

H. AITKEN.  
COKE-OVEN

No. 169,756.

Patented Nov. 9, 1875.

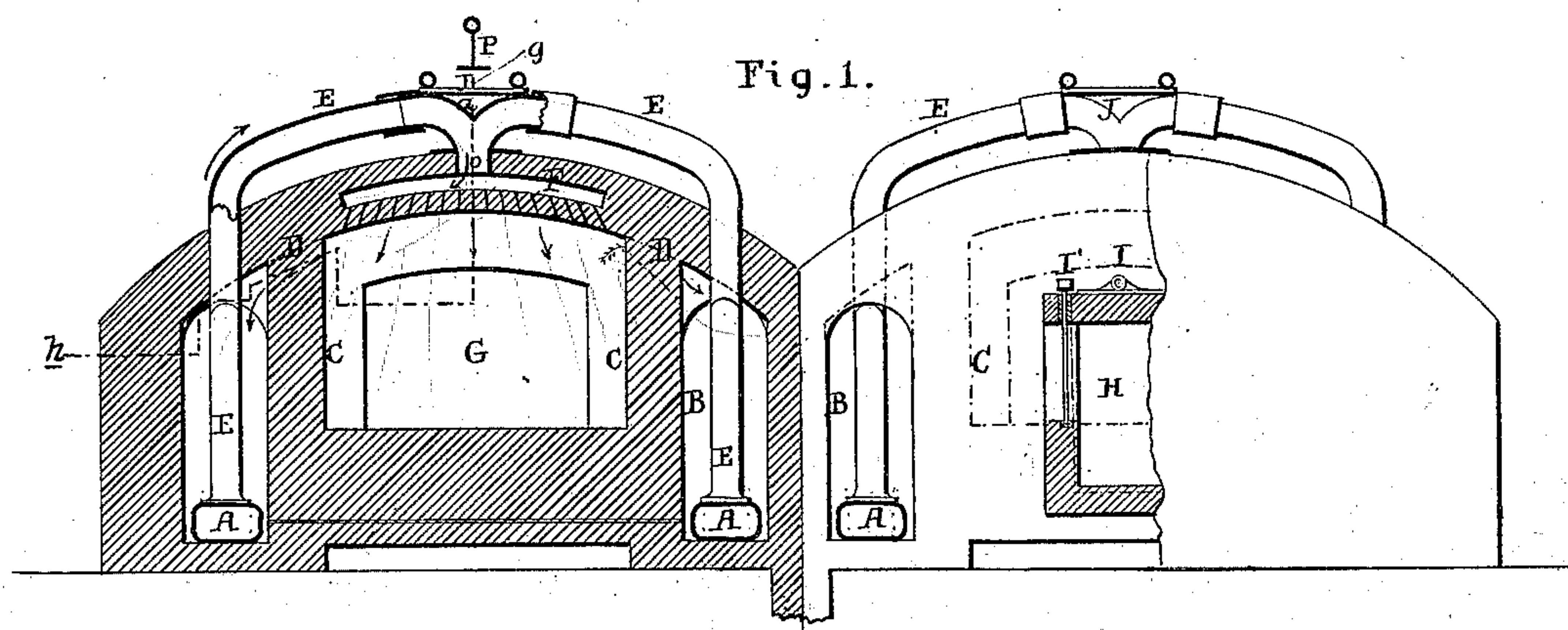


Fig. 2.

