3 Sheets—Sheet 1.

H. SEGER & H. DUEBERG.

GAS KILN FOR BURNING BRICK.

No. 179,069. Patented June 20, 1876.

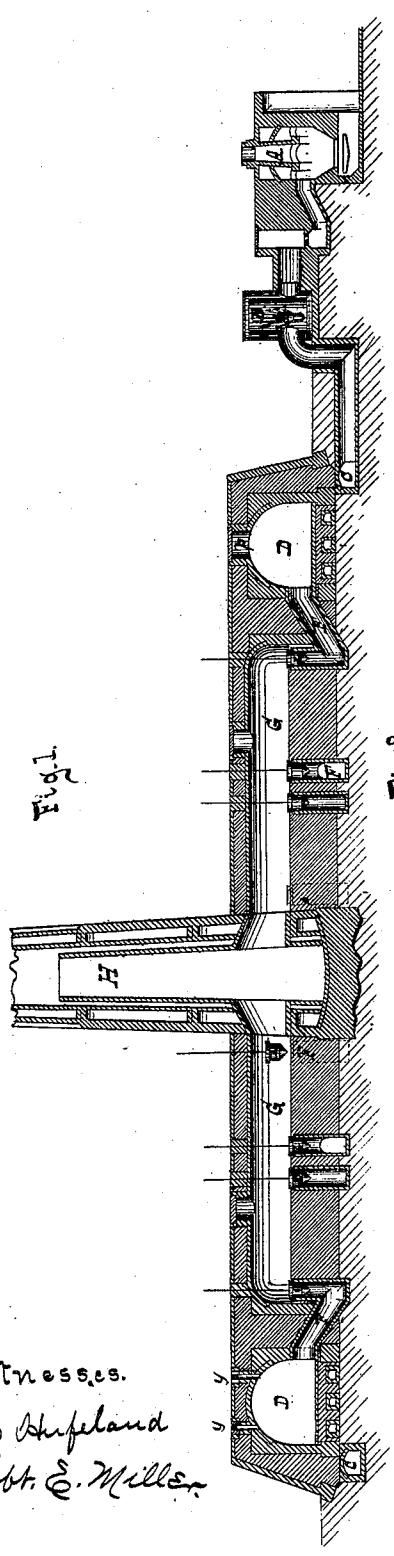

Fig. 1.

