Nov. 18, 1924. 1,516,082

R. CRAVAU

COKE OVEN

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Fig. 1.

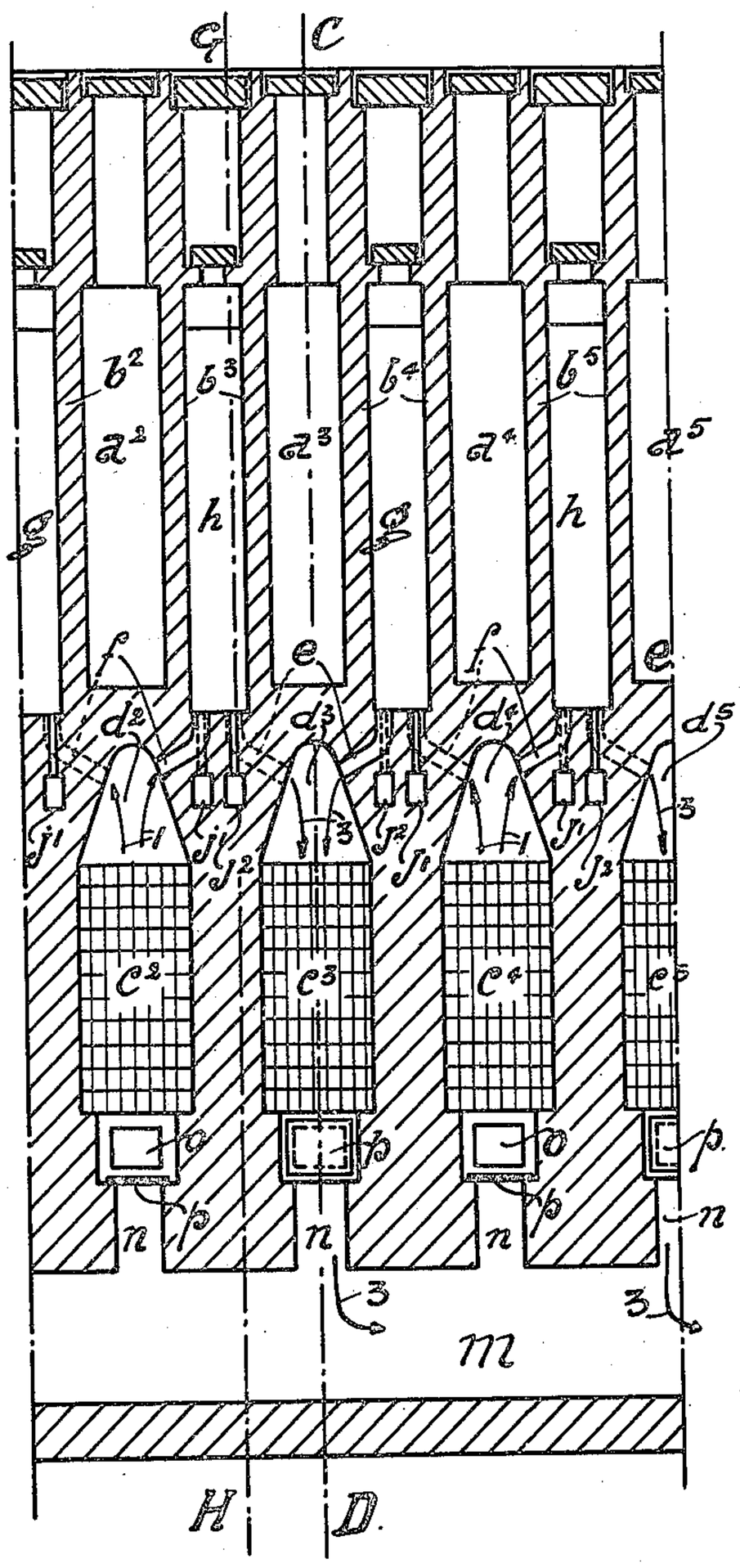

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Fig. 2.

