

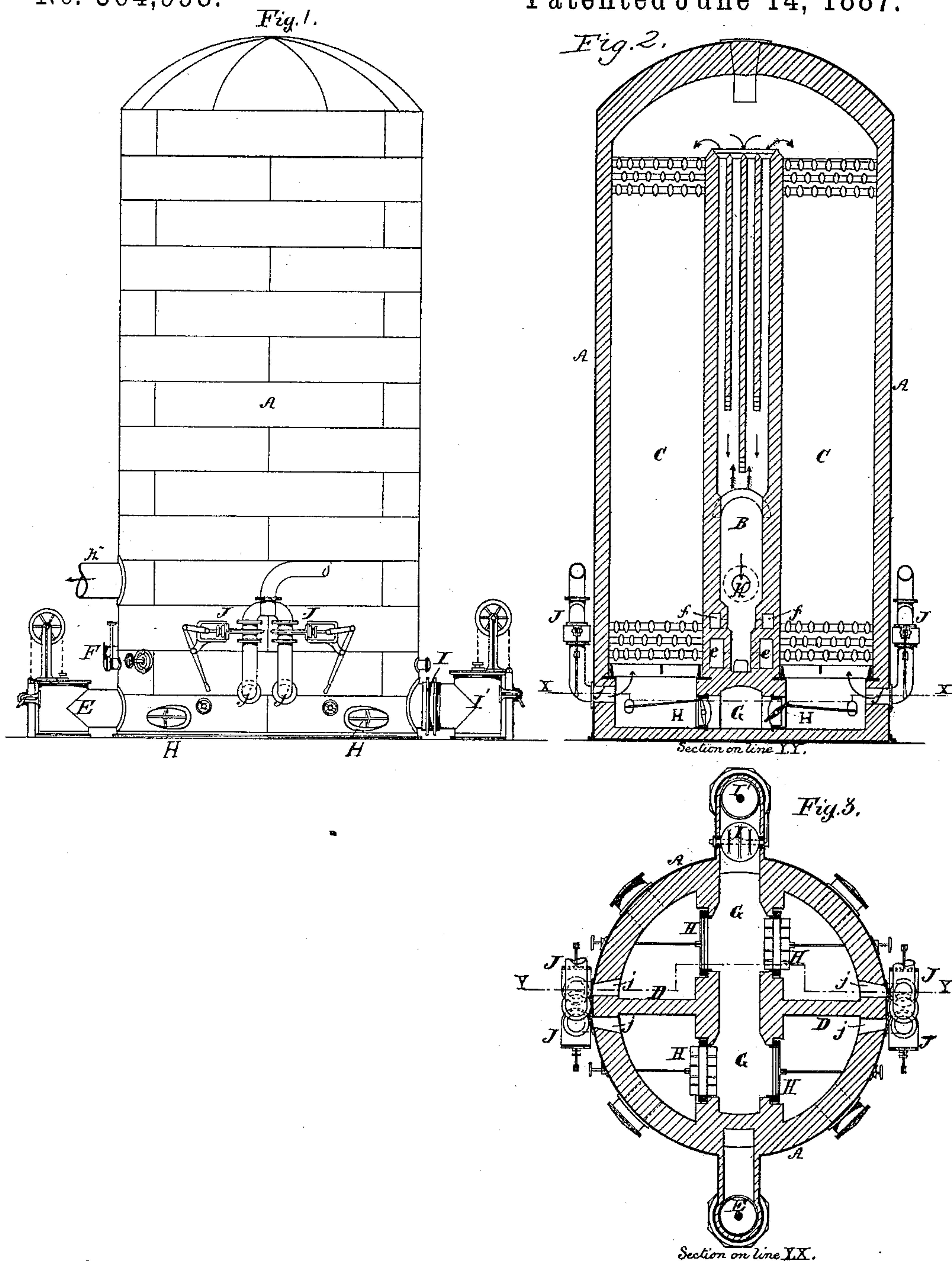
(No Model.)

3 Sheets—Sheet 1.

B. FORD & J. MONCUR.
REGENERATIVE HOT BLAST STOVE.

No. 364,998.

Patented June 14, 1887.



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(No Model.)

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Fig. 6.