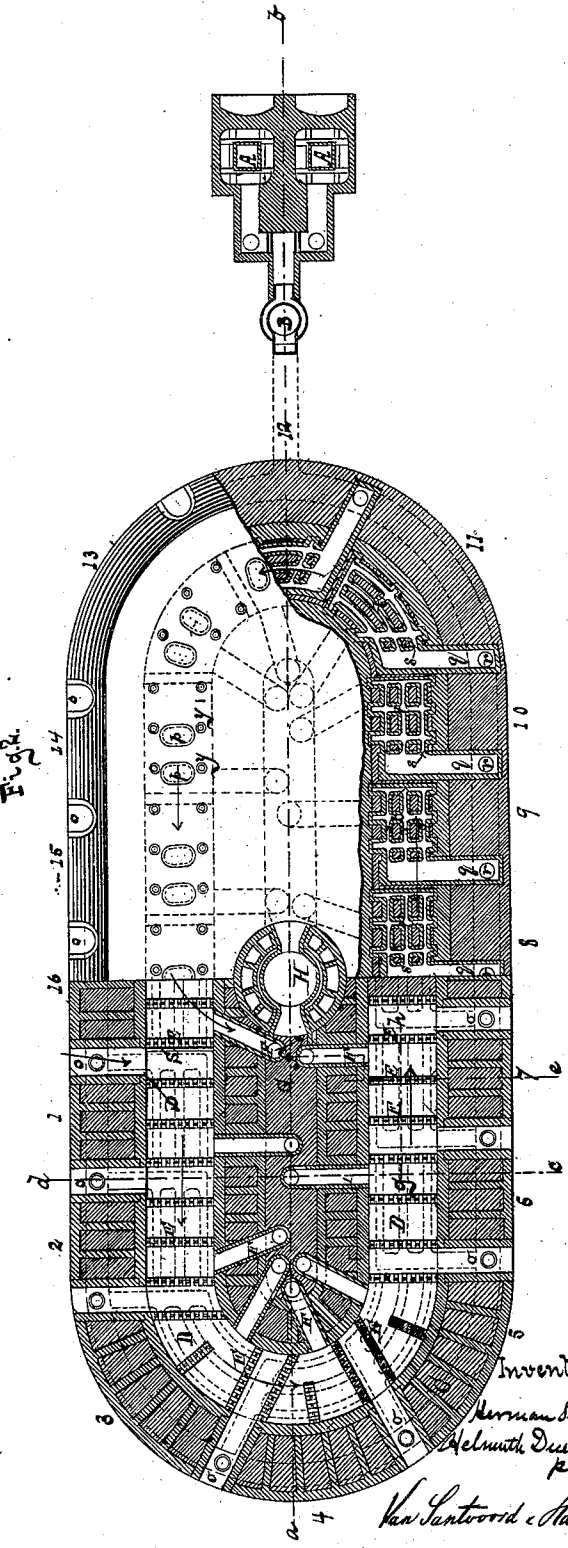

Fig. 2.

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Fig. 3.

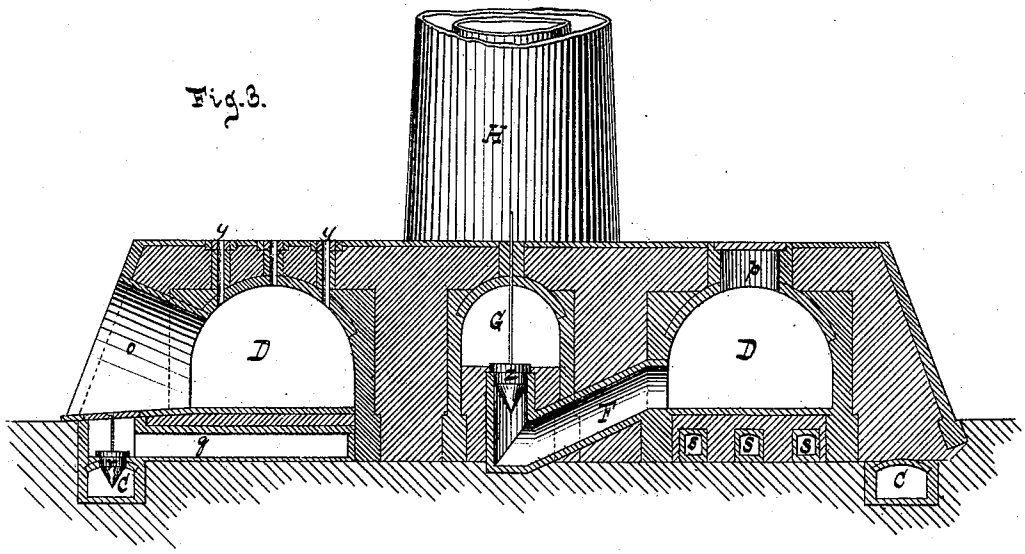

Fig. 4.

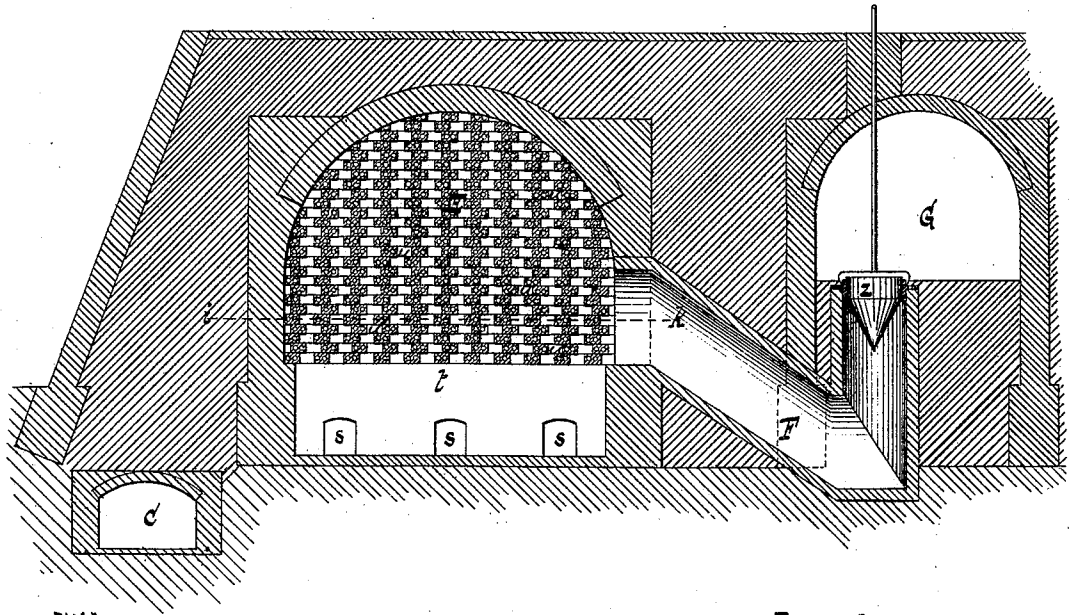

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Fig. 5.