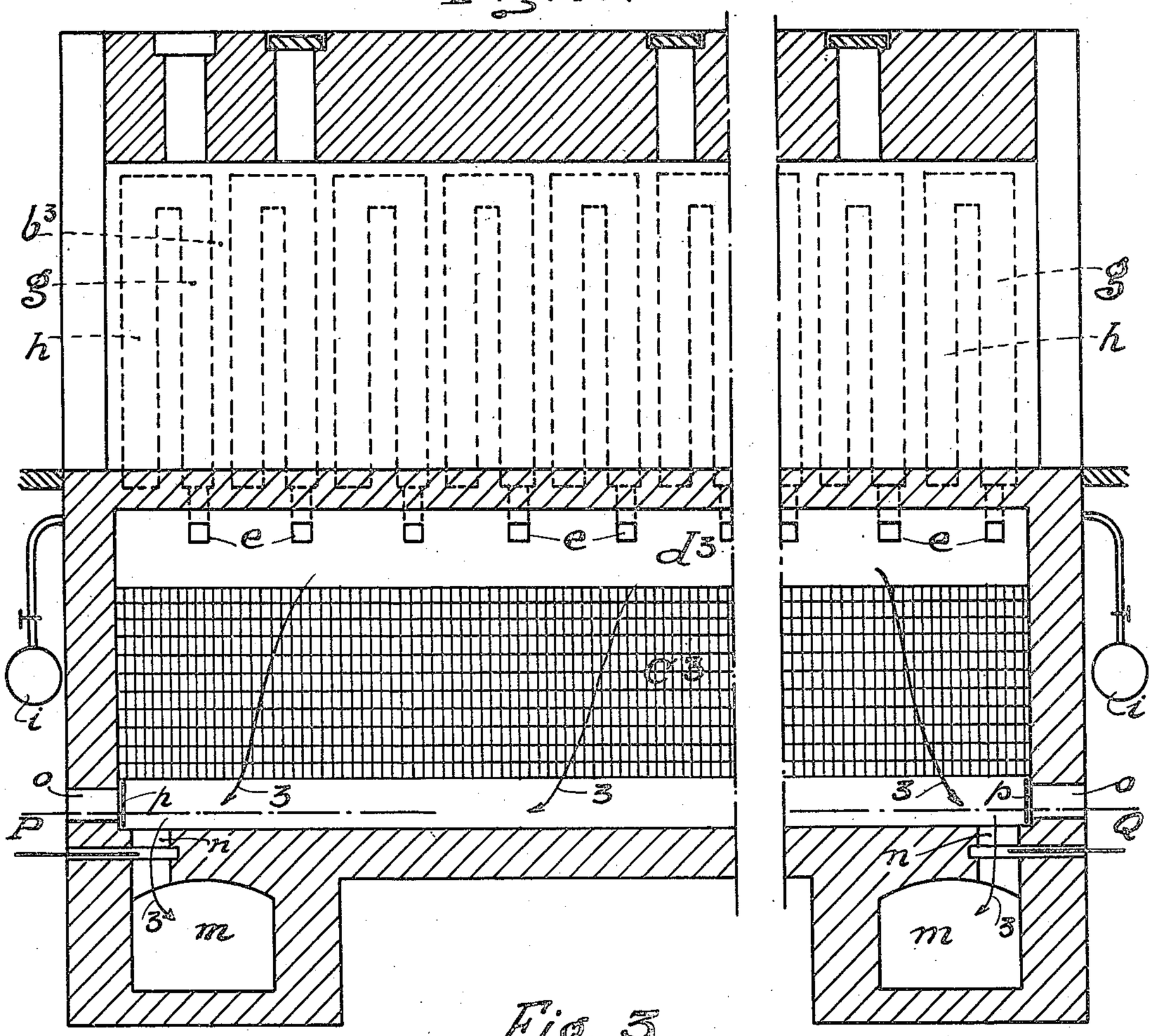

Fig. 3.

