L. G. FROMONT.

GAS FURNACE.

APPLICATION FILED APR. 6, 1905.

900,845. Patented Oct. 13, 1908.

4 SHEETS—SHEET 1.

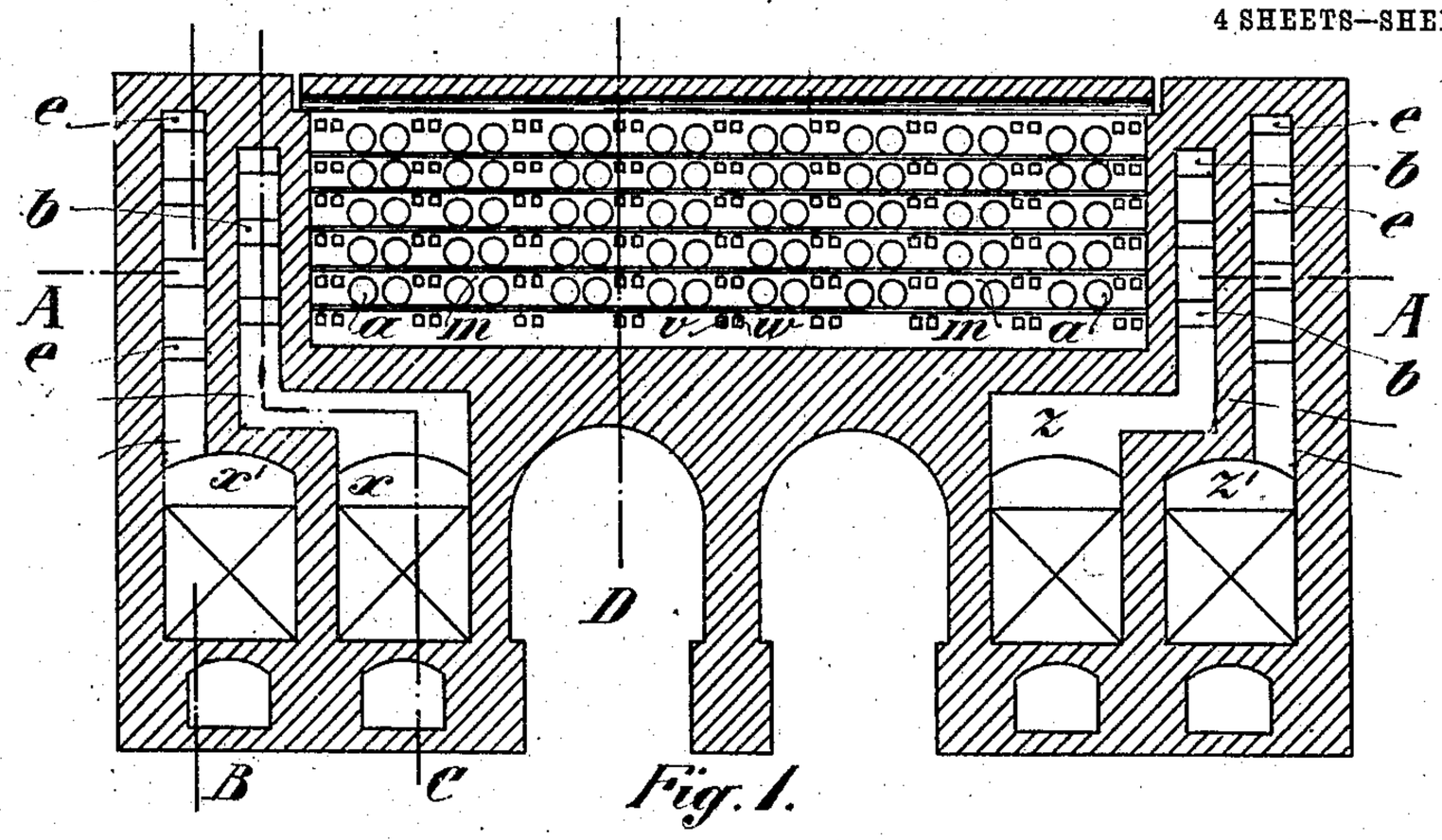

Fig. 1.

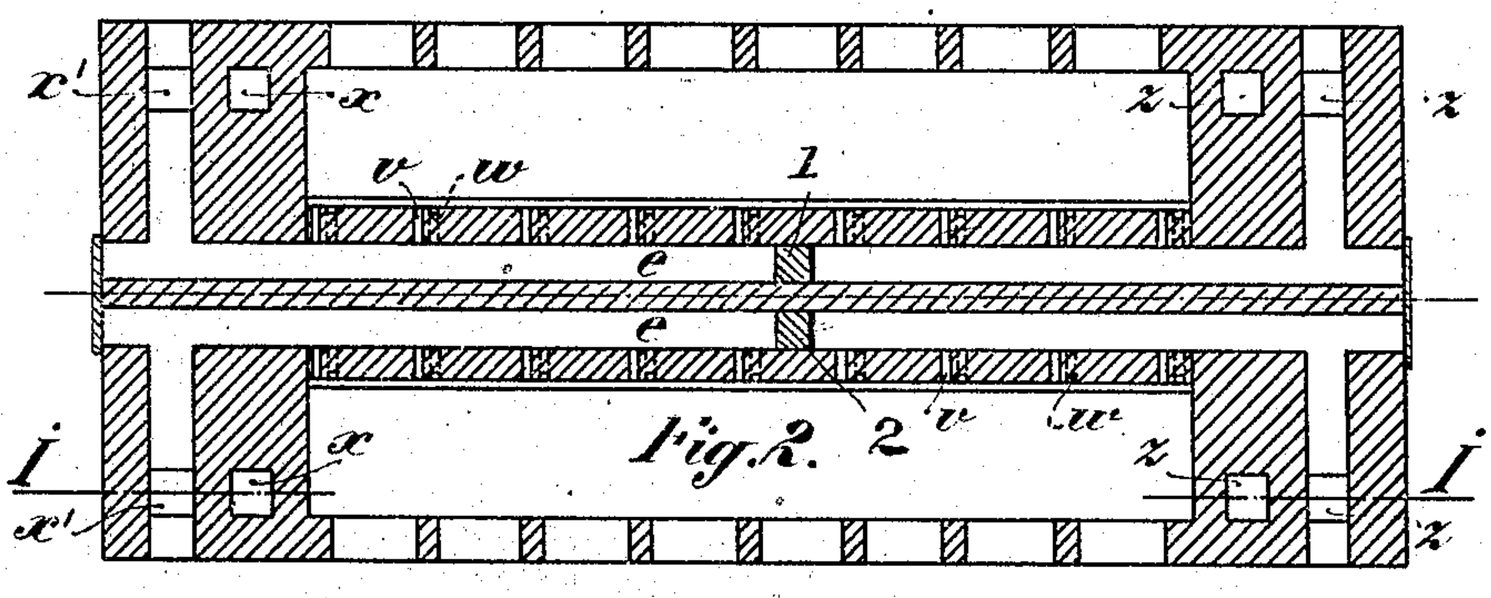

Fig. 2.