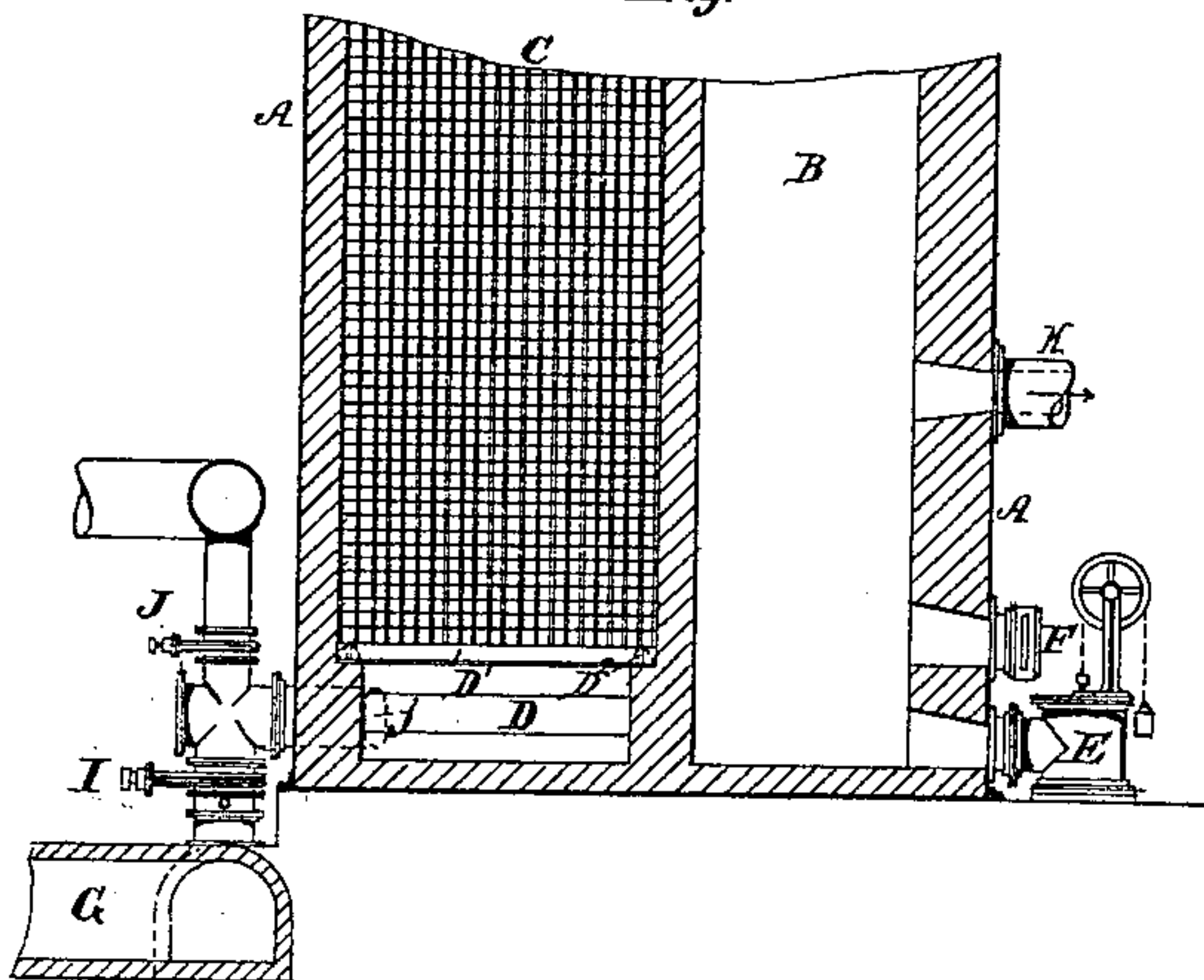


Fig. 7.

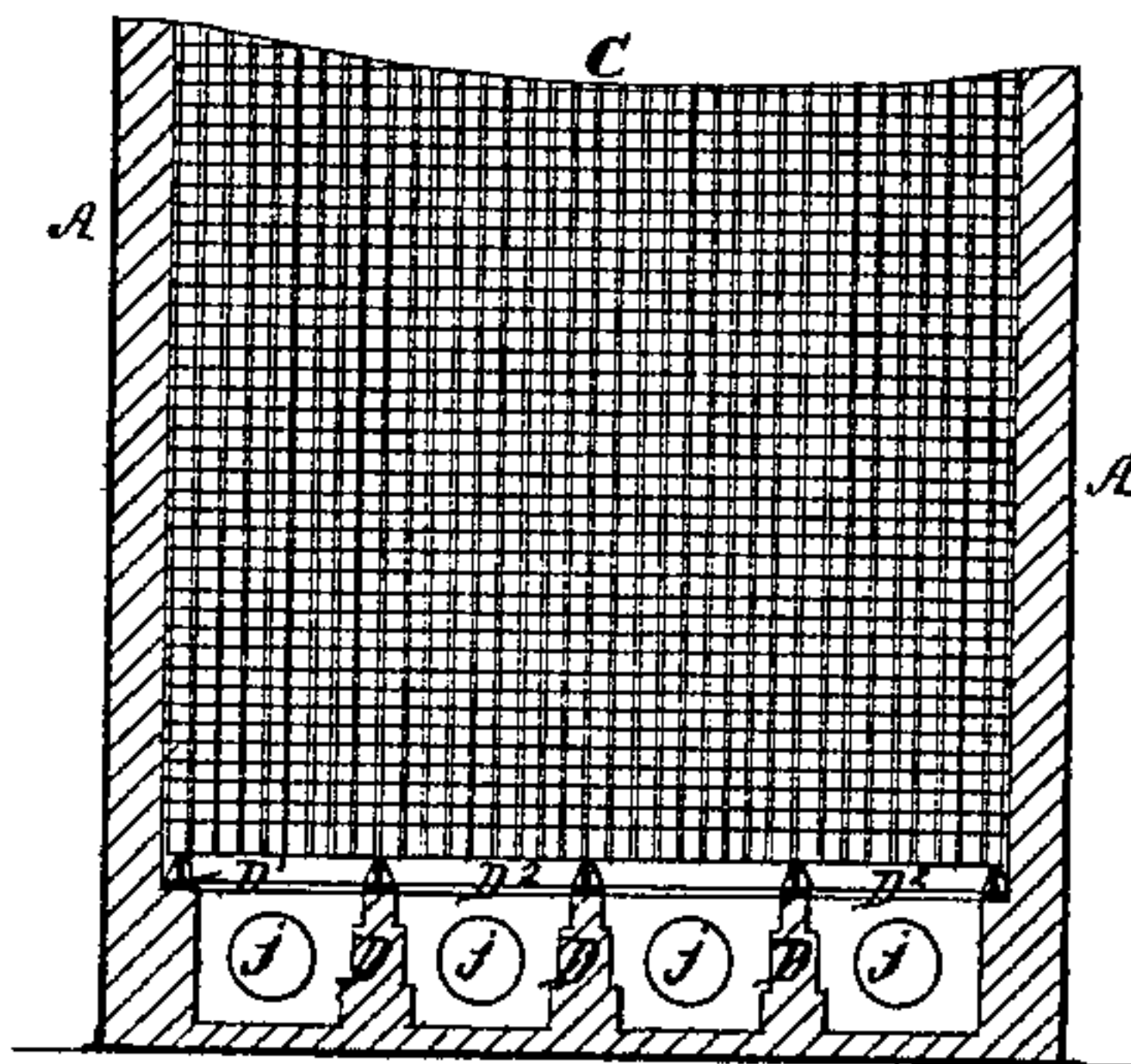


Fig. 4.