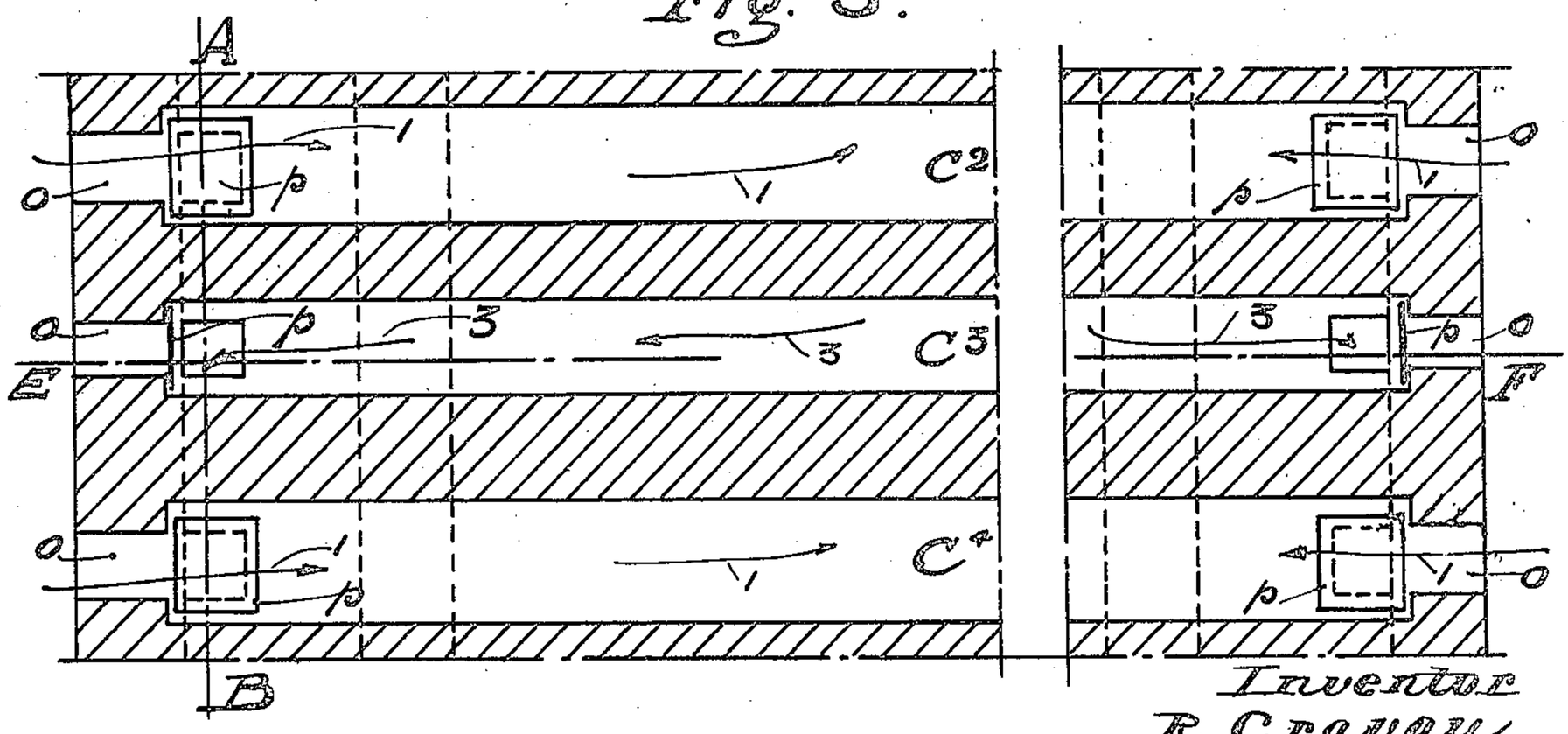

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Fig. 4.