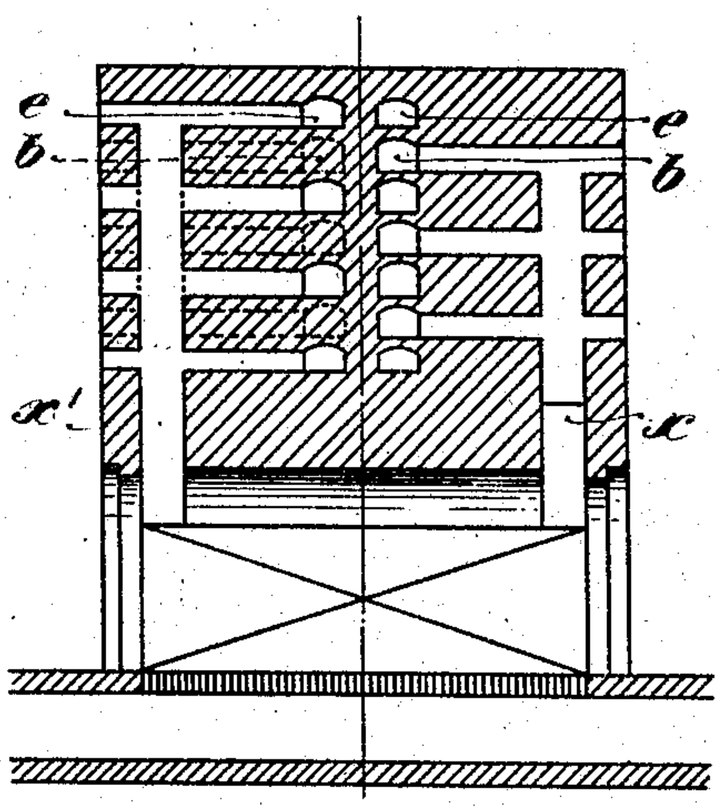

Fig. 3.

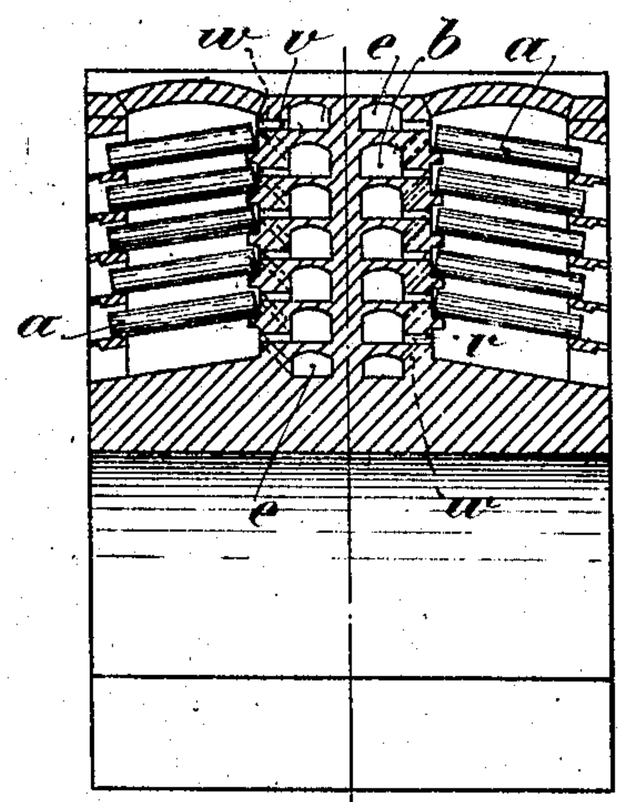

Fig. 4.

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4 SHEETS—SHEET 2.

