjacent fire-box, a continuous hollow bridge wall or heating chamber arranged at the rear of the grates and provided with an opening into each of the ash-pits, a series of separately operable dampers controlling the passages from said heating chamber to said ash-pits, a return flue leading from the chimney flue to said heating chamber, a blower connected with the return flue and also arranged to take fresh air, means for controlling the flow through the return flue to the blower, and means for controlling the admission of fresh air to the blower.

In testimony that I claim the foregoing as my invention I affix my signature in presence of two witnesses.

JOHN SMITHLEY.

Witnesses:
M. E. DAYTON,
C. CLARENCE POOLE.