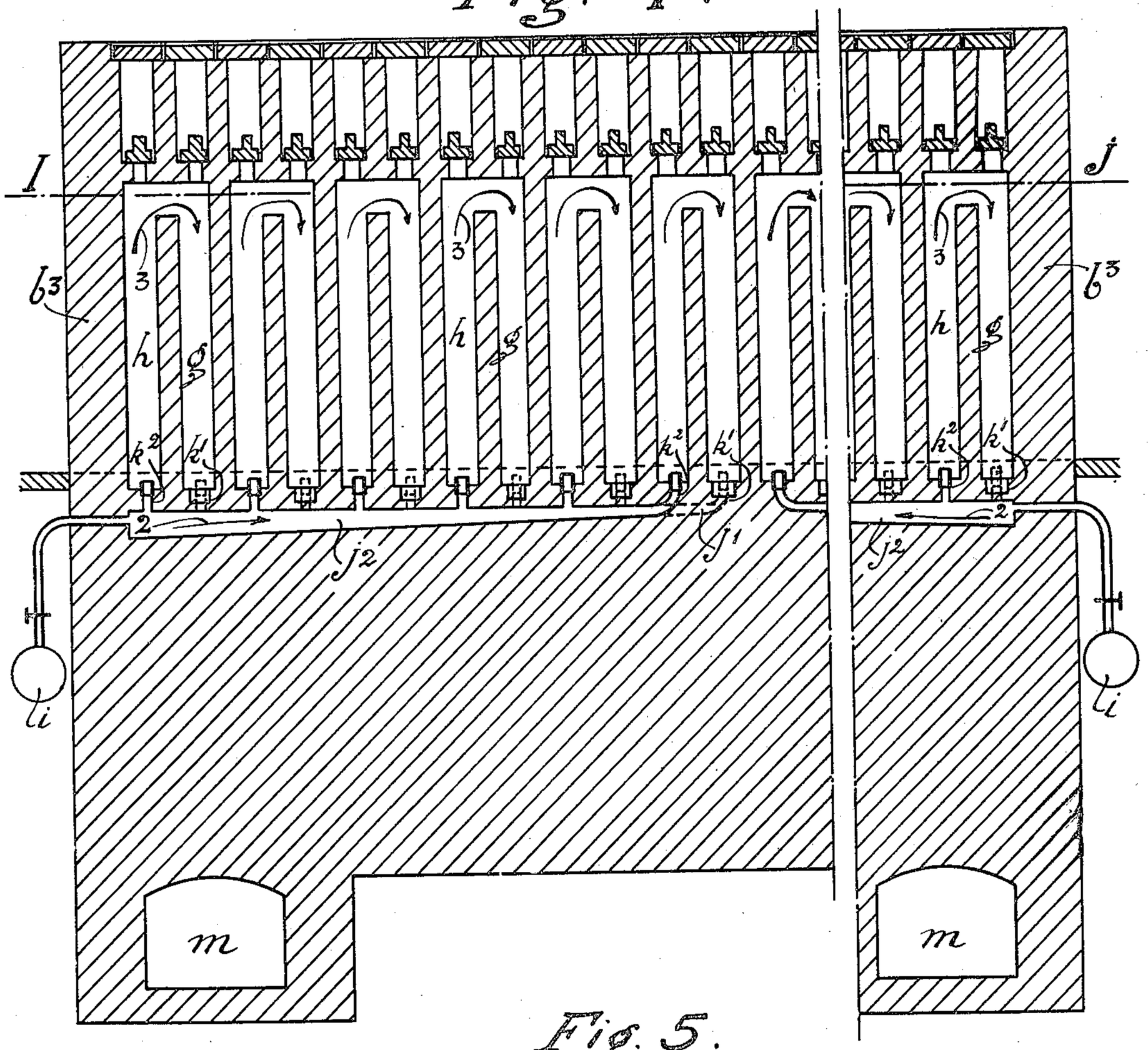

Fig. 5.

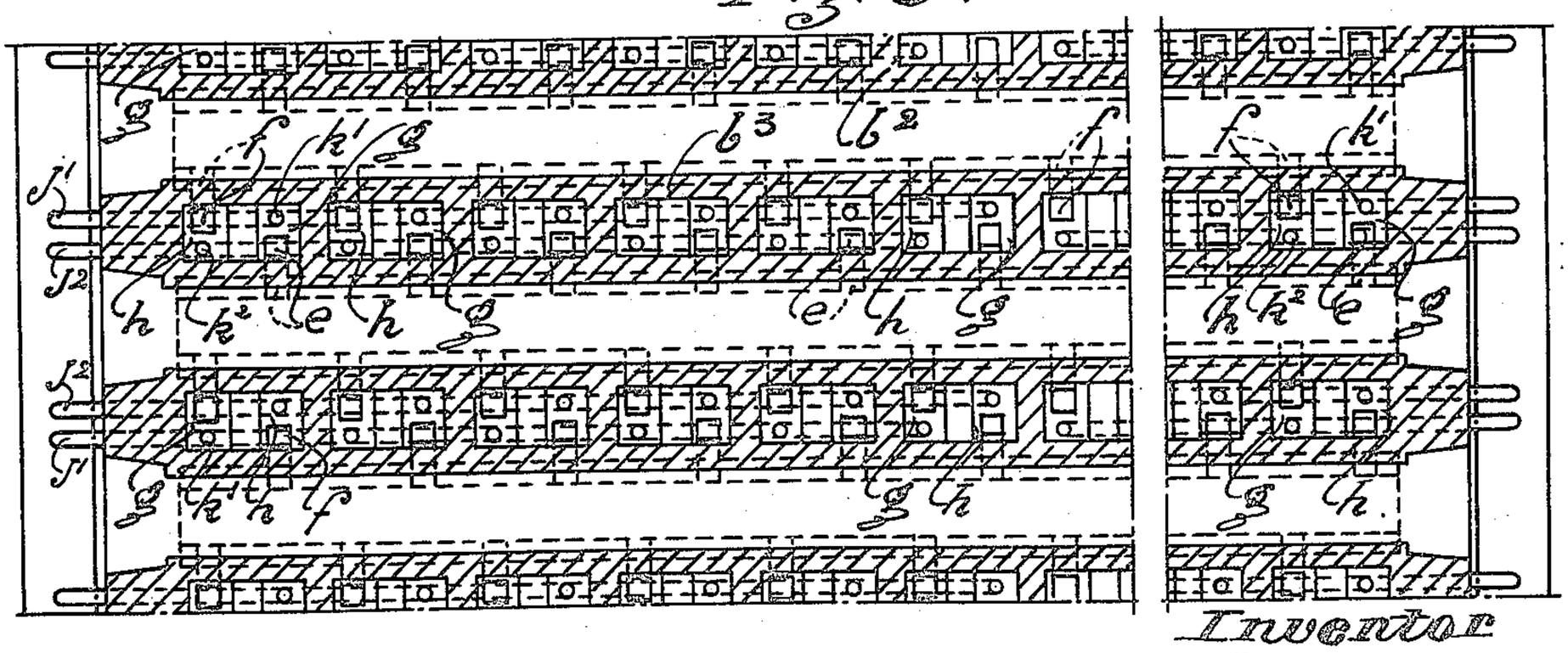

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Fig. 6.