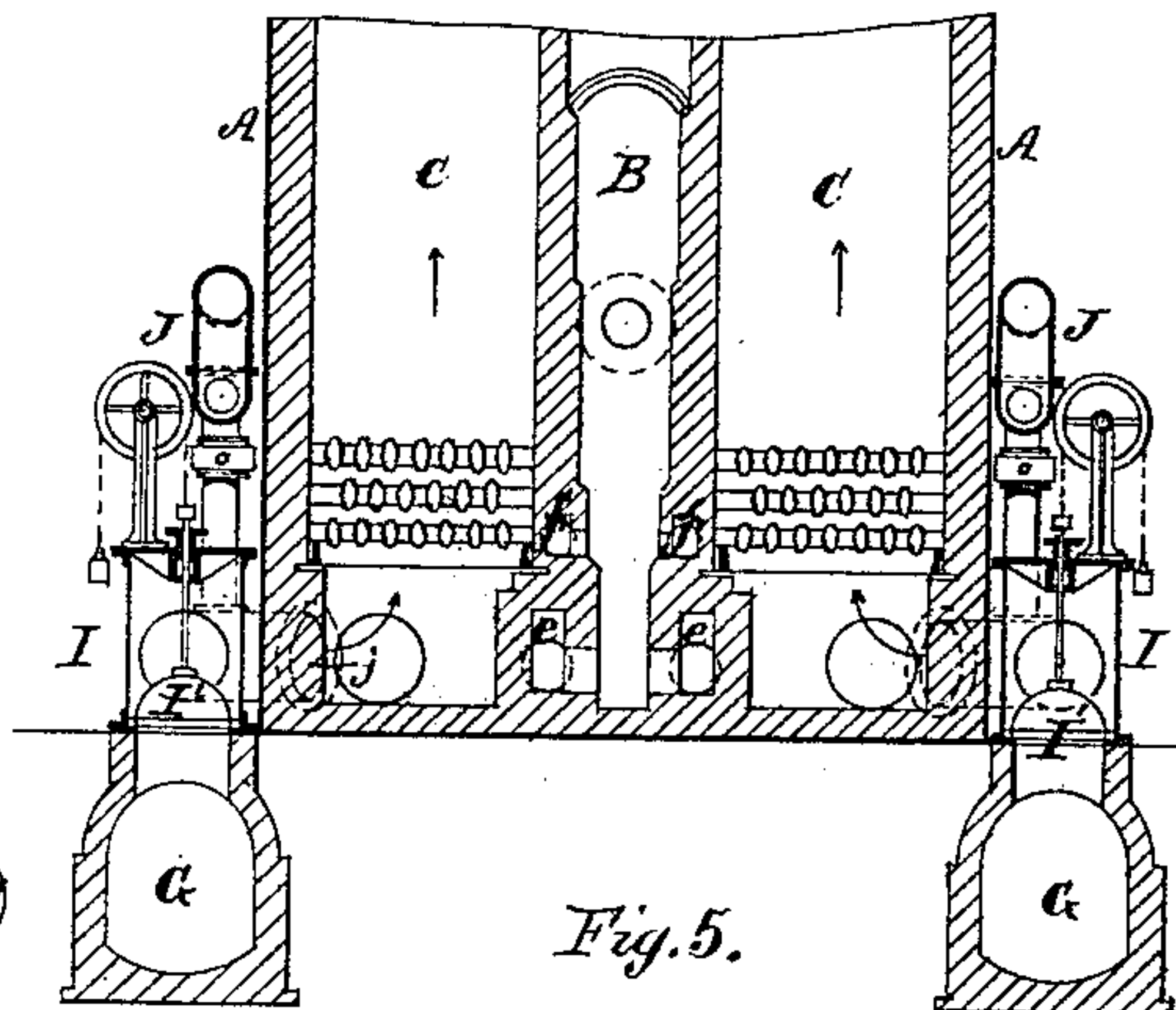


Fig. 8.