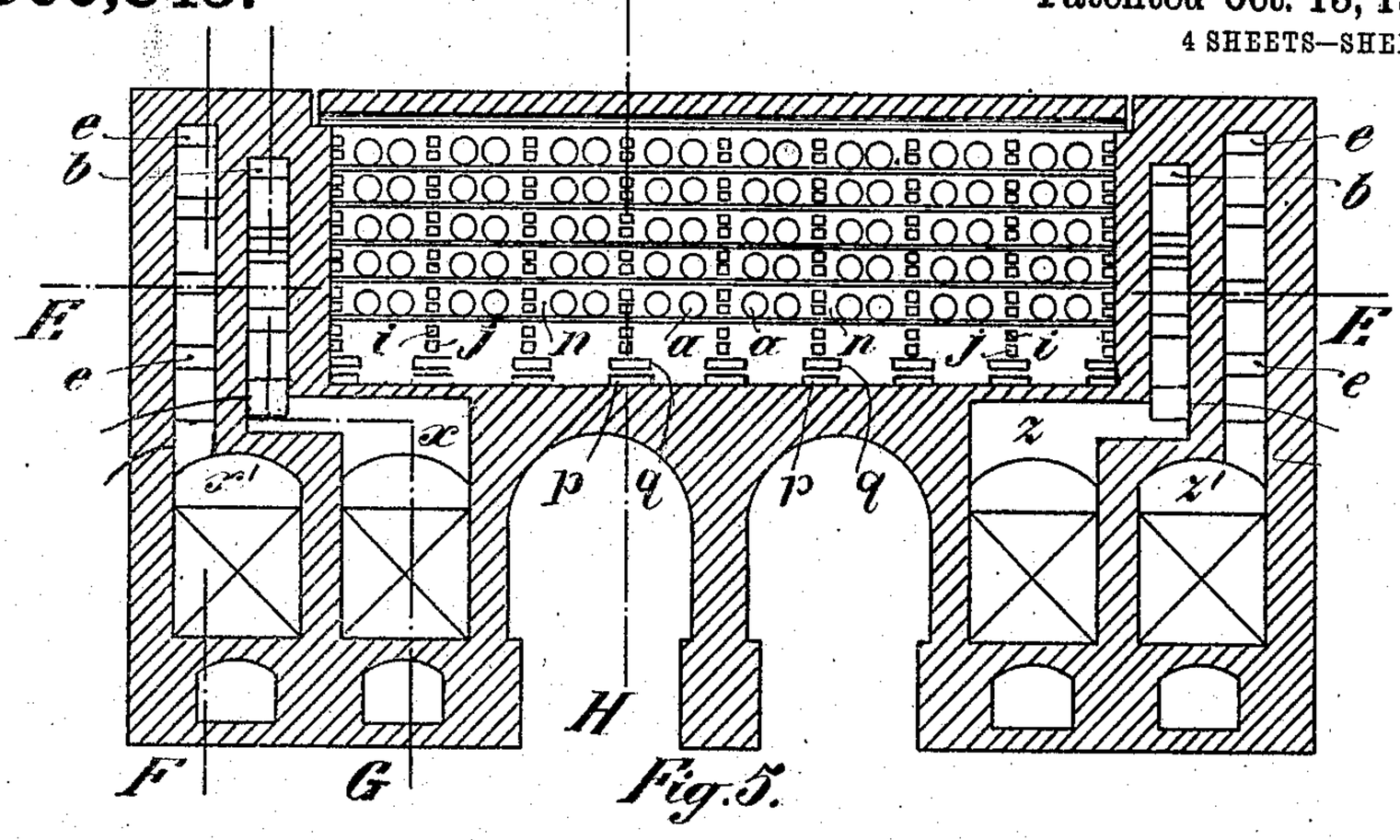

Fig. 5.

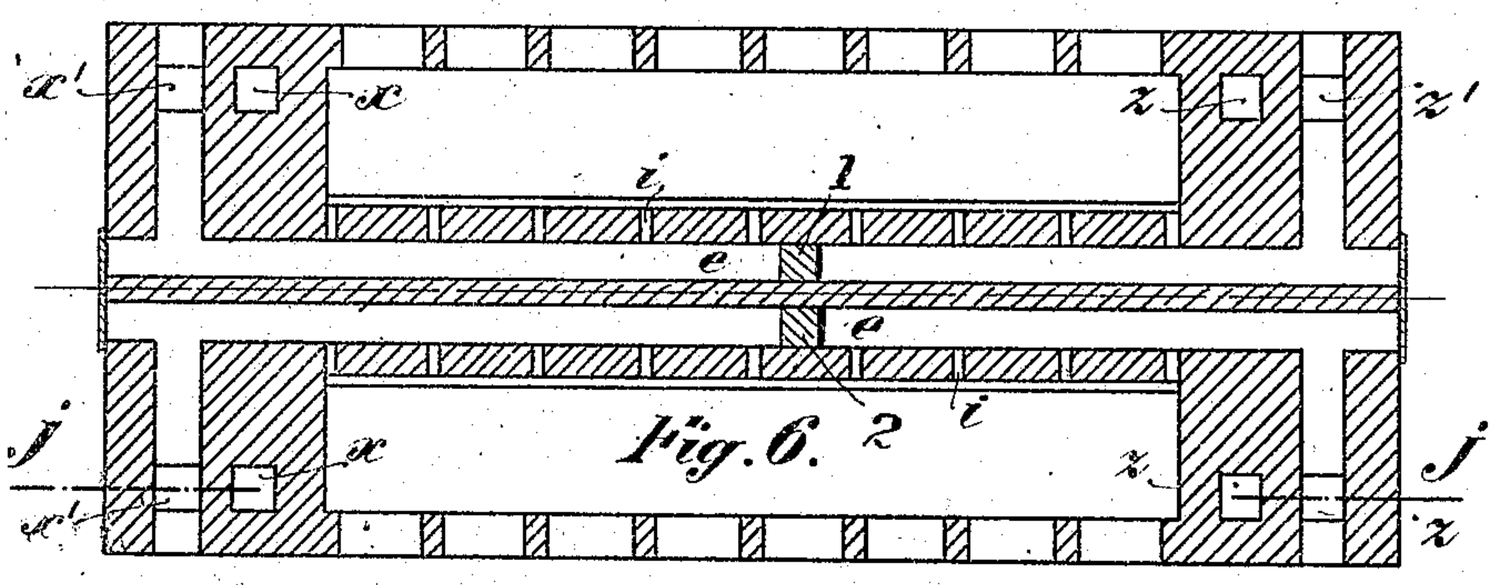

Fig. 6.

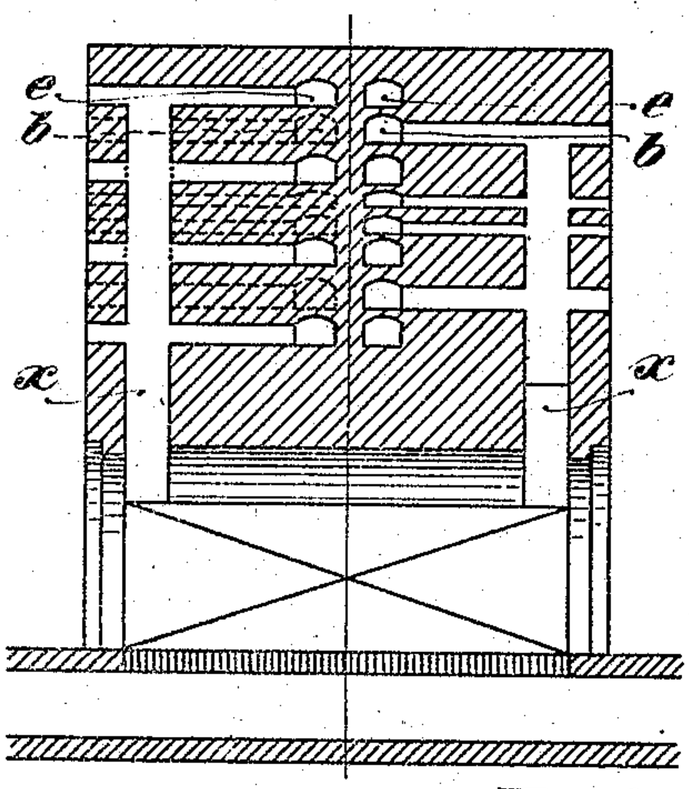

Fig. 7.

