

L. PHLEGER.
 COMBINED STEAM AND HOT AIR HEATING APPARATUS.
 No. 44,888. Patented Nov. 1, 1864.

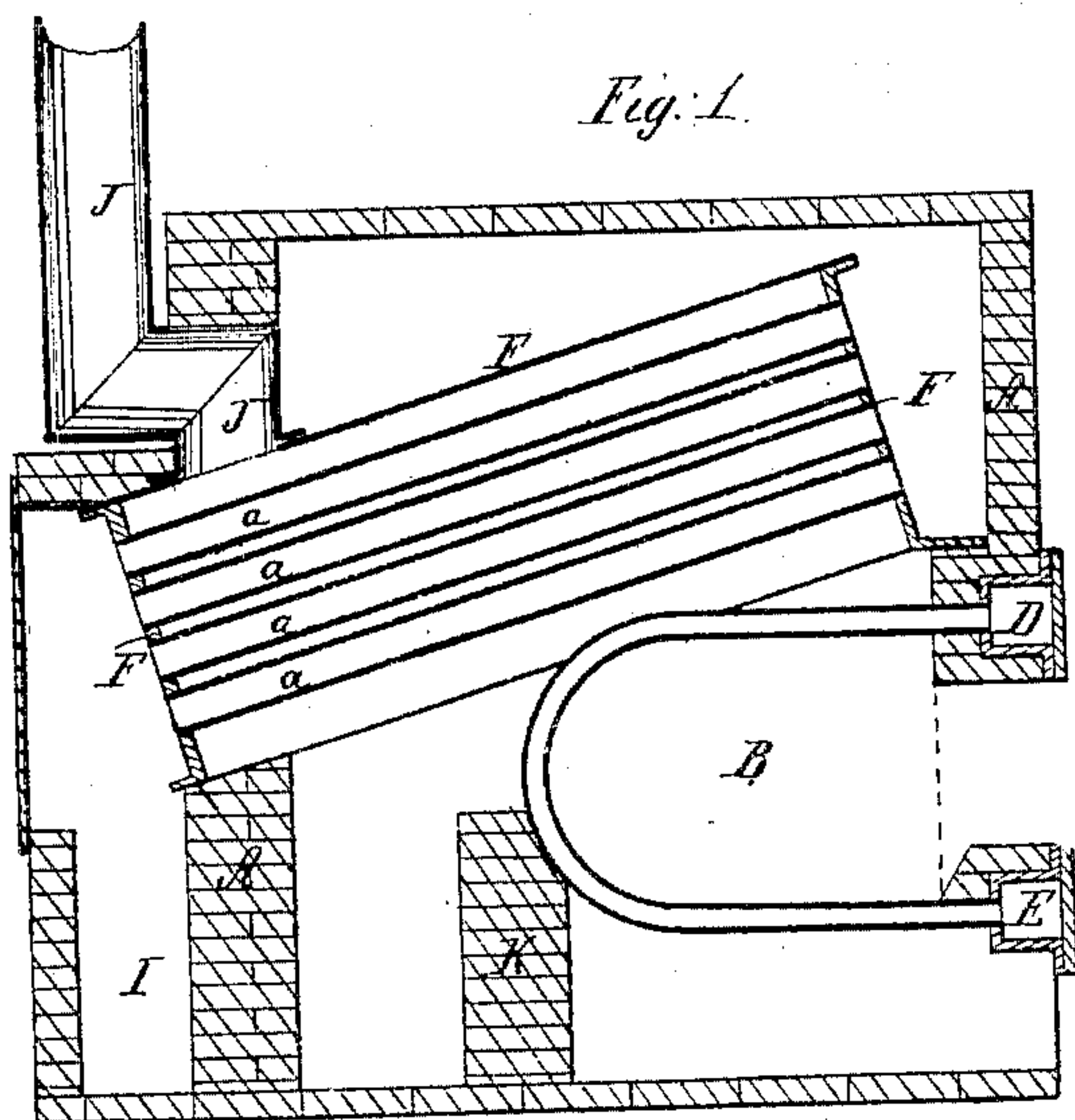


Fig. 2.