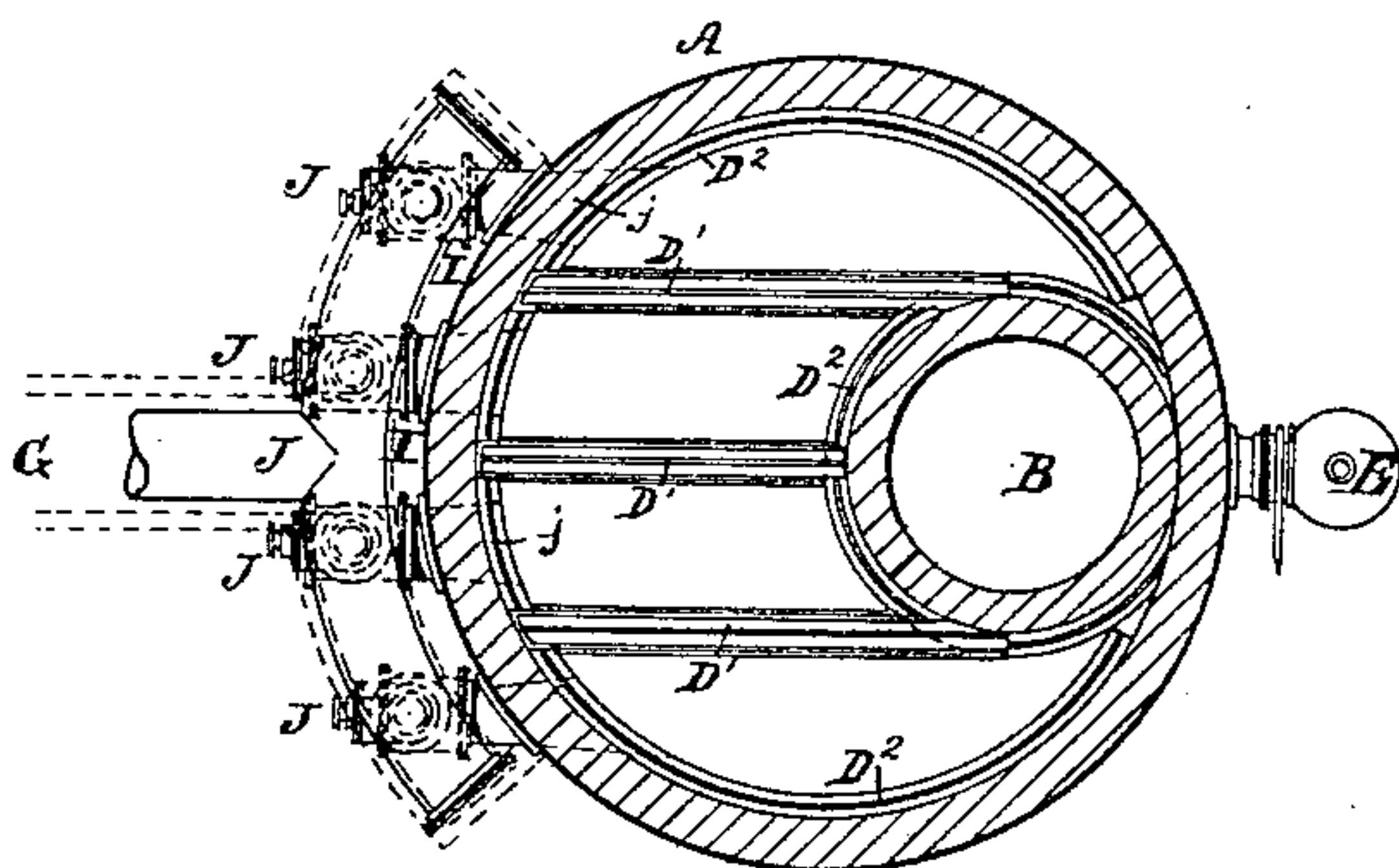
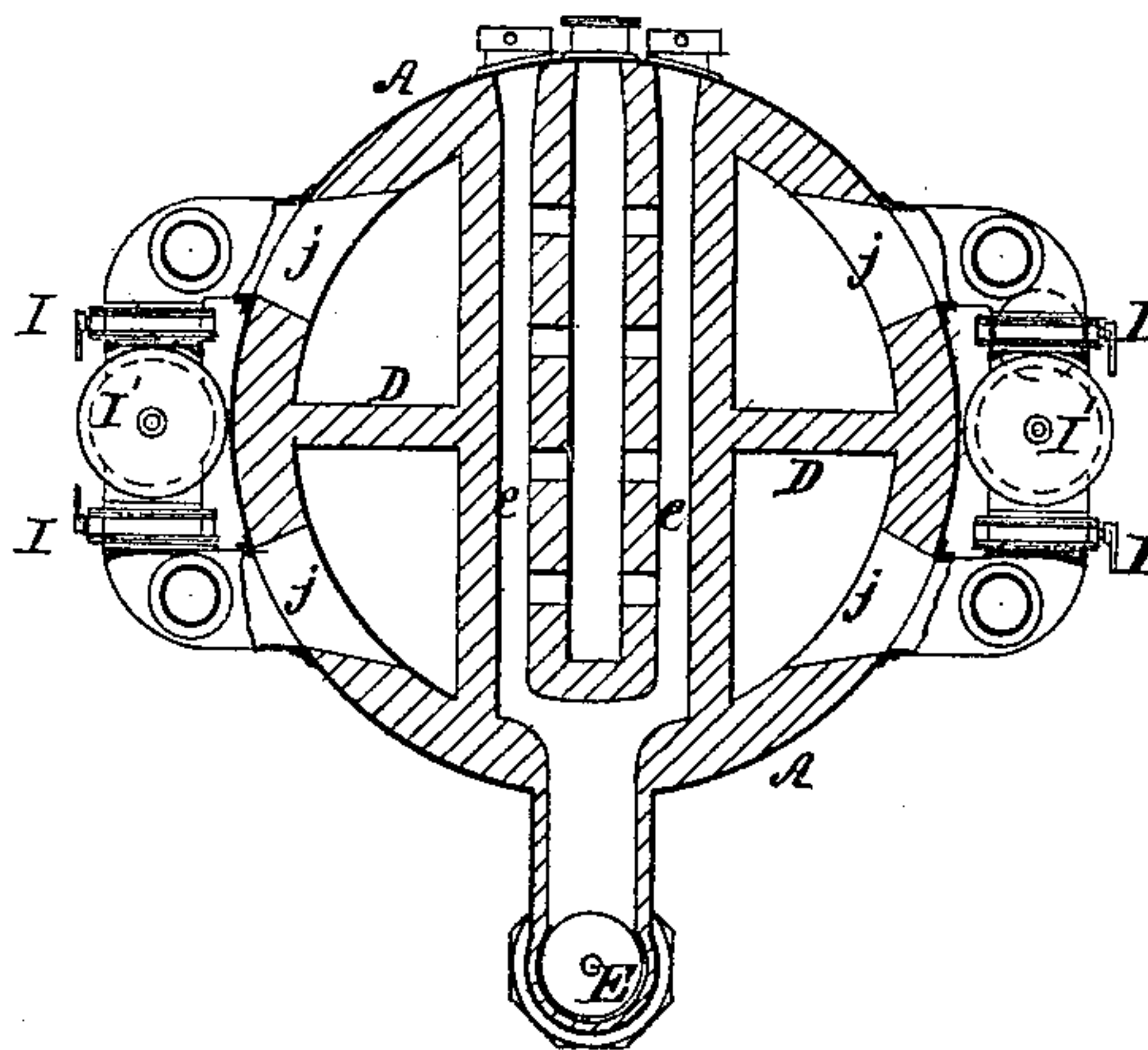


Fig. 5.



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Fig. 9.