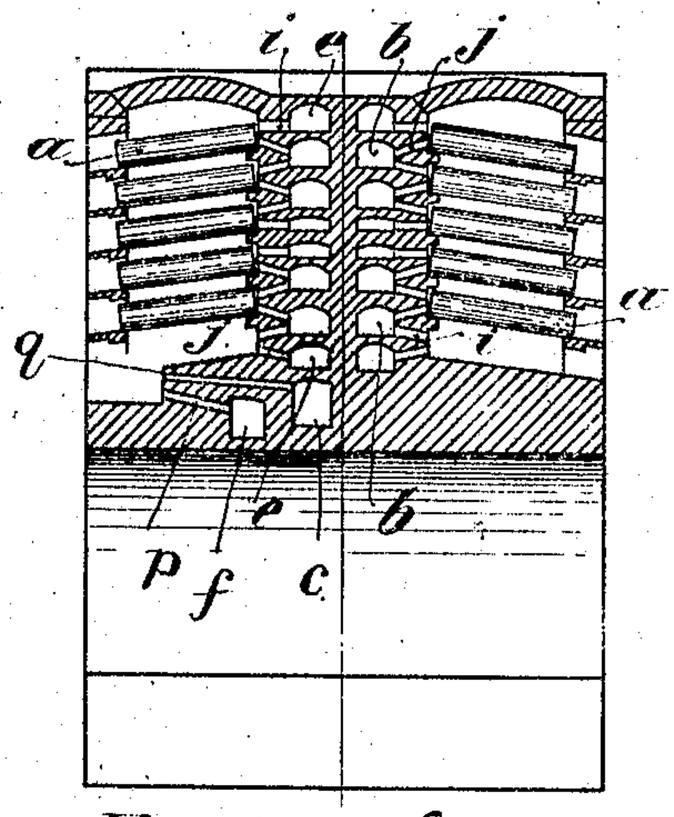

Fig. 8.

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4 SHEETS—SHEET 3

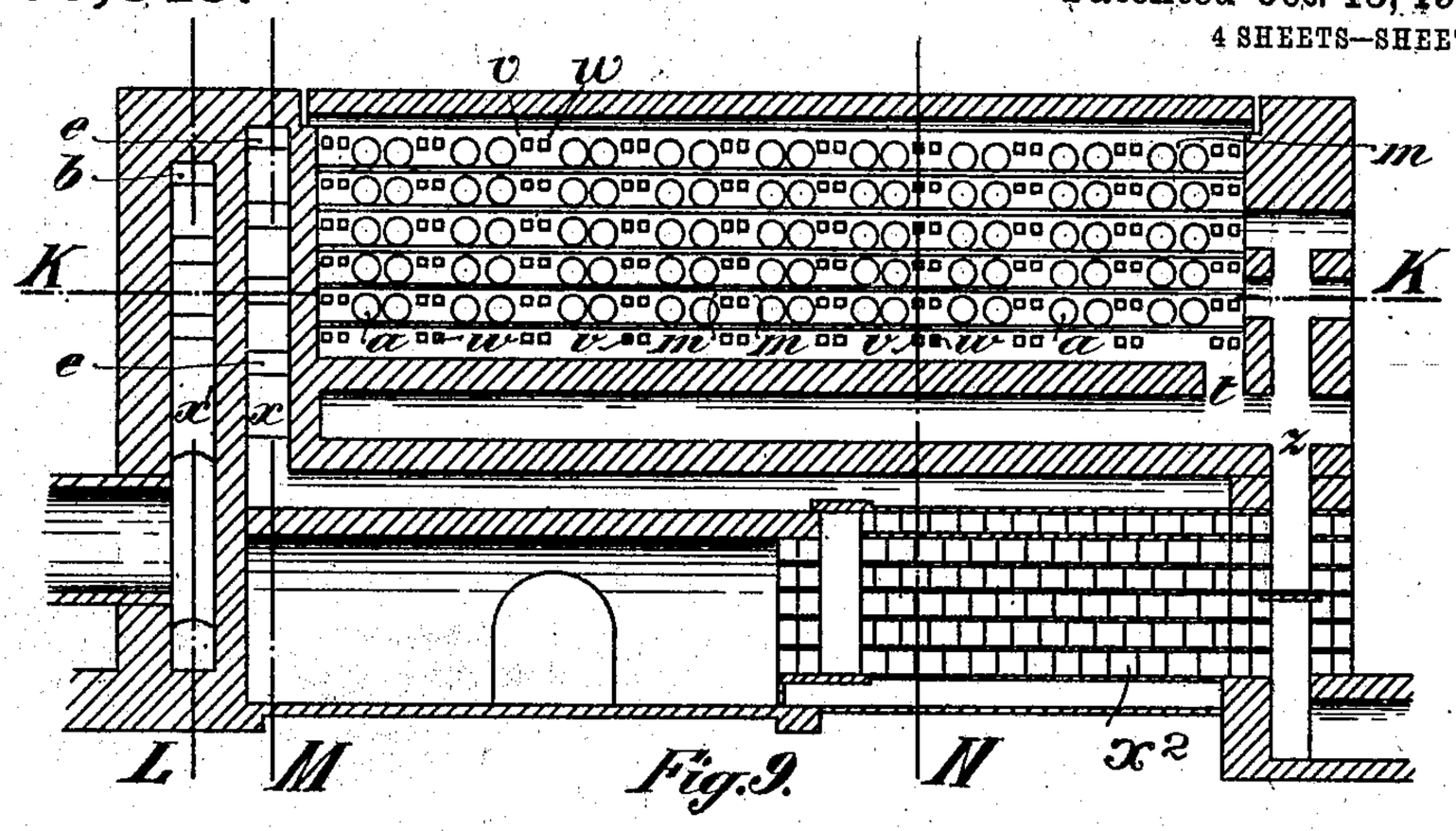

Fig. 9.