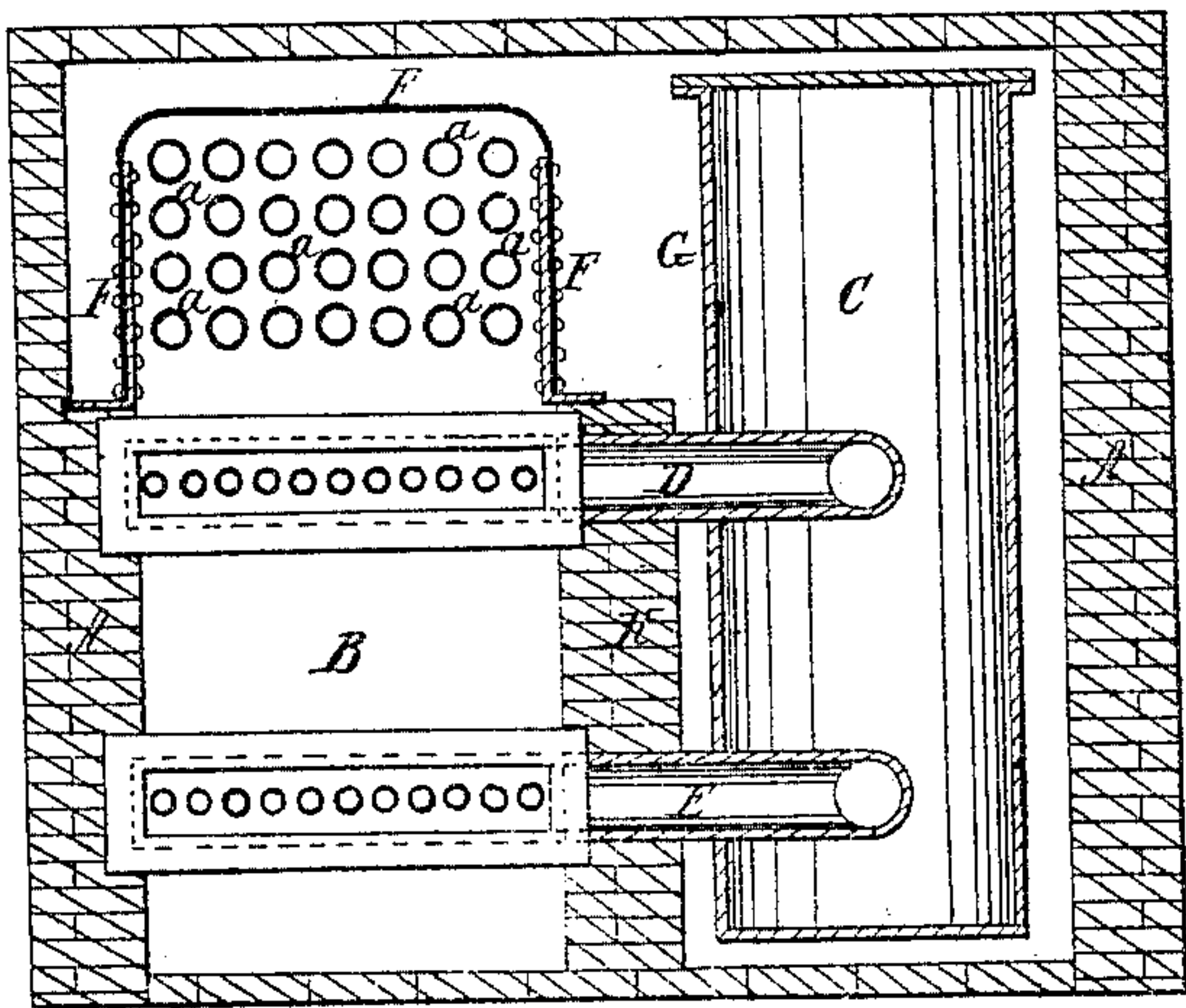