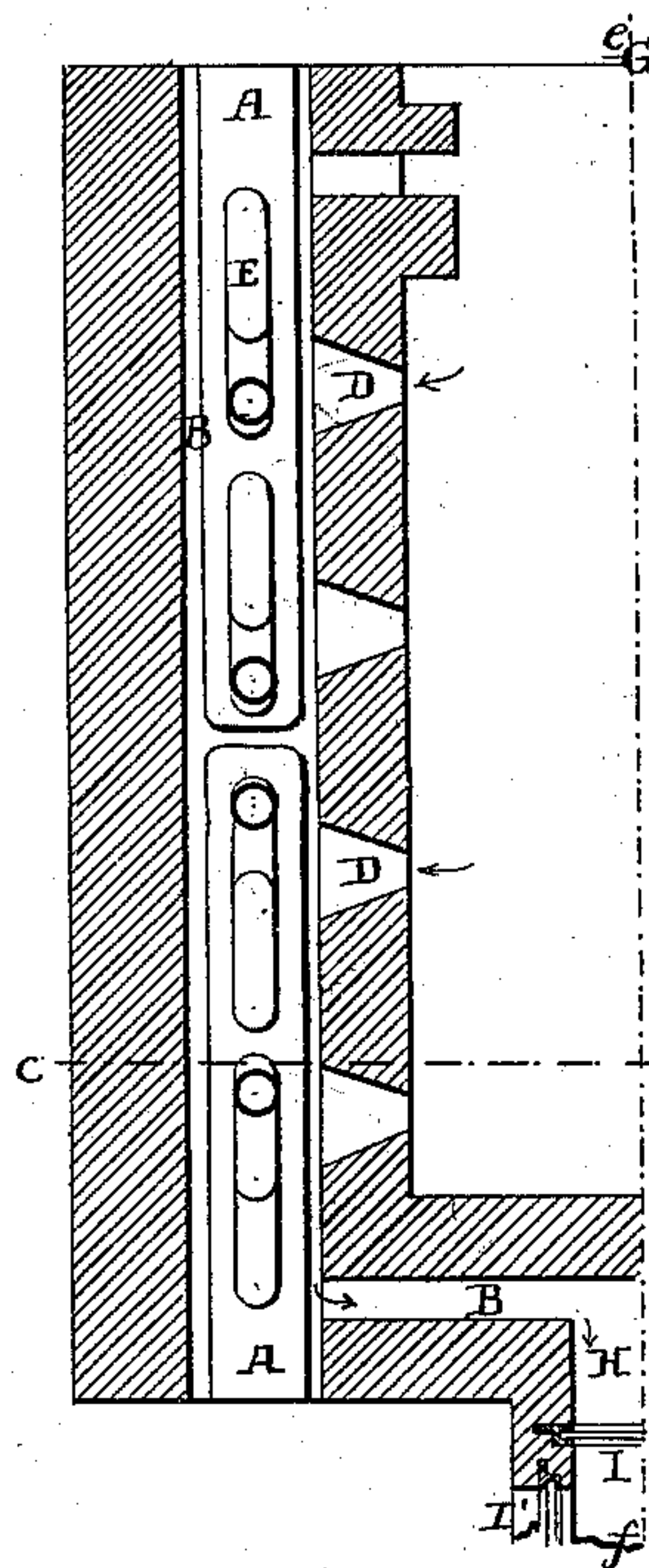
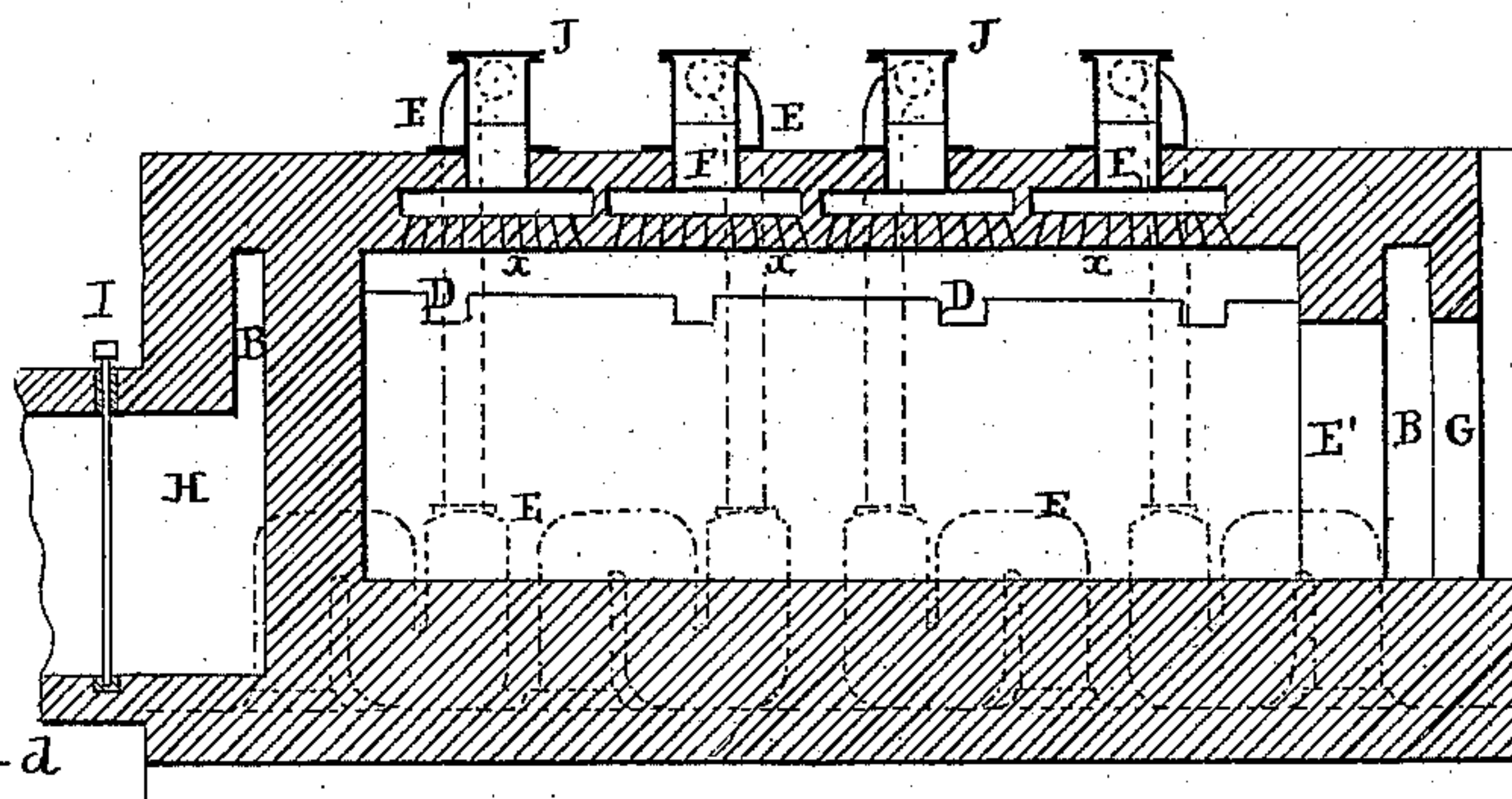


Fig. 3.



Witnesses:

*Harry Coleman*  
*W. E. Chaffee*

*Henry Aitken*  
*By his attys*  
*Howson & Son*

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Fig. 5.