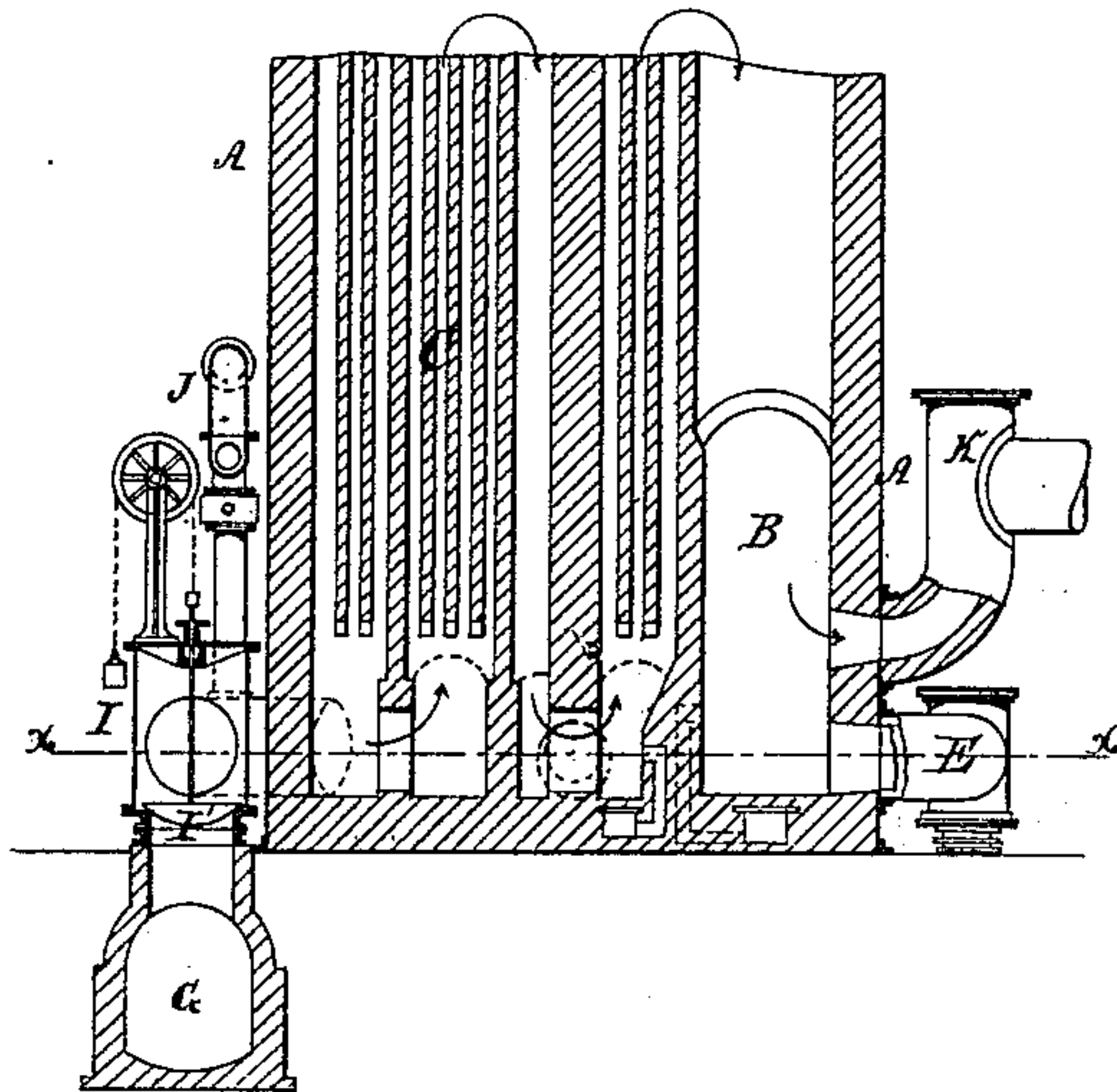


Fig. 10.