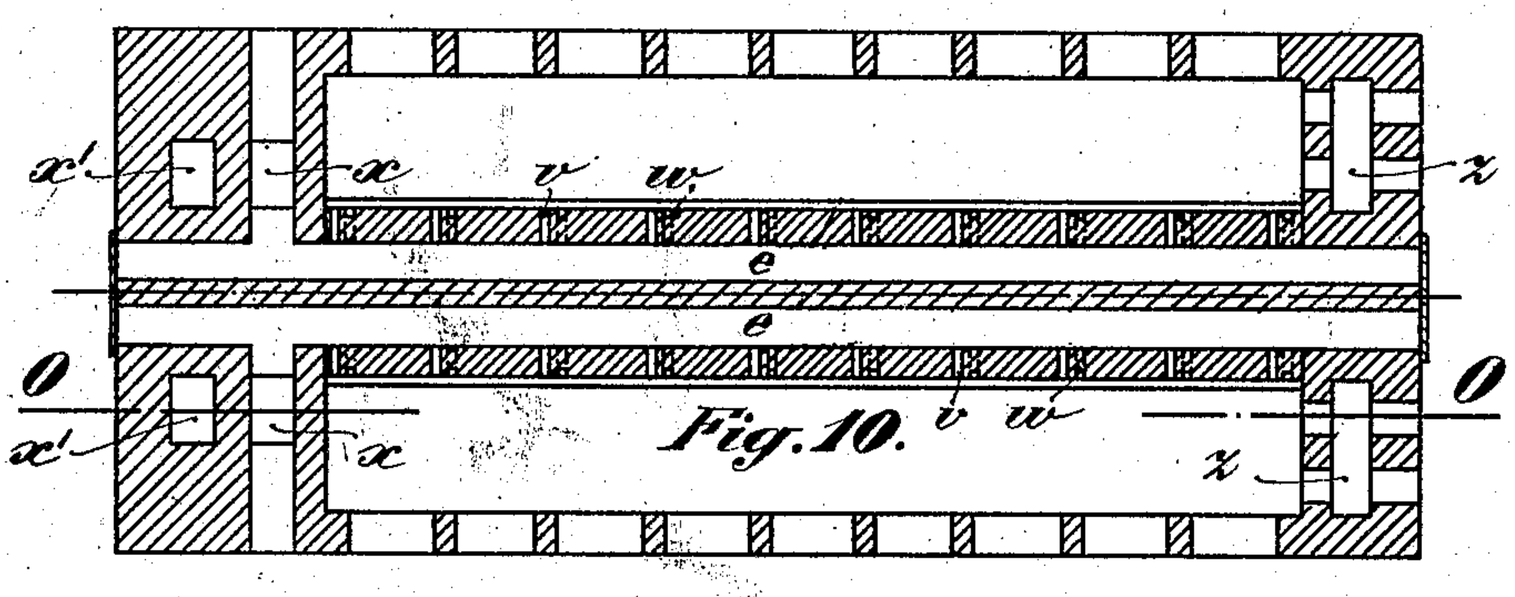

Fig. 10.

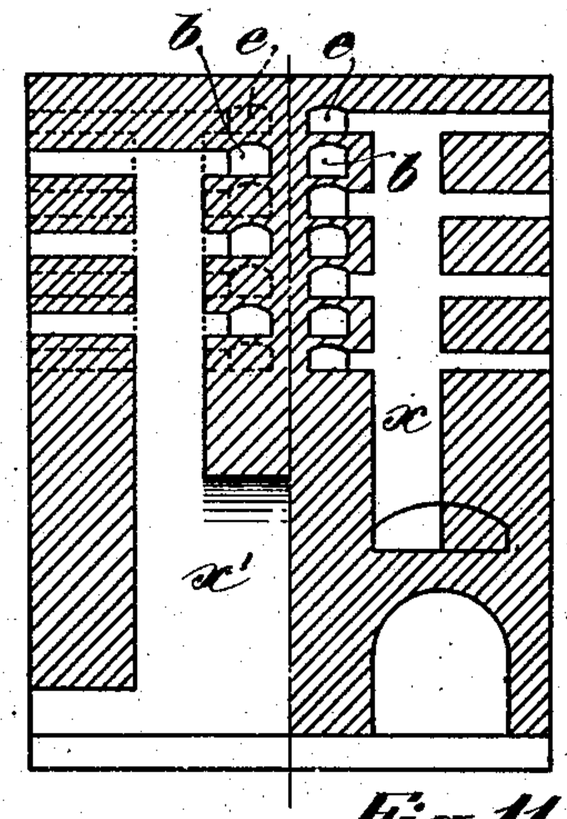

Fig. 11.

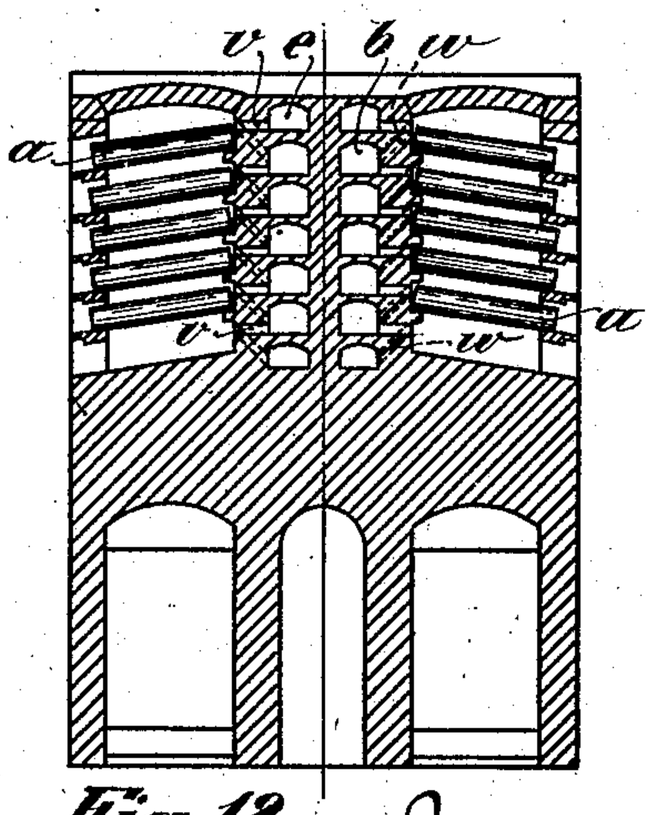

Fig. 12.

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4 SHEETS—SHEET 4.