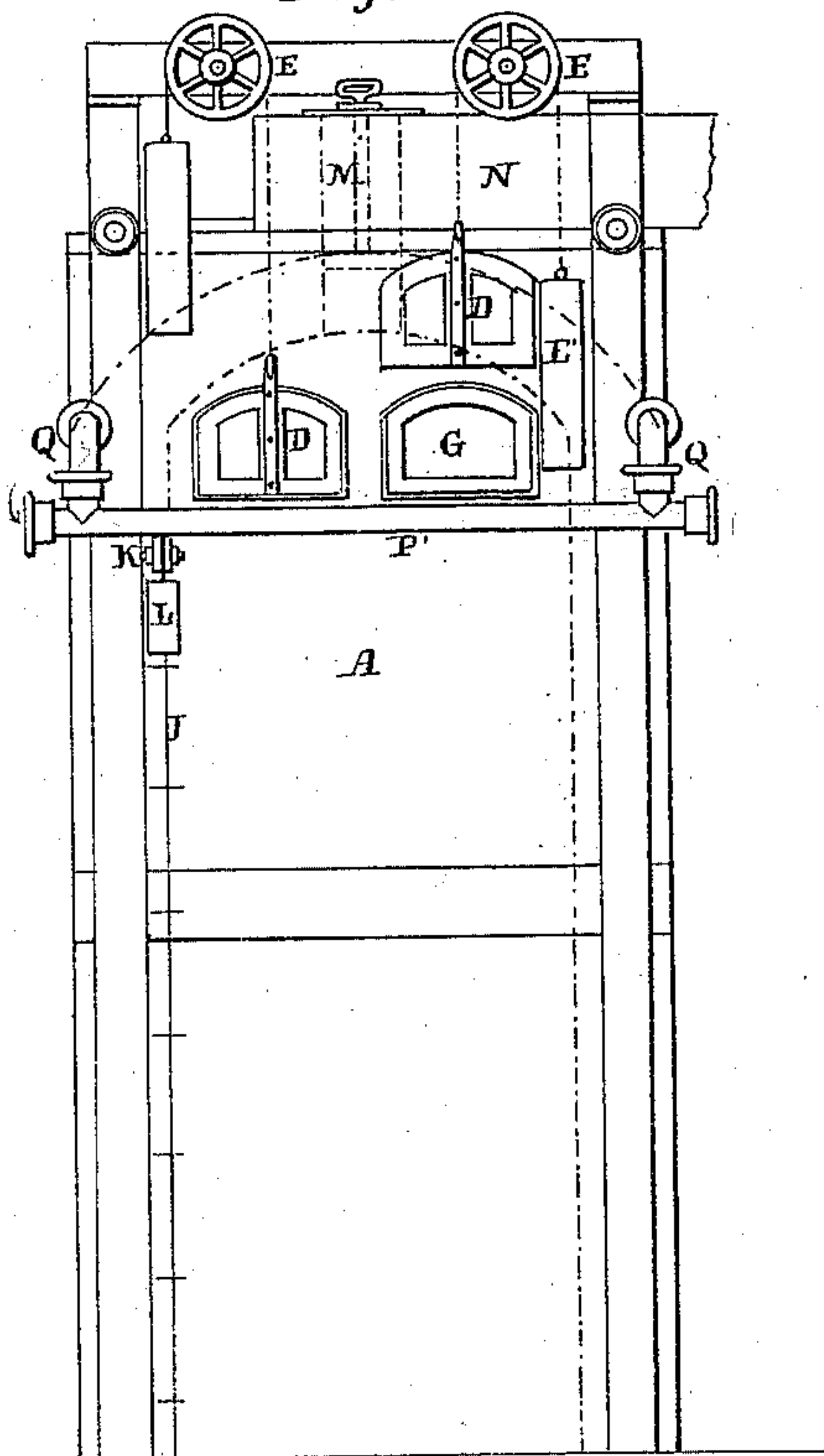


Fig. 4.