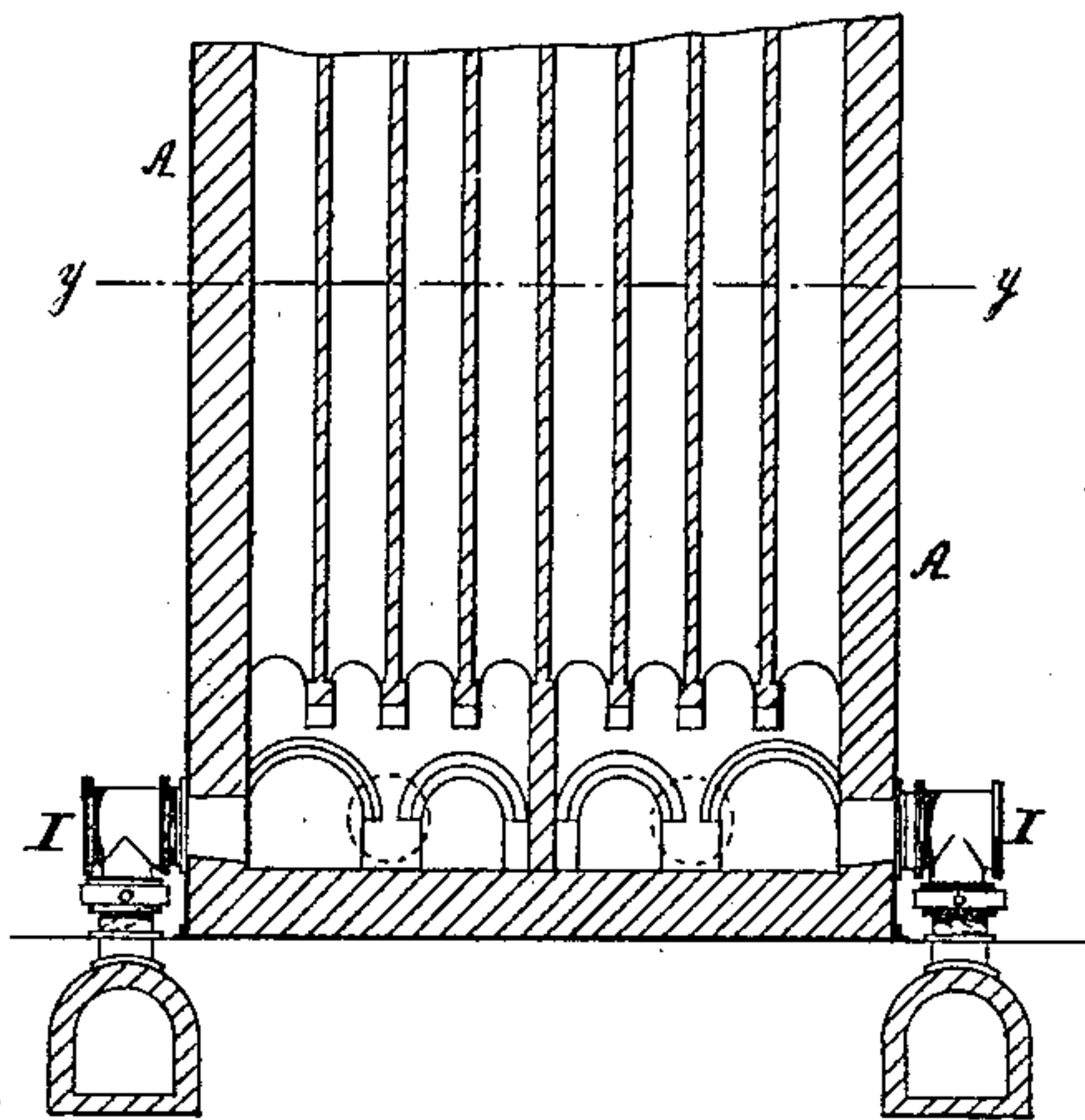
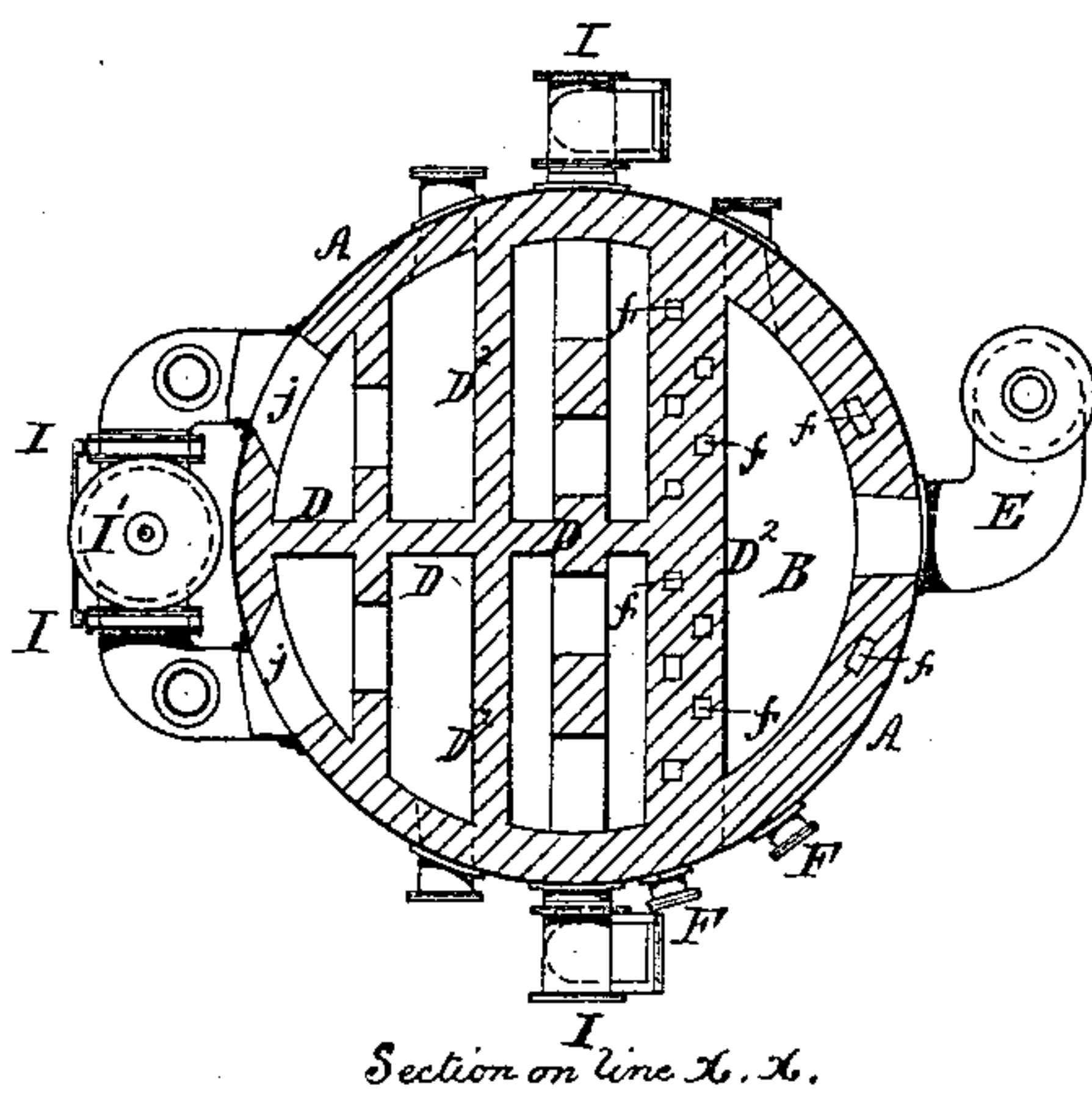
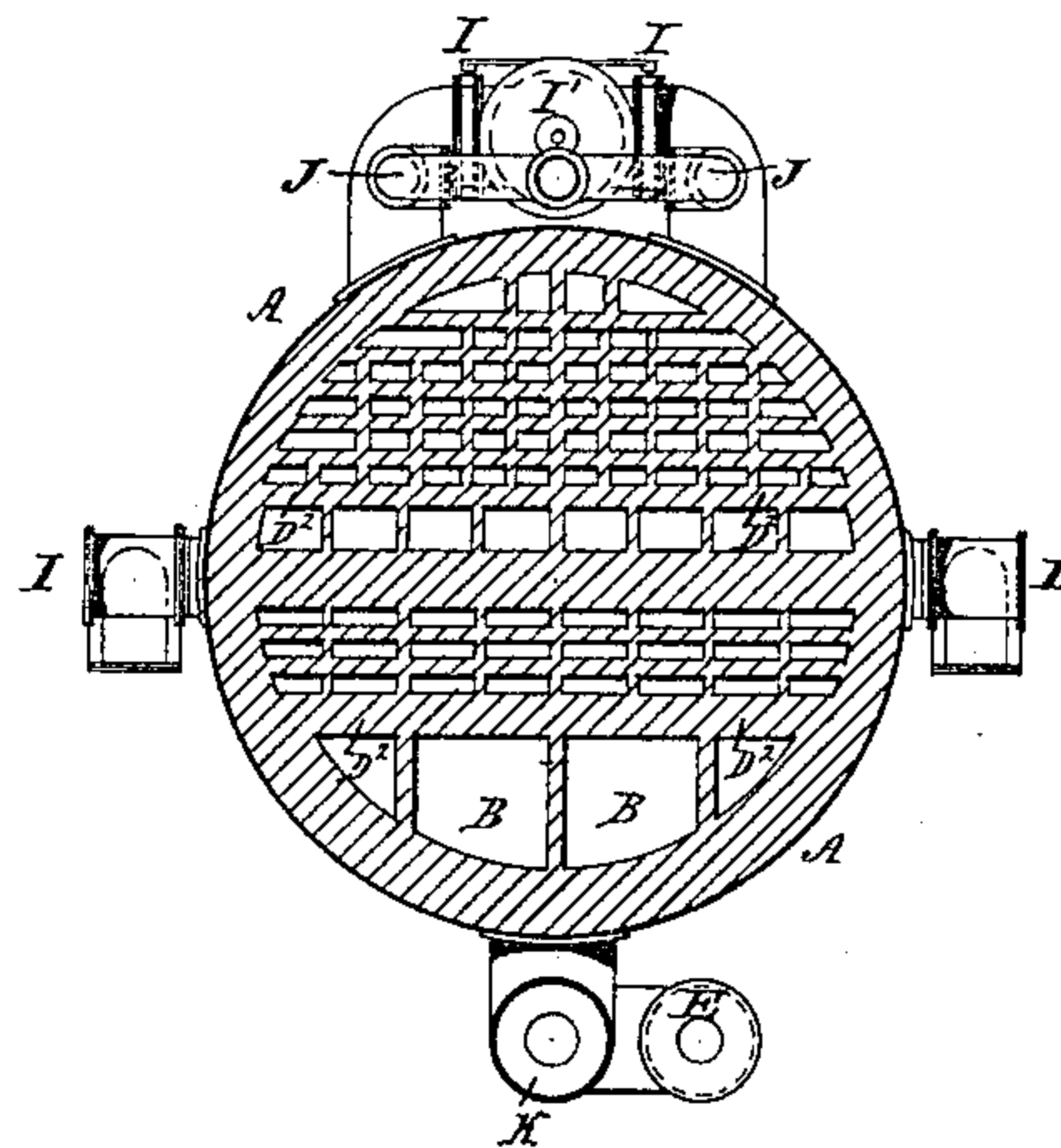