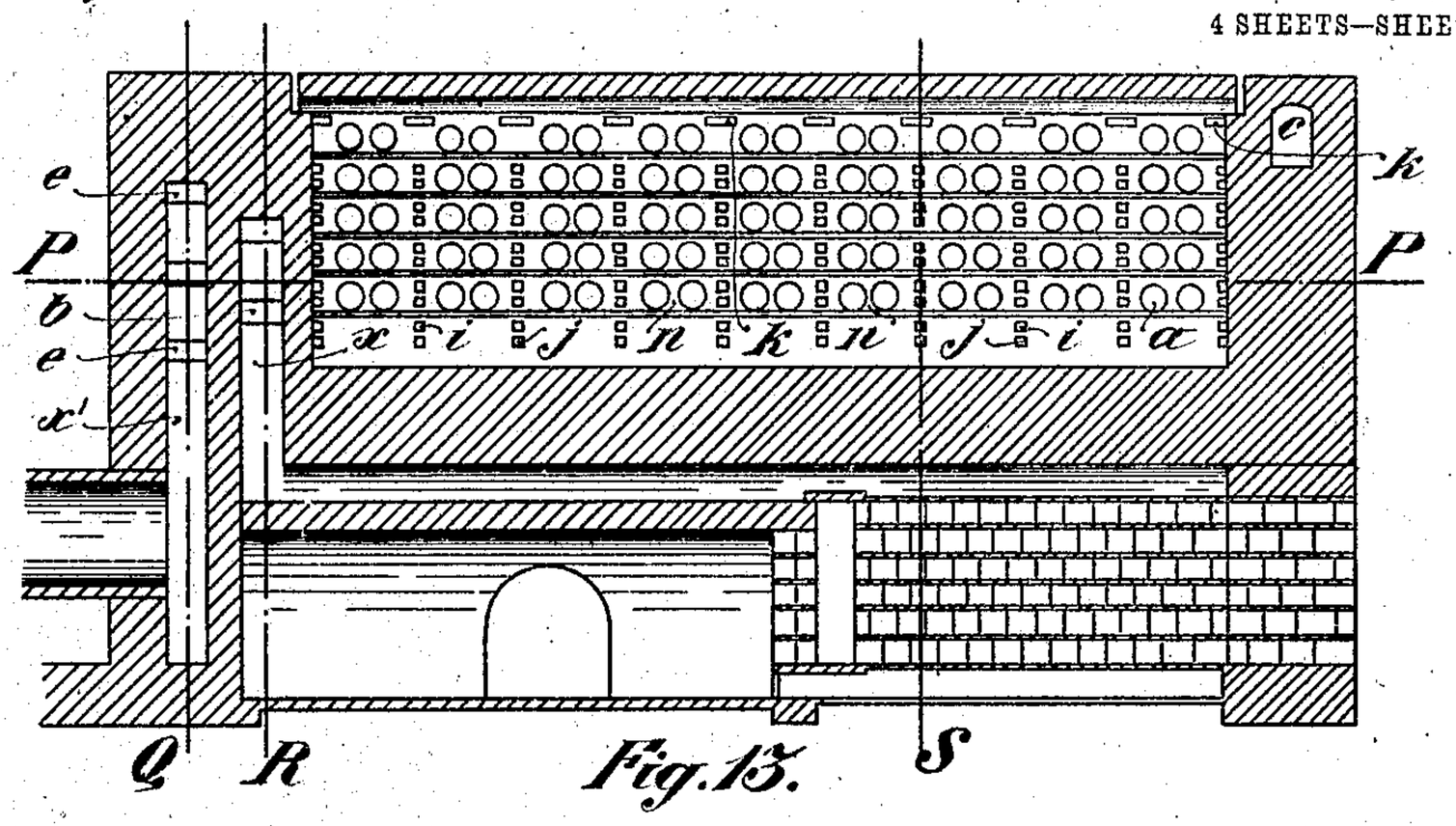

Fig. 13.

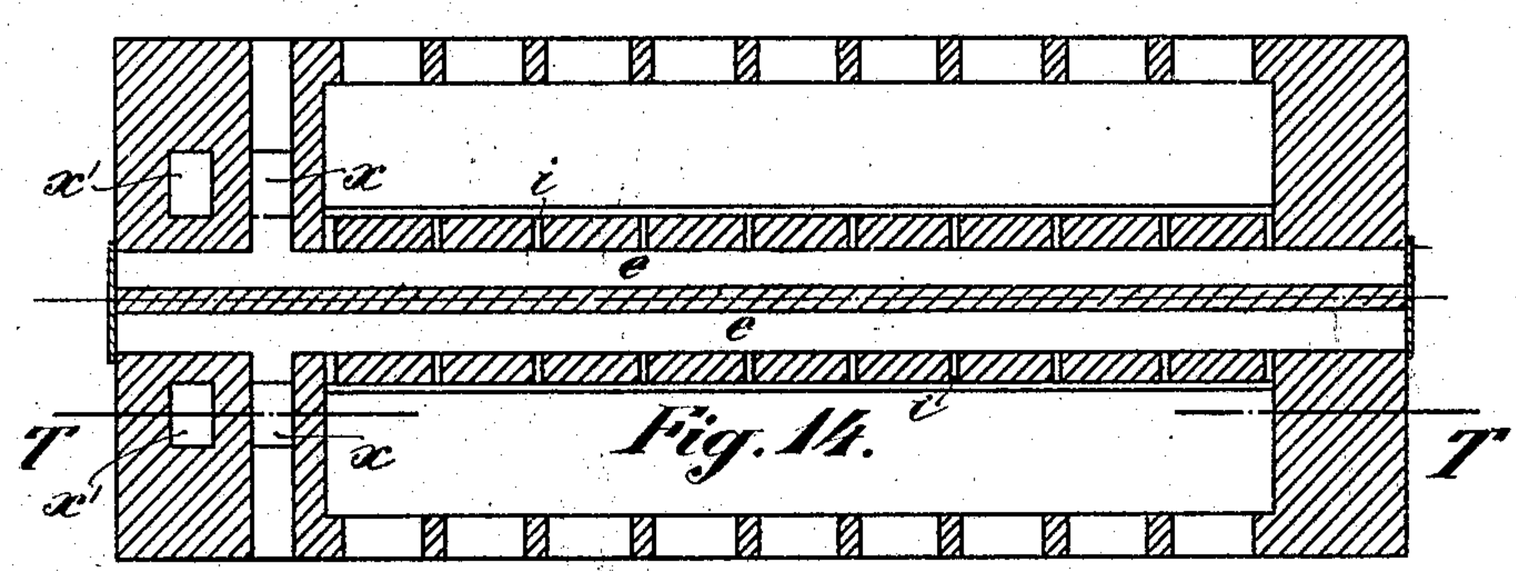

Fig. 14.