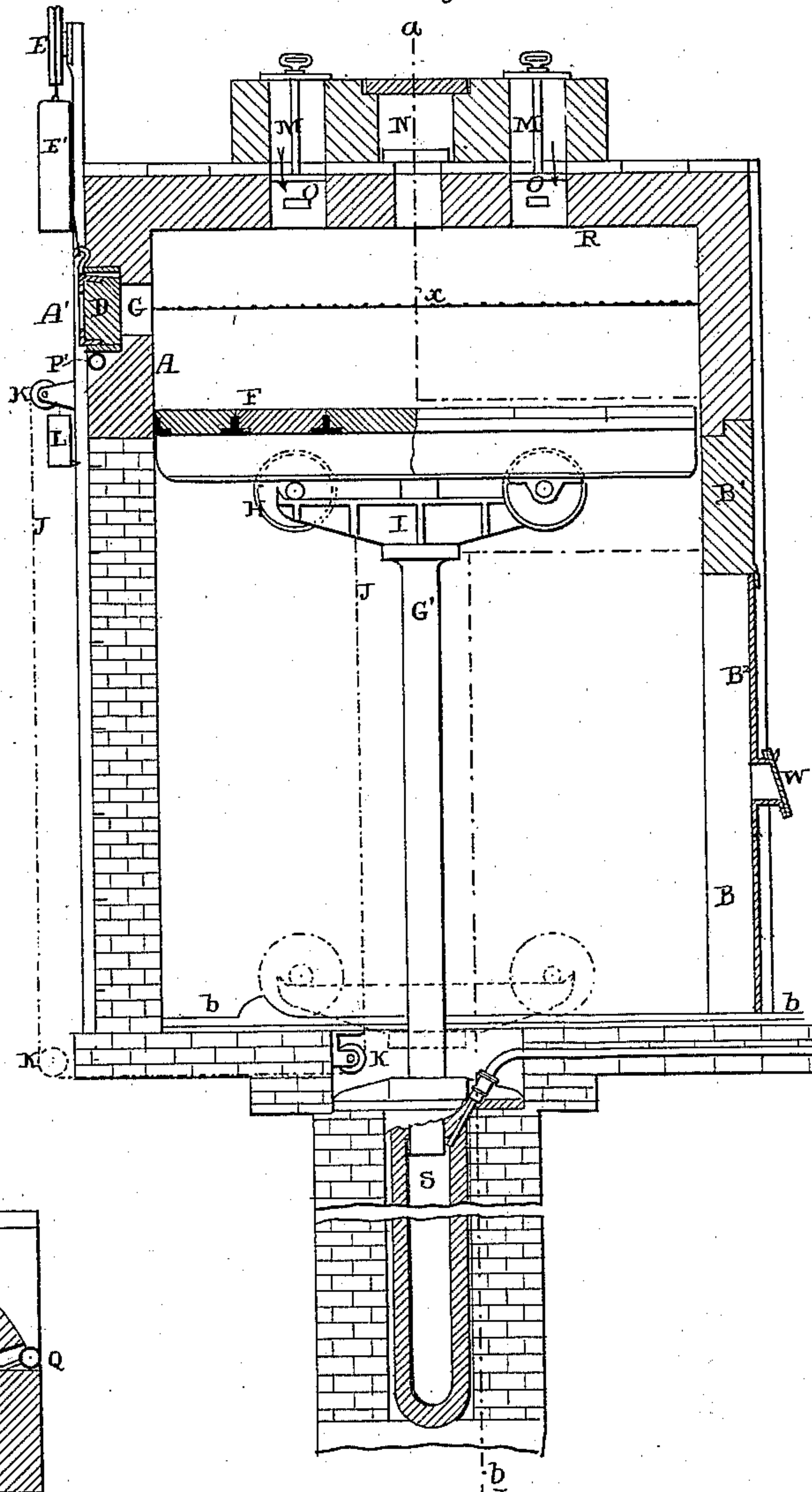
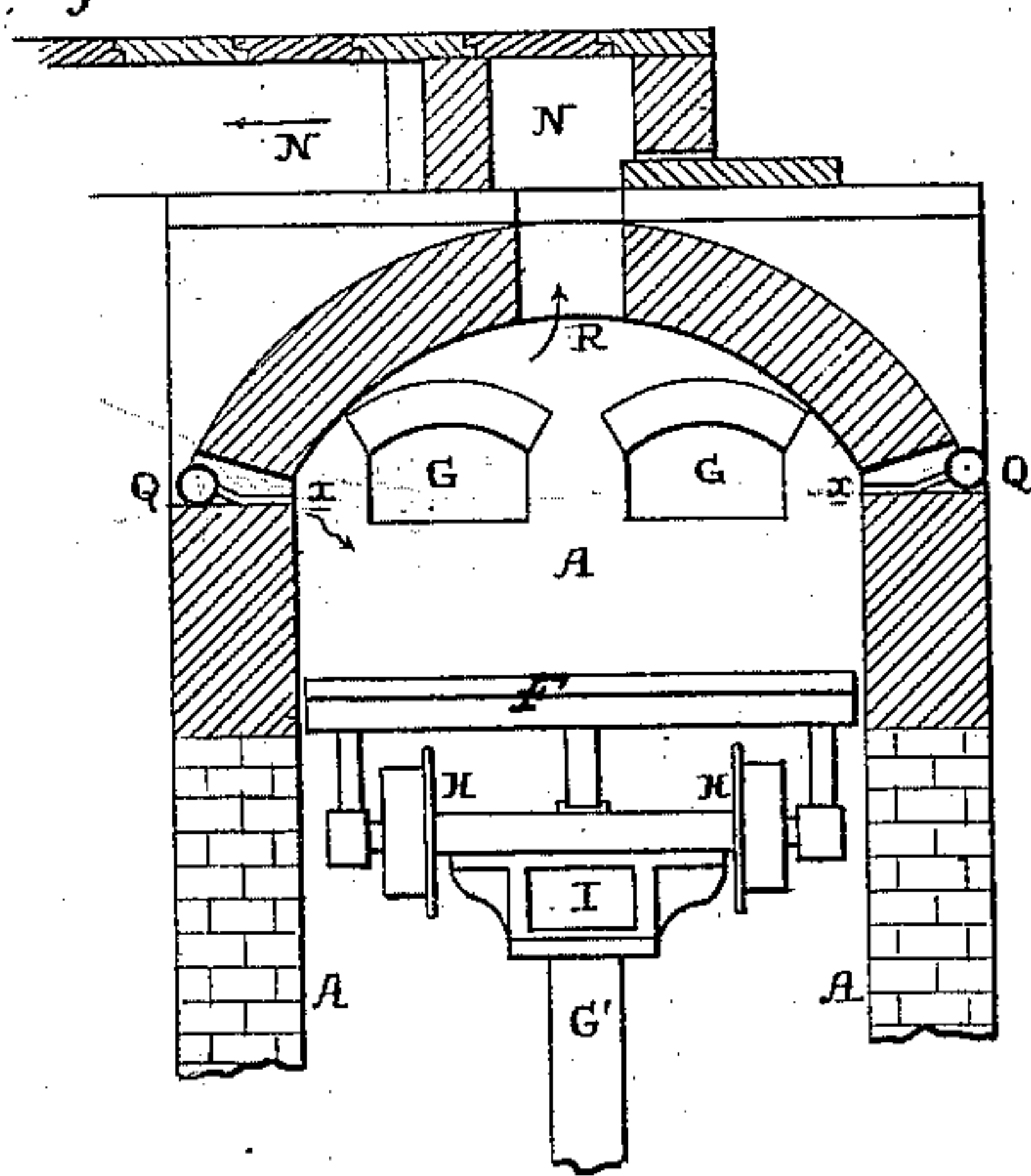


Fig. 6.



Witnesses:

*Harry Coleman.*  
*W. E. Chaffee*

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*By his attys*  
*Houston & Son*



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Fig. 8.