Fig. 11.



Section on line x. x.

Fig. 12.



Section on line y. y.

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UNITED STATES PATENT OFFICE.

BENJAMIN FORD, OF MIDDLESBROUGH-ON-TEES, COUNTY OF YORK, AND
JOHN MONCUR, OF DISTINGTON, COUNTY OF CUMBERLAND, ENGLAND.

REGENERATIVE HOT-BLAST STOVE.

SPECIFICATION forming part of Letters Patent No. 364,998, dated June 14, 1887.

Application filed April 27, 1886. Serial No. 200,344. (No model.) Patented in England March 29, 1886, No. 4,402.

To all whom it may concern:

Be it known that we, BENJAMIN FORD, residing at Middlesbrough-on-Tees, in the county of York, England, engineer, and JOHN MONCUR, of the Distington Iron Works, county of Cumberland, England, both citizens of the United Kingdom of Great Britain and Ireland, have invented new and useful Improvements in Regenerative Hot-Blast Stoves; and we do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the manufacture or art to which it relates to make and use the same.

Our invention, which relates to regenerative hot-blast stoves for heating the air-blast for blast-furnaces, and is in part a development of the invention described in the specification of Letters Patent of the United States No. 294,314, dated February 26, 1884, granted to us, has for its objects the making provision for more effective cleaning of the fire-brick regenerators and other internal parts of such stoves while they are in use, and for maintaining a uniform temperature of the hot blast.

The improvements constituting our invention consist, first, in providing in connection with each compartment into which, for the purpose set forth in our prior specification above referred to, the stove or its regenerator is divided, one or more blast-valves and inlets by means of which the blast may be so regulated that a practically uniform high temperature may be maintained during the time that the stove is on blast, and whereby the dust carried into the stove and that deposited on the heating-surfaces during combustion of the gas or other fuel in firing the stove may be periodically expelled; second, in combining the above-described separate blast-valves and inlets with the external valves to each compartment of the stove, as described in our prior specification above referred to, and that with or without any "internal" valves of the

kind set forth in the said specification; and, third, in the application to Cowper's, Whitwell's, and other forms of regenerative hot-blast stoves of the foregoing improvements, and of the system of dividing the stoves into compartments, described in the aforesaid specification.

In the accompanying drawings, which illustrate our invention, Figures 1, 2, and 3 on Sheet 1 are respectively an elevation, a vertical section, and a horizontal section showing the application of our improvements to a regenerative hot-blast stove of the kind described in our specification No. 294,314 of 1884. Figs. 4 and 5 are respectively a vertical section and a horizontal section showing the lower part of a modified form of our hot-blast stove without internal valves, but having the arrangement of combustion-chamber described in our former specification, in combination with the use of separate blast-valves and inlets and external valves to each compartment. Figs. 6 and 7 are vertical sections, at right angles to each other, of the lower part of a "Cowper" stove having our improvements applied thereto, and Fig. 8 is a horizontal section of the same. Figs. 9 and 10 are vertical sections, at right angles to each other, of a "Whitwell" stove embodying our improvements, and Figs. 11 and 12 are horizontal sections of the same at different lines.