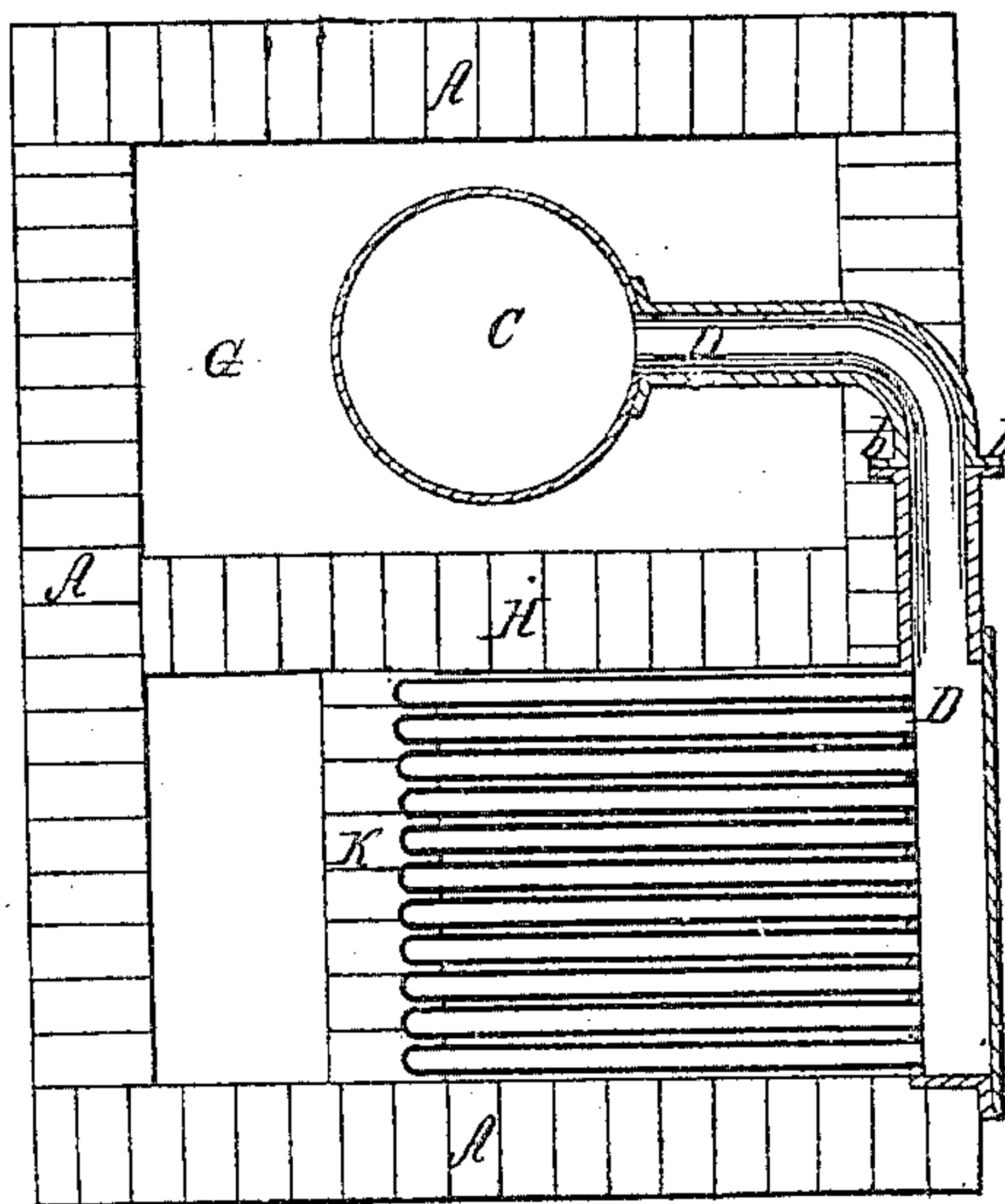