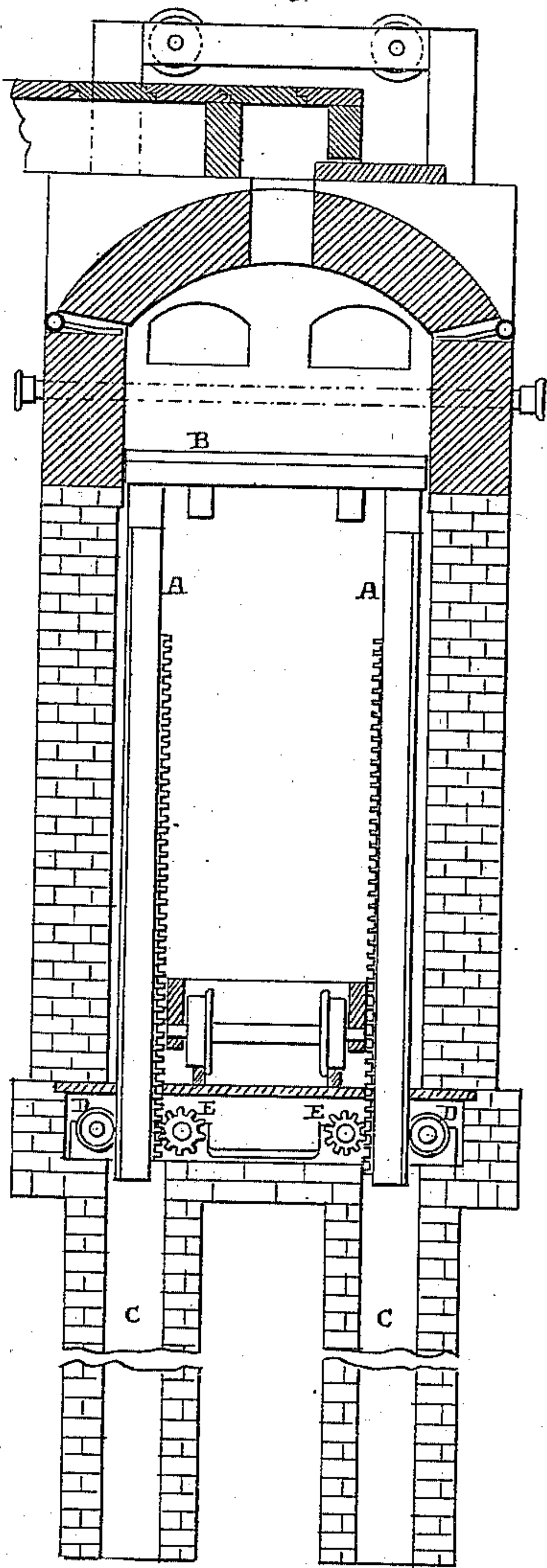


Fig. 7.