As represented in the drawings, the stove under its several modifications comprises the usual internally-lined casing, A, which is provided with a combustion-chamber, B, and a series of regenerators, C, of any of the well-known forms, the stove being in each case divided into compartments by means of vertical walls D, which extend to the top of the regenerators, excepting when the regenerators are themselves composed of vertical walls, in which case, as hereinafter mentioned, the walls D extend only to the under side of such regenerators.

The gaseous fuel, which by combustion

serves to heat the regenerators, is admitted by a valve, E, and ports *e* to the combustion-chamber B, whereinto the necessary air is admitted by a valve, F, and ports *f* in the usual way. The hot products resulting from combustion of the gas pass upward to the top of the chamber B, and descend, as indicated by the arrows, through the regenerators C C, and thence pass by an outlet-flue, G, to the chimney, the internal valves, H, when such are provided, as shown in Figs. 1, 2, and 3, in connection with each compartment of the stove, and the external valve, I, being then open, or these separate external valves, I, provided to each compartment, when there are no internal valves, as in Figs. 4 to 12, being opened. After firing, the gas-valve E and the valves H and I are closed, and one, two, or more of the air-blast-admission valves, J, of which a separate one is provided for each compartment of the stove, are opened, and the air flowing in through the inlets *j* passes, as indicated by the darts, upward through the regenerators, down through the upper part of the combustion-chamber B, and thence by an outlet, K, which in the stoves, Figs. 1, 2, 3, 4, and 5, may be on either or on both sides of the external wall of the combustion-chamber B of the stove, to the tuyeres of the blast-furnace.

In the stove represented by Figs. 1, 2, and 3 internal valves, H, are provided and are operated by hand from the outside. The air-blast valves J and external valves, I, which are of ordinary construction, may be operated by hand-levers or otherwise, while the gas-inlet valve E and the main outlet-valve I' may be operated by racks and pinions and hand-cranks, or by similar means.

In the stove shown in Figs. 4 and 5 the internal valves are dispensed with, and the lower part of the inlets *j*, for the air-blast from the valves J, also serve as the outlets for the products of combustion and for the expulsion of the dust or deposit, when the external valves, I, which are fitted in branches leading to the chimney-flue G, are opened and valve J closed.

In the improved Cowper stove (represented in Figs. 6, 7, and 8) the air-blast valves J and external valves, I, are similarly arranged in connection with the inlets *j*, the series of valves being conveniently fitted at one side of the stove, owing to the arrangement of the compartments into which the stove is divided by the parallel walls D, while the hot-blast-discharge pipe K and the gas-admission valve E are fitted in the external wall of the combustion-chamber at the opposite side of the stove. The walls D, which are built under the regenerators, have a coping formed by girders D' D², which are wedged close up to the

under side of the grids or supports of the regenerators.

In the modified form of Whitwell stove (represented by Figs. 9, 10, 11, and 12) the division-walls D are built up to meet the lower ends of the vertical walls of the regenerator in order to divide the stove into compartments, the transverse walls D² serving for further subdivision in lieu of the combustion-chamber, which serves the like purpose in the forms of stoves shown in Figs. 1 to 5. Separate air-blast valves J and external outlet-valves, I, are provided for each compartment, the valves for the two compartments adjacent to the combustion-chamber compartments being, for convenience, fitted on opposite sides of the stove. The building up of the division-walls D in the Cowper and Whitwell forms of stove may be effected in the manner described without interfering with the existing arrangements of the regenerator.

By the employment of separate air-blast valves J and outlet-valves I for each compartment of the several forms of hot-blast stoves described the pressure of the air contained in the stove at the moment of its discharge on changing from blast to gas, or at any time while on blast, may be supplemented or re-enforced by the full blast pressure from the blowing-engine to assist in expelling the dust and deposit from the heating-surfaces into the outlet, to which the air has momentary access by the sudden opening of the outlet-valve of an adjacent compartment, whose heating-surfaces are also thereby freed from deposit.

The several parts of the hot-blast stoves described may be varied as regards form and arrangement, the internal valves shown in Figs. 1, 2, and 3 being, for example, applicable to the stoves shown in Figs. 4 to 12, and the arrangement of the blast-inlet and external valves shown in these latter figures being applicable to the stoves shown in Figs. 1 to 3. The several improvements herein set forth may also be applied to other forms of hot-blast stoves than those represented in the drawings.

It should be understood that we do not desire to claim in this application the device shown and described in our patent above referred to, as that we have already claimed; but

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

1. In a hot-blast stove divided into several compartments, the provision of separate air-blast inlets provided with valves opening directly into each compartment through inlets *j* and separate outlet-valves to each compartment, whereby a practically uniform temperature may be maintained and the pressure

of air within the stove may be supplemented or re-enforced at the moment of discharge through any one of the compartments, for the purpose of expelling the dust or deposit
5 on the heating surfaces, substantially as herein described.

2. The combination, in a hot-blast stove having a single regenerative chamber, of vertical walls built to divide the space thereunder into
10 two or more compartments, a combined air-inlet and gas-outlet pipe to each compartment, a common trunk connecting two or more of them, separate air-blast pipes connected thereto and independently regulated by separate valves, and a gas-discharge flue connected
15 to said trunk and having a regulating-valve, substantially as set forth.

In witness whereof we have hereunto set our hands and seals this 5th day of April, 1886.

BENJAMIN FORD. [L. S.]
JOHN MONCUR. [L. S.]

Witnesses to the signing hereof by the said Benjamin Ford:

J. R. STUBBS,
Solicitor and Notary Public, Middlesbrough.

U. ROTHWELL,
Solicitor's Clerk, Middlesbrough.

Witnesses to the signing hereof by the said John Moncur:

LEWIS T. HELDER,
Solicitor and Notary Public, Whitehaven.

TH. ROWLAND,
His Clerk.