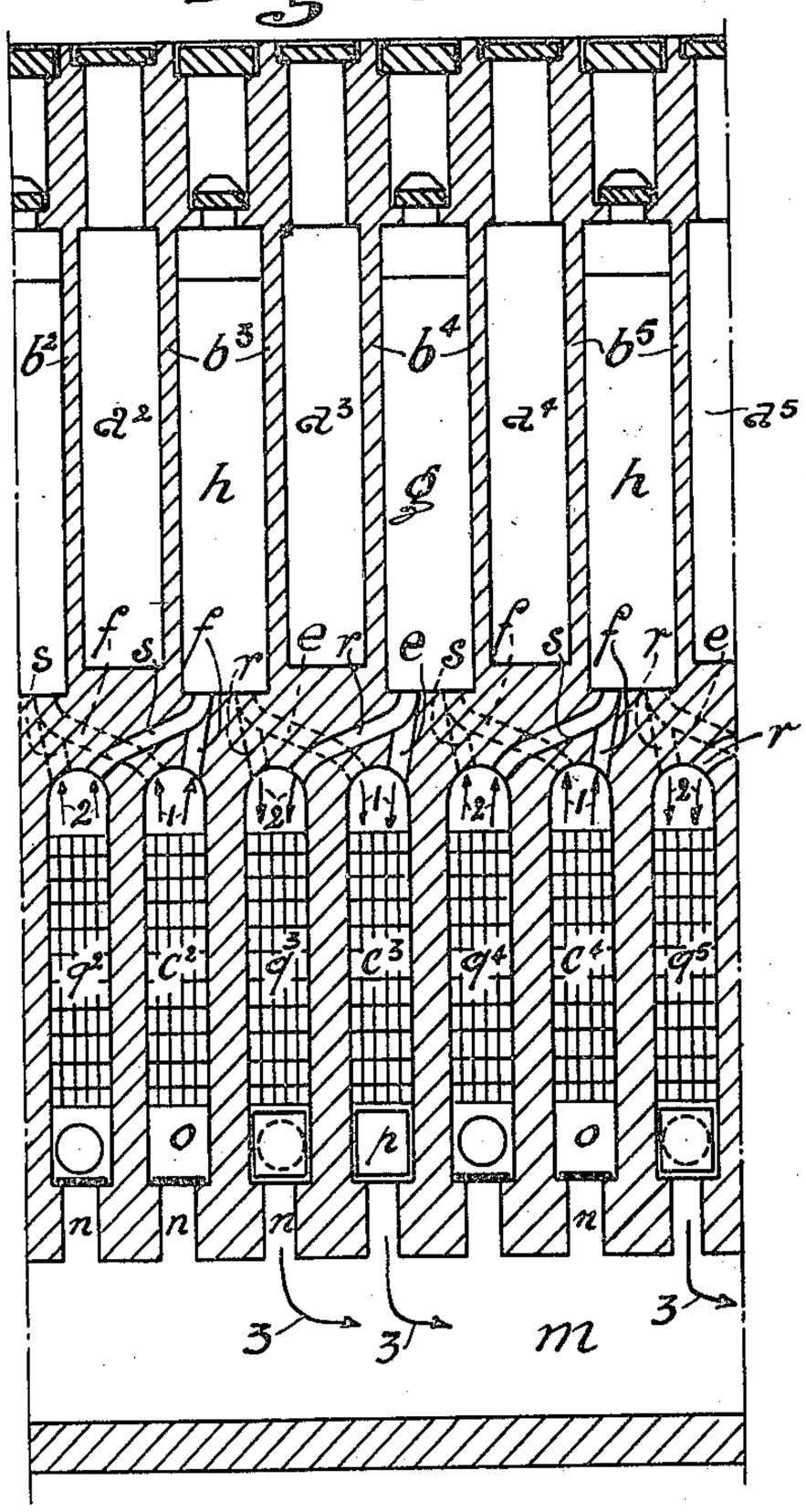
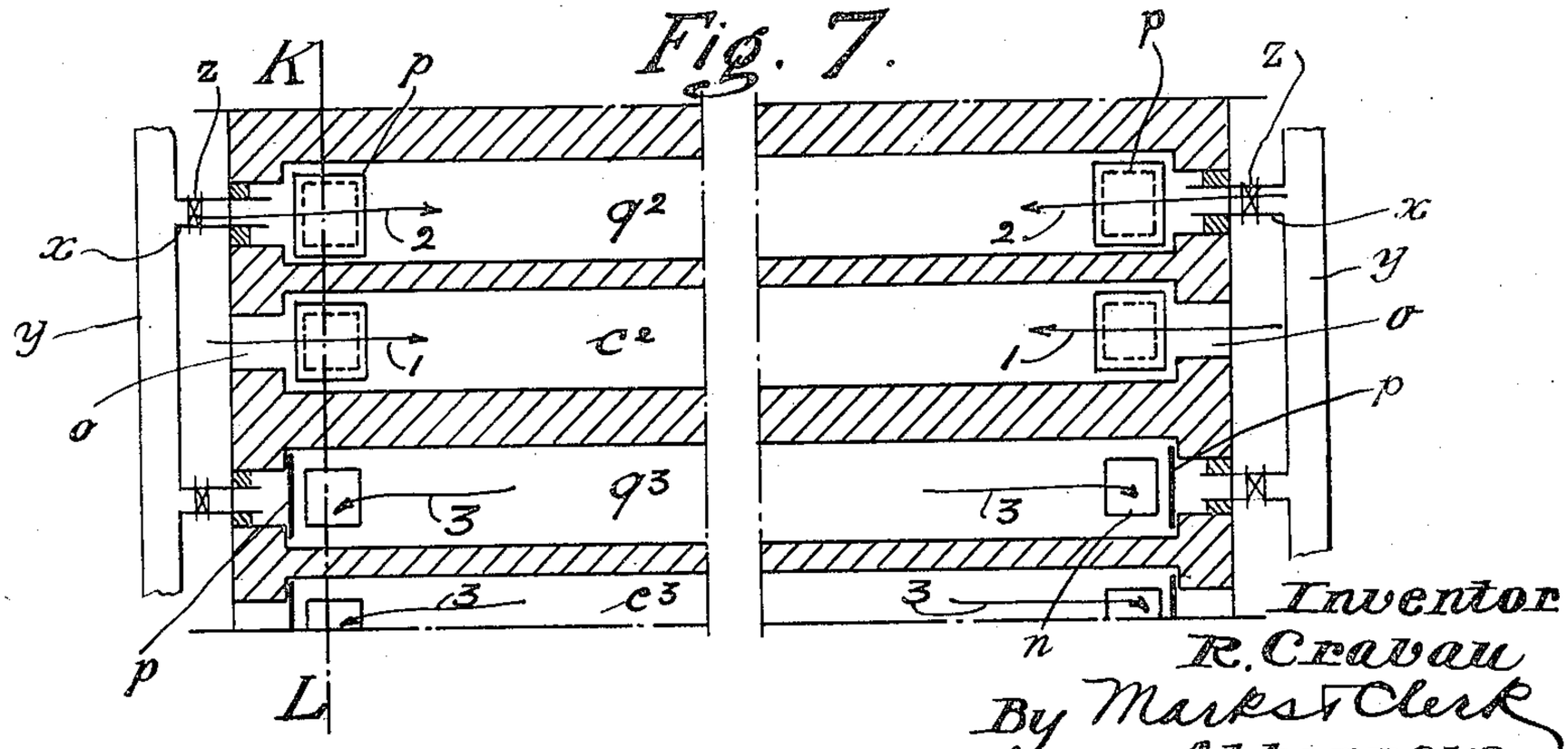