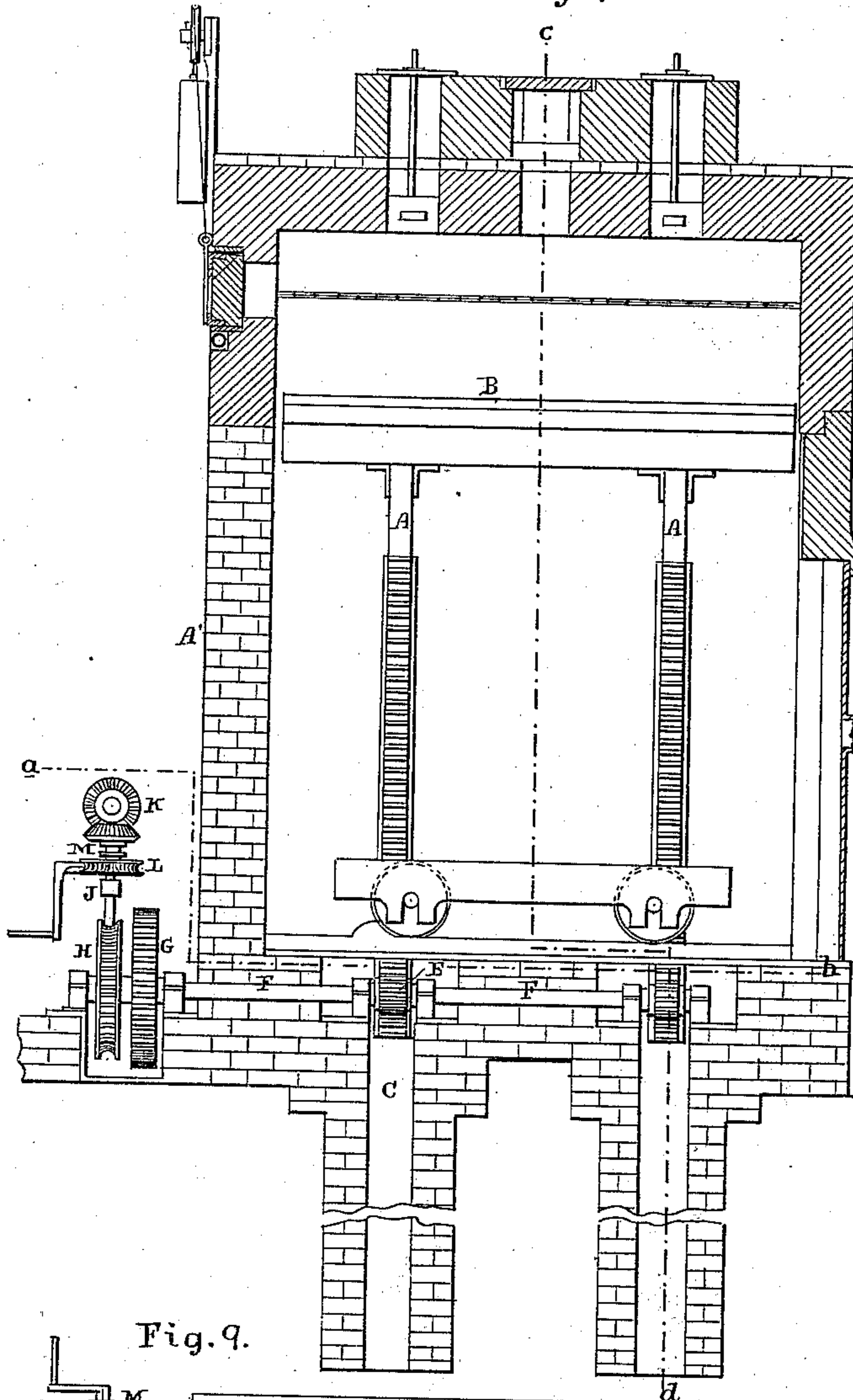
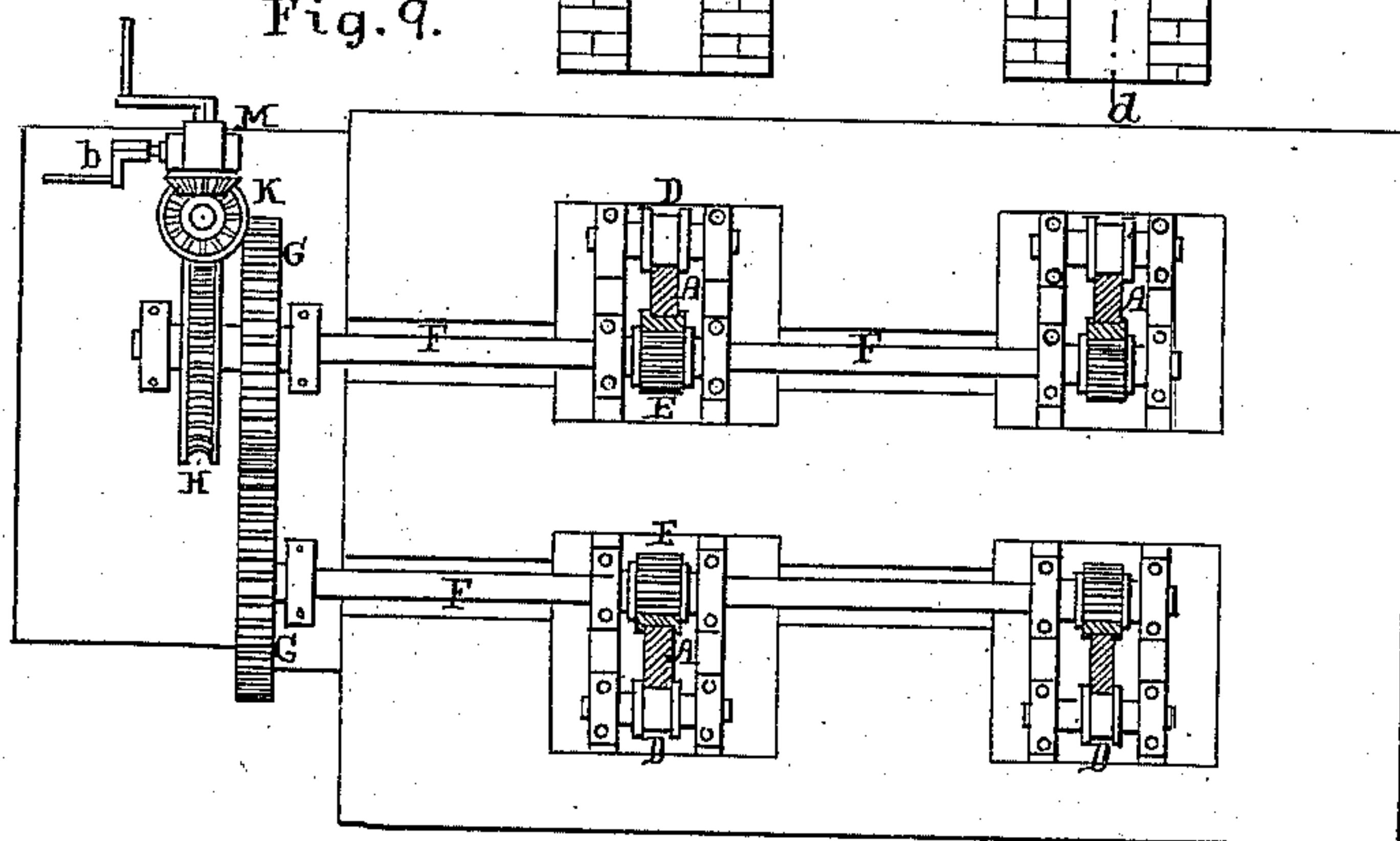


Fig. 9.



Witnesses:

*Harry Coleman.*  
*W. E. Chaffee*

*Henry Aitken*  
*By his attys*  
*Hudson & Son*



# UNITED STATES PATENT OFFICE.

HENRY AITKEN, OF FALKIRK, NORTH BRITAIN.

## IMPROVEMENT IN COKE-OVENS.

Specification forming part of Letters Patent No. 169,756, dated November 9, 1875; application filed November 20, 1874.

*To all whom it may concern:*

Be it known that I, HENRY AITKEN, of Falkirk, in the county of Stirling, North Britain, have invented improvements in coking coal and other carbonaceous matters, and in the apparatus employed therefor, of which the following is a specification:

The object of my invention is a coking-oven in which air, after being thoroughly heated by passing through heated channels, is directed among the gases arising from coke arranged upon a stationary or movable bottom, all as described hereafter, and as shown in the accompanying drawing, in which—

Figure 1 is an elevation, partly in section; Fig. 2, a partial plan in section, and Fig. 3 a sectional elevation, of an oven or kiln constructed to coke coal or other carbonaceous matters in accordance with this invention.