Fig. 3.



Inventor,

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UNITED STATES PATENT OFFICE.

LEONARD PHLEGER, OF PHILADELPHIA, PENNSYLVANIA.

COMBINED STEAM AND HOT-AIR HEATING APPARATUS.

Specification forming part of Letters Patent No. 44,888, dated November 1, 1864.

To all whom it may concern:

Be it known that I, LEONARD PHLEGER, of the city and county of Philadelphia, and State of Pennsylvania, have invented certain new and useful Improvements in Combined Steam and Hot-Air Heating Apparatus for Warming Buildings, &c.; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, making a part of this specification, in which—

Figure 1 represents a vertical section taken through and from front to rear of the fire-box or grates and the air-heating flues or tubes. Fig. 2 represents a vertical transverse section through or across the fire-box and air-pipes and through the water-pipes and boiler in an adjacent chamber. Fig. 3 represents a horizontal section of the boiler and its water-pipe and a top plan of the hollow U shaped grate bars.

Similar letters of reference where they occur in the separate figures denote like parts in all the drawings.

My invention relates to the combined use of steam and hot air for the purpose of warming buildings, both the steam and heated air being procured from one and the same fire, as will be explained.

The entire heating apparatus may be inclosed in a wall, A, in the usual well-known way, through which the usual pipes or passages for the smoke, gas, &c., and for the heated air may pass and lead to any desired place. The fire-box B is composed of a series of U-shaped hollow bars, through which water from the boiler C passes and circulates, and by which it becomes heated. The upper arm or bend of the bars unite with a water-way, D, that unites with the boiler at or near its center, while the lower bend or arms of said bars unite with another water-way, E, entering the boiler nearer its base. By this arrangement there is a free circulation of water through the boiler, water-ways, and hollow grate-bars. Over the fire-box B and within a jacket or shell, F, are placed in an inclined position a series of tubes or pipes, *a*, through which air passes, and in its passage becomes highly heated, and then passes into the chamber G, in which the boiler C is placed, where it unites with the air surrounding the boiler, and from whence this united air heated by direct con-

tact with the fire-heated pipes *a* and the steam or water-heated boiler C may be taken to the room or apartment to be warmed.

The boiler is separated from the fire-chamber by a wall, H, through which the pipes D E pass to make the connection between the two. The air to be heated is taken into the chamber I, and thence into the rear ends of the tubes *a*, and their inclination allows the heated air to freely pass up and into the chamber G, around the boiler, and over, and around the jacket F, covering the air-pipes *a*.

The object and advantage of the U-shaped hollow grate-bars is that not only the burning fuel, but the heated and burning gases above the fuel, will all be in contact with metal inclosing water, and these U or bow shaped bars admit of free circulation of the water through them and through the connecting-pipes D E to and through the boiler C, and this free and rapid circulation avoids all danger from overstraining the boiler, should any neglect or accident cause a too great generation of steam, but I propose to regulate the draft and heat automatically from the pressure of the steam in the boiler, and thus keep it uniform.

The heated product of combustion, after passing up through and around the hollow grate or water bars, rises and passes in contact with the external surfaces of the air-pipes *a* and against the jacket F and its crown-sheet, and thence is deflected or otherwise, and taken off through the pipe or flue J.

The grate or water bars are so united to the common passages D and E, and they in turn so united at *b*, the pipes more immediately leading into the boiler, as that the hollow grate-bars, when burned out or requiring repairs, can be detached, taken out, and replaced without disturbing the boiler.

K is a bridge-wall for supporting the rears of the hollow grate-bars.

Suitable openings, closed by doors, should be provided for cleaning out or repairing the interior of the heater, as well as for putting in fuel, taking out ashes, or for draft or for supplying air to the pipes and boiler-chamber.

Having thus fully described my invention, what I claim is—

1. A fire-box composed of U-shaped hollow water-bars, substantially as and for the purpose described.

2. The combination of the fire-box with the jacketed or inclosed inclined air-tubes or passages, substantially as and for the purpose described.

3. The combination of the fire-box with the hot-air tubes and with a steam-boiler, when so arranged as that the heated air through the tubes and that heated in the boiler-cham-

ber shall commingle in a common chamber, and thus pass off to the room or apartment to be heated, substantially as described.

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