Fig. 7.



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Patented Nov. 18, 1924. 1,516,082

UNITED STATES PATENT OFFICE.

RAOUL CRAVAU, OF BRUSSELS, BELGIUM.

COKE OVEN.

Application filed January 17, 1921. Serial No. 437,927.

To all whom it may concern:

Be it known that I, RAOUL CRAVAU, subject of the King of the Belgians, residing at Brussels, Belgium, have invented new and useful Improvements in Coke Ovens, of which the following is a specification.

This invention relates to coke ovens of the regenerative type, that is wherein provision is made for the recovery of heat and for the periodic reversal of currents of gas in the regenerators. In most ovens of this type the regenerators are each divided into two halves which communicate with one another through the heating flues and are used alternately for heating the air and if necessary the fuel gas, and for recovery of the heat of the burnt gases. In other coke ovens of the regenerative type, however, each regenerator extends throughout the length of the heating walls and the regenerators of even and of odd number are used alternately for heating and for recovering purposes. With this arrangement the regenerators are alternately connected to the smoke stack, the air entering one end of a regenerator and the burnt gases escaping through the opposite end of the next regenerator.

An advantagte of this arrangement is the possibility of uniformly heating the walls by alternating the ascending and the descending flues (i. e. the flues with an upward draught and those with a downward draught) while maintaining parallelism between the gaseous currents in the stacks of brickwork on the one hand and in the heating flues on the other hand.

With this arrangement however a serious difficulty arises in uniformly distributing the gaseous currents throughout the regenerators. Thus, on account of the fact that the air enters one end of the chamber through a horizontal conduit of comparatively small cross-section whence it is distributed into the regenerator through a series of openings, the current of air rushes at high speed and eddies can hardly be avoided; further the static pressure of the air increases as it advances in said conduit and the distribution of the air is influenced accordingly. A similar though reverse action takes place at and near the outlet for the burnt gases.

The object of the present invention is to overcome these difficulties by decreasing the speed of the fluids as they rush into and out of the conduits leading to and from the regenerators, and by reducing the horizontal path they must follow before they reach or after they leave the stacks of brickwork.

In accordance with this invention this object is attained by providing all the regenerators with an air inlet at each end thereof so that the air can be admitted simultaneously through both ends of a regenerator, and by branching all the regenerators on two collector galleries so that the escape of the burnt gases can take place simultaneously through both galleries. Preferably such galleries are connected to the regenerators at or near the ends thereof so that the regenerators may be alternately connected with the outside air and with the collector galleries by means of valves.