As shown at Fig. 1 the oven or kiln is constructed with a chamber or space, F, in the roof thereof, which may communicate with the outer atmosphere, or with a pipe or passage, through which air is conducted, and with the interior C of the oven or kiln by the perforations or air-passages *x*. The kiln or oven is formed with ports or openings D communicating between the interior C of the oven or kiln and the flue B, which extends at each side of the kiln or oven from each side of the charging and drawing doorway to the flue H, through which the products of combustion are conveyed away from the oven or kiln by means of a stalk or chimney, or other means of producing a draft. The flue H is provided with a damper, I, for regulating the draft, and a side damper, I', is provided in order that, should leakage occur at the damper I, when the latter is closed, the draft of the chimney may draw air through the opening at I, and not through the oven or kiln.

In operating with this arrangement of oven or kiln the coal or other carbonaceous matters to be coked is introduced to the interior thereof through the doorway or opening G, and ignited in the ordinary manner, and so soon as sufficient gas comes off or is evolved from the material being coked, a wall is built, or other stopping put in across the opening at E', inside the flue B, and plastered up so as to connect the side walls, and leave a space

for the gases to pass round.—The outside doorway or opening at G is also closed, and the draft through the flues B and H (see arrows, Fig. 2,) insures or facilitates the flow of atmospheric air through the chamber F to the interior C of the oven or kiln, whereat it comes in contact and mixes with the gases arising from the coal or other carbonaceous matters, burning a whole or portion of the same, producing a very high temperature, and thereby coking the charge, after which the products of combustion pass off through the ports or passages D, and flues B and H. The admission of air is continued and regulated as long as gas continues to be evolved from the materials being coked, after which the said materials may be "watered out" and withdrawn, or allowed to remain in the oven or kiln to cool.

In place of drawing in the air by the action of a chimney it may be blown or forced in under pressure through pipes A placed in the flues B at each side of the oven. From the pipes A winding or meandering pipes E (the contours of which are more particularly seen in dotted lines in Fig. 3) conduct the air-blast to the chambers F, from whence it passes to the interior through the apertures or perforations *x*. The side flues B are closed at each end by doors, (not shown in the drawings,) but which are movable to afford access to the interiors of the flues, and access is had to the interiors of the pipes E by removing the covers J and upper portions *a* of the bends at the junctions thereof, which portions are made separate from the remainder of the bends. When the cover J and portion *a* have been so removed the passage to the chamber F may be closed by the stopper P, Fig. 1.

It will be apparent that the oven may be circular, in which case the flue B will be annular.

Under another arrangement of forcing or blowing heated air into the upper part of coking ovens or kilns illustrated in vertical sections at Figs. 4, 5, and 6, the air, after being forced or blown through the pipe A, and being heated therein, or previously heated by the waste gases from the oven or otherwise, passes through the branch pipe Q, from whence it is blown into the upper part of the



oven or kiln through the tuyeres or jets  $x$ . The oven or kiln may be charged through holes M in the top, or charged and drawn through an opening or doorway, G, at the end or side, and the products of combustion pass off from the oven or kiln by the port N.

Any desired number of coking ovens or kilns may be situated in a double line on each side of the main flue, and cocks or fly-valves may be provided by which to regulate or cut off the air-blast from any one or more of such ovens.

The waste products of combustion resulting from the coking of coal or other carbonaceous matter in any of the ovens herein described and shown, may, besides heating the air-blast, be employed in raising steam for forcing or blowing the air into the upper parts of the ovens or kilns, or for heating and raising steam, or a portion of the gases may be conveyed away from the ovens or kilns for other purposes. When there is more tarry matter than is necessary for "grindering" the carbonaceous matter being coked or carbonized, a portion of the same may be drawn off at the bottom of the ovens or kilns by means of pipes, and thereafter condensed, and thereby a portion of the tar and tar-water secured.

Where the coking operations are to be continuous—that is to say, several charges of coal are to be coked successively, and all ultimately drawn from the improved ovens or kilns at one operation—the lower portions of the kilns are constructed as shown in Figs. 4 to 9—that is, with the bottom of the kiln or oven movable, or capable of being raised or lowered, and fixed at any required level by means of hydraulic rams, racks, and pinions, or by blocks and tackle, or by mechanical equivalents of these.

Fig. 4 is a vertical section; Fig. 5, an elevation of the end marked A' in Fig. 4; and Fig. 6 a transverse section on the line  $a b$ , Fig. 4.

The oven or kiln is formed as an air-tight chamber, A, at one side of which, at the lower end, is a doorway, B, and at or near to the upper end of the chamber, vents or passages, G, are formed in one end thereof, so that should the gas, arising from the carbonaceous matter being coked, explode in the chamber it will do no harm, as, by the force of the explosion, the plugs D, by which the passages or vents are closed, are blown outward from their seats. The vents or passages G also serve as holes through which to spread the carbonaceous matters over the bottom of the oven, as before described. The plugs D are suspended from chains passed over pulleys E, at the opposite extremities of which counter-weights E' are attached. The opening at B is closed by doors B<sup>1</sup> B<sup>2</sup>, when the oven or kiln is in operation; and it is preferred to make the door B<sup>1</sup> of iron lined with brick or fire-clay. In case the gases explode in the lower part of the oven or kiln a safety-valve, W, is placed in the door B<sup>2</sup>, which allows the gases to escape

similarly to the valves D at the other side of the oven.