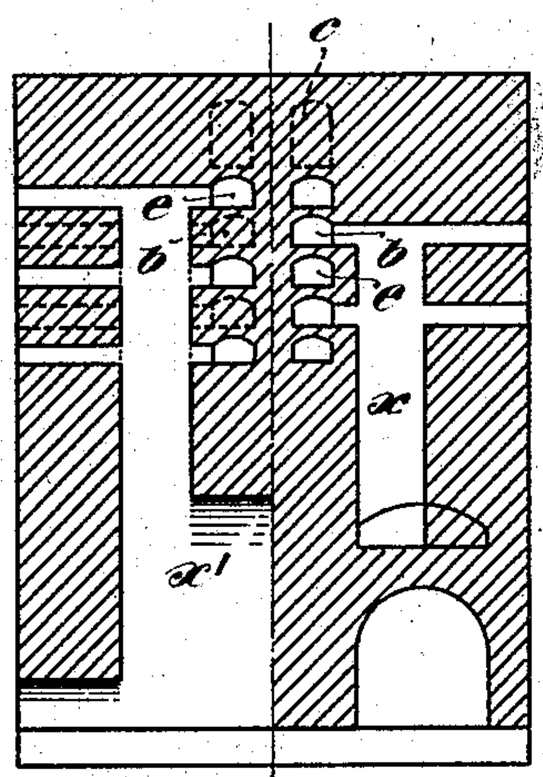

Fig. 15.

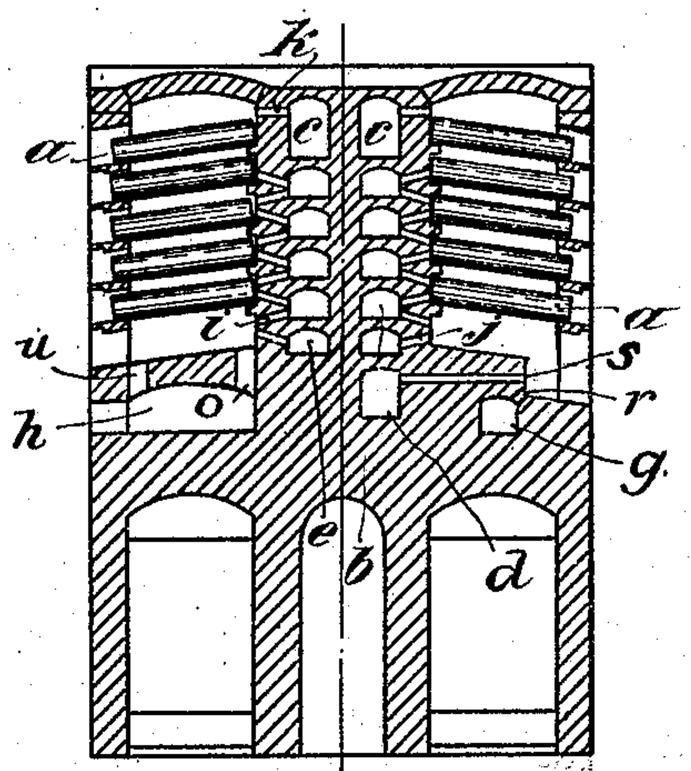

Fig. 16.

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UNITED STATES PATENT OFFICE.

LOUIS GEORGES FROMONT, OF LIEGE, BELGIUM.

GAS-FURNACE.

No. 900,845. Specification of Letters Patent. Patented Oct. 13, 1908.

Application filed April 6, 1905. Serial No. 254,168.

To all whom it may concern:

Be it known that I, LOUIS GEORGES FROMONT, subject of the King of Belgium, residing at Liege, Belgium, have invented certain new and useful Improvements in Gas-Furnaces; and I do hereby declare the following to be a clear and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

Gas furnaces, and particularly regenerative gas furnaces used in the manufacture of zinc, as heretofore constructed, have been unsatisfactory because of the unequal distribution of heat through the various parts. Also in kilns in which the gases of combustion are caused to travel alternately in opposite vertical directions, which kilns are always divided into two chambers, serving alternately as combustion and exhaust chambers, it has been necessary to employ extremely gaseous coal which is expensive and difficult to obtain in many localities. These defects in furnaces of the character referred to as commonly constructed, are avoided by the present invention.

In the accompanying drawing, Figure 1 is a vertical section, on the line I—I, of Fig. 2, through a furnace in which the combustion gases move horizontally and alternately in opposite directions, constructed in accordance with the present invention; Fig. 2 is a horizontal section on the line A—A of Fig. 1; Fig. 3 is a vertical section through the furnace, the left hand portion thereof being on the line B—B, of Fig. 1 and the right hand portion on the line C—C of said figure; Fig. 4 is a vertical section on the line D—D of Fig. 1; Fig. 5 is a vertical section on the line J—J of Fig. 6, through a reversing furnace in which the combustion gases move vertically; Fig. 6 is a horizontal section on the line E—E of Fig. 5; Fig. 7 is a vertical sectional view, the left hand portion thereof being on the line F—F of Fig. 5 and the right hand portion on the line G—G of said figure; Fig. 8 is a vertical section on the line H—H of Fig. 5; Fig. 9 is a view on the line O—O of Fig. 10 similar to Figs. 1 and 5 through a non-reversing furnace in which the combustion gases move horizontally; Fig. 10 is a horizontal section on the line K—K of Fig. 9; Fig. 11 is a vertical section through the furnace, the left hand portion thereof being on the line L—L of Fig. 9 and the right hand portion on the line M—M of Fig. 9; Fig. 12 is a sectional view on the line N—N of Fig. 9; Fig. 13 is a vertical section on the line T—T of Fig. 14 through a non-reversing furnace in which the combustion gases move vertically; Fig. 14 is a horizontal section on the line P—P of Fig. 13; Fig. 15 is a vertical section the left hand portion being on the line Q—Q of Fig. 13 and the right hand portion on the line R—R of said figure; and Fig. 16 is a vertical section on the line S—S of Fig. 13.

The type of furnace illustrated in the drawings is that in which there are provided two independent furnace chambers separated by a central partition in which are formed two sets of channels *b*, *e*, said channels extending throughout the length of the furnace and having their outer ends closed by suitable means. The channels *e* communicate with chambers *x*, *z*, of two regenerators, and the channels *b* communicate respectively with similar chambers *x'*, *z'*, in said regenerators. The admission and direction of movement of air and gases from the regenerators and through the furnace chambers and channels *b*, *e*, are controlled by suitable valves represented at 1, 2, in Figs. 2 and 6 in the ordinary manner.