In the accompanying drawings which illustrate by way of example two constructions according to the invention,

Figure 1 is a vertical section on line A—B (Figure 3);

Figure 2 is a vertical section through the line C—D in Figure 1;

Figure 3 is a horizontal section on line P—Q (Figure 2);

Figure 4 is a vertical section on line G—H (Figure 1), and

Figure 5 a horizontal section on line I—J (Figure 4) of a battery of ovens burning a rich gas.

Figure 6 is a vertical section on line K—L (Figure 7) and,

Figure 7 a horizontal section in a place corresponding to that of Figure 3, of a battery of coke ovens heated by "poor" or lean gas such as producer or blast furnace gas.

In Figures 1–5, a^2, a^3 indicate the coking chambers, the side walls of which are constituted by the hollow walls b^2, b^3, b^4. Under the coking chambers are provided regenerators c^2, c^3, c^4 containing stacks of heat-retaining material leaving at the upper part of each regenerator a free space or distribution chamber d^2, d^3, d^4 extending throughout the whole length of the walls.

Ducts e e afford a direct communication between each regenerator of odd number c^1, c^2, c^3 . . . and the two adjoining walls and ducts f likewise connect each regenerator of even number c^2, c^4, c^6 . . . direct with the two adjoining walls. Each wall comprises a series of pairs of vertical flues g, h, the flues of each pair communicating with each other at the top. As shown in

Fig. 5, the flues g in any heating wall are arranged opposite the flues h in the adjacent walls. At the bottom of each flue g opens a duct e and at the bottom of each flue h opens a duct f, so that all the pairs of flues g h of one and the same wall are arranged in parallel between a regenerator of odd number and the adjoining regenerator of even number.

The fuel gas is supplied to the flues of the heating walls through main conduits i, i on which are branched conduits j^1, j^1 and j^2, j^2 provided in the brickwork at the base of the walls. The conduits j^1 supply the flues g through the intermediary of tubes k^1 terminating at the base of the said flues, and the conduits j^2 supply in the same way the flues h through the intermediary of tubes k^2.

All the regenerators c^2, c^3, c^4 are connected with two collector galleries m, m which are used in a permanent manner for exhausting the burnt gases. Each regenerator has moreover at each end a conduit o which can be connected direct to the outer air. In this way advantage is taken of the accessibility of both ends of the regenerators extending throughout the whole length of the ovens, for the purpose of bringing about simultaneous introduction of air through their end walls.

The galleries m, m are preferably placed under the block of ovens and connected to the ends of the regenerators by flues n n in such a manner that each flue n opens into the regenerator next to a conduit o, and that the alternate opening and closing of the said two passages can be effected by means of one and the same valve p.

The operation of the ovens is as follows:

If for instance the regenerators of even number c^2, c^4, c^6 are used for heating the air, the regenerators of odd number c^1, c^3, c^5 ... being used then to recover the heat of the burnt gases, the valves p are placed so as to close the flues n of the even regenerators, and the conduits o of the odd regenerators. Cold air passes direct from the outside into all the even regenerators through their two ends and is heated in passing the stacks of material in the upward direction and evenly distributed throughout the whole length of the heating walls owing to the communication established in each regenerator by the chamber d which forms above the stack a free space of sufficient section to ensure equilibrium of pressure from one end of the regenerator to the other.

Through the ducts f, f the hot air escapes into the flues h where it ignites the fuel gas coming from the tubes k^2. The products of combustion rise in the walls through the flues h and descend again through the flues g thus heating the oven very efficiently. Through the ducts e, e the burnt gases reach the regenerators c^1, c^3, c^5 where an equilibrium of pressure is established throughout the whole length of the latter. All the pairs of flues g, h being arranged in parallel between the zones of distribution constituted by the chambers d^2, d^4, d^6... of the regenerators c^2, c^4, c^6 and the chambers d^1, d^3, d^5 ... of the regenerators c^1, c^3, c^5, it follows that there will be a uniform draft in all the heating flues.

In the odd regenerators the burnt gases give off the greater portion of their heat on contact with the stacks of material through which they pass in the downward direction. They divide into two equal currents which are drawn simultaneously through the flues n situated at the two ends of the regenerators, then through the galleries m which are in open communication with the chimney. The arrows 1, 2, 3 indicate the respective paths of the air, fuel gas and products of combustion during this period.

It will be seen that the circulation of the gaseous currents in the stacks of material takes place in a methodical and efficient manner. The air passes through the regenerators in an upward direction, and in the downward direction the gases are cooled. Moreover, as the air is heated, it comes in contact with surfaces the temperature of which progressively increases, while as the burnt gases are cooled, they pass between walls of decreasing temperature.

On the other hand, the air coming direct from the outside through the two ends of the regenerators, does not meet any appreciable resistance. There are no sole flues nor horizontal conduits at the top of the heating walls, and the draft of the chimney has to overcome only the resistance met by the gaseous currents after their escape from the heating flues.