The bottom F of the oven or kiln, which is capable of being raised and lowered, and fixed at any desired position by the hydraulic ram G', is preferably made of iron with a "sole" composed of slabs of fire-clay or other refractory material, and it is provided with wheels H, by which the bottom F, when at its lowest position, may be run on rails out of the chamber of the oven or kiln. When in a raised position the movable bottom F is supported on a framing or platform, I, fixed on the head of the ram G', as shown. A light rope or chain, J, is attached to the framing or platform I, and passed round pulleys K, to the outside of the oven or kiln, whereat it is attached to a small weight, L, by which the position of the movable bottom at the interior of the oven or kiln is indicated, the weight L rising and falling with the bottom F. The charging-openings M, formed in the arch of the oven or kiln on each side of the flue N, are provided with plugs O, which are of fire-clay or other refractory material. The air for burning the gases issuing from the substances being coked is forced or blown through the pipe P', Fig. 5, from whence it passes into the pipes Q at each side of the oven or kiln, as before stated, and enters the upper part thereof between the charge of material being coked or carbonized and the arch R, through the tuyeres or jets  $x$ , and, impinging upon the gases evolved from the said materials, consumes or partially consumes the same, the products of combustion thereafter passing off through the flue N.

In operating with the oven or kiln, the bottom F is first raised to its highest position by forcing water into the cylinder S, for raising the ram G' and bottom F. The oven or kiln is then charged, through the openings M, with the material to be coked or carbonized, which is ignited through the openings M, or through the vents or passages G, and when sufficient gases begin to be evolved therefrom the openings M and vents or passages G are closed by their respective stoppers or plugs, and the air-blast is blown in through the tuyeres  $x$ . After the first charge has been coked or carbonized by the heat of the burning gases, and while the coke and the oven or kiln are still hot, the ram G' is allowed to descend, thereby carrying down the movable bottom F, and coke thereon, a distance sufficient to receive another charge of carbonaceous matters above the coke. This second charge is, in its turn, also coked or carbonized, and thereon is again moved downward, after which the bottom, with the two charges of coke, is lowered to receive a third charge, this succession of lowering and coking operations being continued until the movable bottom reaches the lower end of the chamber, when, with the coke upon it, it is run out on the rails  $b$  and removed, after which the bottom is replaced in its position above the ram G', (or another movable bottom may be substituted therefor,) the ram



with the bottom is raised again in the chamber A, and the oven is then ready for receiving another succession of charges.

The oven is, preferably, formed with a slight taper from the bottom to the top, so as to allow the charge to descend without much friction, and the door side of the oven is, preferably, made wider, so as to permit of the coke being withdrawn with facility.

A scale is, or may be, fixed in the brickwork of the oven or kiln opposite the hanging weight L, by which means the descent of the movable bottom at each succeeding charge of carbonaceous matters is or may be indicated.

An especial feature of the coke oven or kiln is that the heat of the successive charges of coke is utilized for effecting a portion of the succeeding coking operations, so that fuel, time, and material are economized.

By the high heat obtained at once the oven or kiln is capable of coking or carbonizing many substances that will not coke in ovens or kilns as hitherto constructed.

In lieu of raising, lowering, and fixing at any desired level, the movable bottom of the coking oven or kiln constructed in accordance with my said invention, by a hydraulic ram, as hereinbefore described and shown, racks and pinions may be employed for that purpose, as shown in vertical section at Fig. 7, in transverse section on the line *c d*, Fig. 7, at Fig. 8, and in sectional plan on the line *a b*, Fig. 7, at Fig. 9.

The air may be forced or blown into the ovens or kilns, hereinbefore described, by means of a blowing engine or fan, or other contrivance, or it may be forced in by heating the air at a lower level than the ovens. When the air is drawn into the ovens or kilns this may be effected by an exhaust-fan by the draft of the chimney or stalk, or by steam or water jets, the exit of the gases in any case being regulated by means of dampers or stoppers placed in the flues or outlets of the ovens or kilns.

In lieu of heating the air by conducting it through pipes placed in the gas-exit flues, it may be heated in a separate air-heating apparatus, communicating with the ovens or kilns by pipes, around and among which the gases from the ovens or kilns are made to circulate; or the air may be heated by passing it and the gases through flues alternately, and these

flues may be made large, and partly filled with brick or other refractory material. More air may be added to the gases as they pass through the flues or heaters, in order to exhaust their heating powers.

It is to be especially observed that it is of great advantage to introduce the air to the ovens or kilns, in the modes hereinbefore described, as highly heated as possible, and at numerous small apertures, and it is also of advantage to direct the air upward as it enters the oven or kiln.

It is obvious from the construction of the improved ovens or kilns embraced by this invention, and from supplying the air to coking ovens or kilns in the manner illustrated, that the amount of air passing into the ovens or kilns may be so regulated as to consume only the gases arising from the carbonaceous matters being coked or carbonized, or such portion thereof as may be required to effect the coking or carbonizing operation without consuming the coke or carbonaceous matters themselves.

I claim—

1. The combination of the oven C, surrounding passage B, and heating-pipes, arranged in the passage B and communicating with channels or tuyeres *x* leading to the oven, all substantially as and for the purpose set forth.

2. The dampers I I', combined with the exit-flue, as and for the purpose set forth.

3. The combination of the pipes E, detachable bends *a a*, and removable covers J, as set forth.

4. The combination of the oven, having openings at the sides, and stoppers D, fitted loosely to said openings, and connected by chains to the walls of the oven, or other permanent object, for the purpose set forth.

5. The combination of the oven, its outlet-flue and tuyeres *x*, a movable bottom or platform, and mechanism for lowering the bottom to bring each successive charge to a position within the oven below the tuyeres, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

HENRY AITKEN. [L. S.]

Witnesses:

GEORGE MACAULAY CRUIKSHANK,  
JOHN MAC NISH.