The retorts *a* are preferably arranged in the furnace chambers in the manner illustrated, being grouped in pairs and supported substantially horizontal. The retorts of each group or pairs are separated by a distance of three to four centimeters and the groups in the same horizontal plane, are separated from each other by a space of thirteen to fourteen centimeters. Such separation of the groups of retorts is necessary in order that the refractory plates on which the retorts rest may be properly supported by refractory pillars. The pillars supporting the retorts form a series of "dead spaces" between the several groups of retorts, which spaces have heretofore not been employed in heating the furnace.

The retorts in one horizontal plane are separated from those above and below them by a distance of fourteen centimeters, which separation is necessary in order that the retort supporting projections on the central wall between the furnace chambers may be sufficiently strong to bear the weight placed thereon. This separation tends to form a series of "dead spaces" between the different rows or layers of retorts. These "dead spaces" formed in the furnace chambers as above described, and which have heretofore

not been utilized, are, by the present invention, made effective as the passages or openings connecting the air and gas channels with the furnace chambers are caused to open into the said chambers through said "dead spaces."

In the furnace illustrated in Figs. 1 to 4 and 9 to 12, the inlet apertures or burners are arranged in the horizontal "dead spaces" *m*, each consisting of two apertures *v*, *w*, communicating respectively with the channels *b*, *e*. Said apertures or burner openings *v*, *w*, are arranged in the same horizontal plane or one behind the other with relation to the direction of movement of the gases through the furnace. By this arrangement the currents of gas and air which enter the furnace chamber through any burner will be immediately and intimately mixed without the employment of any obstacle in the path of such currents to effect such mixing.

In the form of furnace illustrated in Figs. 5 to 8 and 13 to 16, in which the combustion gases move vertically through the furnace, each burner also includes two orifices *i*, *j*, which are arranged in the vertical "dead spaces" *n* and communicate respectively with the flues or channels *e*, *b*. The relative arrangement of the burner openings *i*, *j*, it will be seen is the same as that of the openings *v*, *w*, previously described.

In the reversing furnace illustrated in Figs. 1 to 8, it will be understood that the gas and air are alternately admitted through the burners adjacent one end of the furnace and withdrawn or escapes through the corresponding burner openings adjacent the opposite end of the furnace. For example, and referring to Fig. 1, if gas is supplied to the regenerator *x* it will enter the furnace chambers through the channels or flues *b* and the burner openings *v* and air will enter said chambers from the regenerator *x'* and through the flues or channels *e* and the openings *w*. The products of combustion will pass from the furnace chambers through the openings *v*, *w*, at the right hand side of the furnace and the flues or channels *b*, *e*, into the regenerators *z*, *z'*. In this type of furnace the combustion flames pass horizontally and by properly adjusting suitable valves the direction of movement of the gases and air may be reversed. That is, the regenerators *z*, *z'* may serve to supply gas and air to the furnace while the chambers *x*, *x'* receive the products of combustion instead of the latter supplying the air and gas as before described.

In the continuous furnace illustrated in Figs. 9 to 16 the gas and air is constantly supplied through the burners and the products of combustion pass from the furnace or escape through orifices *k* and flues *e* (in the vertical combustion furnace illustrated in Figs. 13 to 16) or by orifices *l* at the extremities of the furnace in the horizontal combustion furnace illustrated in Figs. 9 to 12.

Among the advantages possessed by a furnace constructed as hereinbefore described and illustrated in the drawings may be noted that as the gas and air are admitted to the furnace at numerous points and throughout the entire height and length of the furnace chambers, complete combustion and equable diffusion of heat are effected throughout the entire furnace. As the combustion takes place in free spaces between the retorts, it is more complete and advantageous than when effected in the manner heretofore commonly followed. With such a furnace it is possible to employ combustibles which are relatively poor in volatile constituents, because the length or extent of flame is reduced to a minimum and also the maximum amount of space within the furnace is employed.

The invention may be embodied in non-intermittent recuperation furnaces for heating the air as well as for reversible regenerator furnaces for heating air and gas or only heating air and may also be employed in furnaces which are not provided with regenerators or recuperators. It may also be employed in reversible regenerator furnaces in which the reversal takes place round an imaginary vertical axis of gyration, or round an imaginary horizontal axis of gyration. Indeed reversal round an imaginary horizontal axis can only be effected by the means herein described.

By the invention it is possible to construct furnaces of maximum size in which there will be an equable diversion of heat throughout the entire length and height of the furnace and a material economy of labor and consumption of fuel effected.

By providing an equable temperature throughout the furnace the duration of life of the furnace, as well as the retorts, muffles, pots or crucibles containing the material to be treated, is materially increased.

Having thus described the invention what is claimed and desired to be secured by Letters-Patent is,

1. A gas furnace having a plurality of retorts therein and having burners arranged in the spaces between the retorts, each burner consisting of two orifices which extend laterally from and respectively communicate at their outer ends with air and gas channels, the inner ends of said orifices being in alinement in the direction of movement of the gases within the furnace chamber.

2. A gas furnace having a plurality of furnace chambers, retorts arranged in tiers in said chambers, a central partition separating said chambers and provided with flues and a tier of burners opening into each chamber, each burner comprising two orifices for the admission of air and gas, respectively arranged one behind the other with relation to

the direction in which the gases move in the furnace.

3. A gas furnace provided with a plurality of independent furnace chambers, a central partition separating said chambers, a series of gas channels in said partition, a series of air channels in said partitions, exhaust channels leading from the furnace chambers, and apertures connecting the furnace chambers with said channels, said chambers and channels being arranged and coöperating so that the courses traversed by the air and gas are constantly the same length and so that the course traversed is of minimum length.

4. In a gas furnace having a plurality of independent furnace chambers each adapted to support a series of retorts, a partition separating two of said chambers and provided with a plurality of interior channels or ducts, said ducts communicating with apertures opening into the retort chambers between the retorts therein and corresponding in number to the number of retorts in said chamber, substantially as and for the purpose described.

5. In a gas furnace having a plurality of independent furnace chambers each adapted to support a series of retorts, a partition separating two of said chambers and provided with a plurality of longitudinally extending independent air and gas ducts, each communicating with apertures opening into the retort chambers between the retorts therein, said apertures being arranged in pairs and the members of each pair communicating respectively with an air and gas duct.

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

LOUIS GEORGES FROMONT.

Witnesses:
ALBERT LECOCQ,
MICHIEL BERGMANS.