When the stacks of the odd regenerators have been raised to a sufficient temperature, the direction of travel of the gaseous currents in the heating walls is reversed. To that end, the admission of the fuel gas to the conduits j^2 and k^2 which supply the flues h is cut off, the valves p of the odd regenerators are raised, the valves p of the oven regenerators are lowered, and the fuel gas is admitted into the conduits j^1 and k^1 which feed the flues g. These movements are effected successively by means of suitable apparatus of well known construction. The direction of the gaseous currents is then reversed in the regenerators and in the heating walls, but the direction of the main currents in the galleries m remains the same.

In that way the reversal of the main currents is avoided, thus dispensing with registers and valves which, in existing ovens, give rise to injurious admission of air, produce resistance to the passage of gaseous currents and bring about by their operation losses of heat owing to the peri-

odical expulsion of volumes of inert fluids filling the galleries at the moment of each reversal.

The present invention is also applicable to coke ovens heated by poor gas coming for instance from producers or blast furnaces and requiring a preliminary heating. In this case under each carbonizing chamber is arranged a pair of regenerators c^1, c^2, c^3 . . . and q^1, q^2, q^3 . . . arranged side by side (Figure 6) and extending throughout the whole length of the heating walls. The regenerators c^1, c^2, c^3 . . . are used for heating the air and arranged in the same way as in Figures 1–5. They are connected alternately with the outside air through conduits o, and with the collector galleries m m through flues n, and they also have a permanent connection to the flues g and h of the heating walls by ducts e and f. The regenerators q^1, q^2, q^3 . . . are used for heating the fuel gas. By means of valves p these regenerators are alternately connected at their ends with gas mains y through pipes x and valves z, and with the collector galleries m m on which all these regenerators are branched. Ducts r and s arranged in the same way as the ducts e and f, connect the regenerators q^1, q^2, q^3 . . . to the flues g and h of the two adjoining heating walls. The arrows 1, 2, 3, show respectively the travel of the currents of air, fuel gas and burnt gases during the period in which the regenerators of even numbers are used for heating the air and the gas, while the regenerators of odd numbers are used for recovering the heat from the products of combustion.

What I claim and desire to secure by Letters Patent of the United States is:

1. In coke ovens of the regenerative type, the combination of coking chambers, heating flues in the walls between adjacent chambers, regenerators arranged under said chambers extending over substantially the whole length of said walls, upwardly extending ducts connecting said regenerators to said heating flues, conduits in both end walls of each regenerator affording direct communication between the outside air and both ends of said regenerators, two galleries arranged in parallel beneath all of the regenerators and at the respective ends thereof, other conduits establishing communication between the galleries and the respective ends of the regenerators and positioned adjacent the first mentioned conduits, and valve members mounted in the regenerators for alternately covering each of said conduits and consequently regulating communication between the regenerators and the galleries and the regenerators and the outside air, substantially as and for the purposes set forth.

2. In coke ovens of the regenerative type the combination of coking chambers, heating flues in the walls between the adjacent chambers, regenerators arranged under said chambers and extending over substantially the whole length of the walls, ducts arranged in suitable spaced intervals throughout the length of said regenerators for directly connecting the regenerators to the flues in the adjacent walls, conduits arranged in both end walls of each regenerator for establishing direct communication between the outside air and both ends of said regenerators, main conduits located exteriorly of the walls for conducting fuel gas, aligning conduits arranged beneath the heating flues in the walls having branches connecting with the flues and having their outer ends connecting with the main fuel gas conduits, spaced galleries arranged parallel to each other transversely beneath said regenerators, conduits between the galleries and the respective ends of each of the regenerators, and valves arranged in the ends of the regenerators and cooperating with the conduits leading from the galleries and the fresh air conduits into the regenerators for alternately connecting each of said regenerators to both of said galleries and to both of said last mentioned conduits, substantially as and for the purposes set forth.

3. A coke oven of the character described including a walled body structure, a series of alternately arranged coking chambers and heating flues arranged transversely of the body structure, a series of transversely arranged regenerators in the walled structure and beneath the coking chambers and arranged in communication with the heating flues, conduits provided transversely of the body and leading from opposite walls and arranged transversely beneath the heating flues and in communication therewith for controlling the supply of fuel gas thereto, conduits arranged through opposed walls and communicating with the respective ends of each of the regenerators for permitting the passage of outside air into the respective ends of the regenerators, galleries arranged at the base of the walled structure transversely beneath all of the regenerators and each being arranged in communication with the respective ends of each of the regenerators, and means mounted in the ends of each of the regenerators for alternately connecting each of said regenerators to both of said fresh air intake conduits and to both of said galleries, substantially as and for the purposes set forth.

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

RAOUL CRAVAU.

Witnesses:

HENRY W. PLUCKER,

B. M. TILAPATINY.