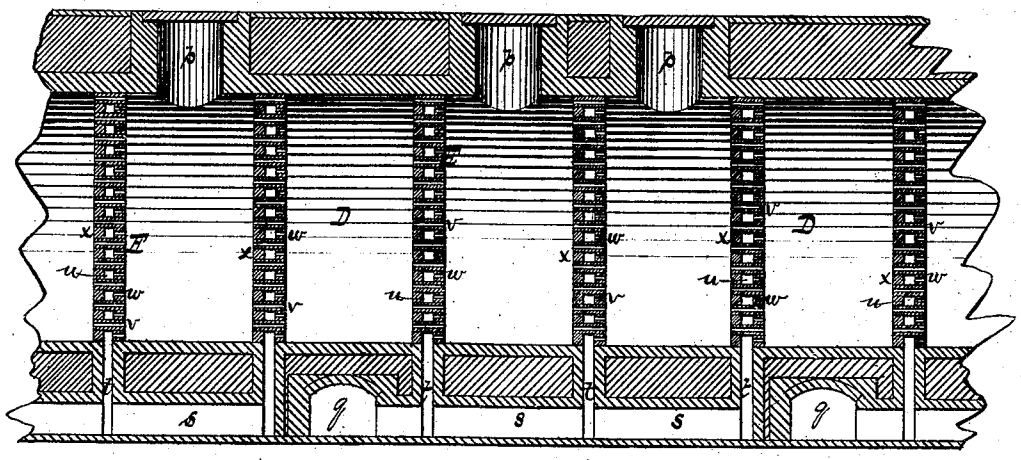
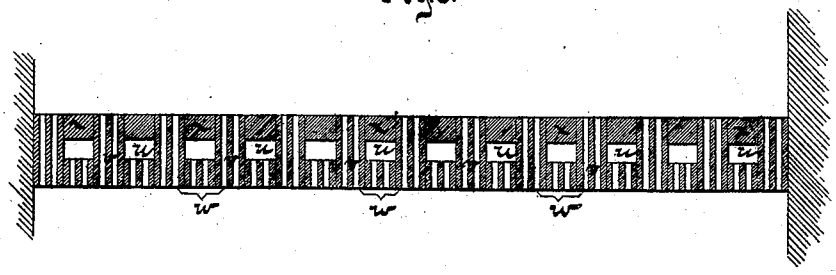


Fig. 6.



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UNITED STATES PATENT OFFICE.

HERMANN SEGER AND HELMUTH DUEBERG, OF BERLIN, PRUSSIA.

IMPROVEMENT IN GAS-KILNS FOR BURNING BRICKS.

Specification forming part of Letters Patent No. **179,069**, dated June 20, 1876; application filed April 21, 1876.

To all whom it may concern:

Be it known that we, HERMANN SEGER and HELMUTH DUEBERG, both of the city of Berlin, Kingdom of Prussia, have invented a new and Improved Gas-Kiln for Burning Bricks, Pottery-Ware, &c., which improvement is fully set forth in the following specification, reference being had to the accompanying drawing, in which—

Figure 1 represents a longitudinal vertical section of our kiln in the plane *a b*, Fig. 2. Fig. 2 is a plan view thereof, partly in section. Fig. 3 is a transverse section in the plane *c d*, Fig. 2. Fig. 4 is a transverse section in the plane *e f*, Fig. 2. Fig. 5 is a longitudinal section in the plane *g h*, Fig. 2, and on a larger scale than the previous figures. Fig. 6 is a horizontal section in the plane *i k*, Fig. 2, and on a scale which is larger than the previous figures.

Similar letters indicate corresponding parts.

Our invention relates to the application of combustible gases—such as carbonic oxide, &c.—to the burning of bricks, tiles, pottery-ware, and articles of a similar nature, and particularly in that class of kilns known as "progressive kilns," for which Letters Patent of the United States were granted to Frederick E. Hoffmann, June 13, 1865, No. 48,244, the object of substituting gas for coal, wood, and other solid fuel being mainly to keep the kiln free from ashes and other impurities.

Our invention consists in such devices for the admission of gas into the kiln as will insure a uniform distribution of the gas and a proper mixture of it with atmospheric air, whereby perfect combustion and a uniform heat are insured. The kiln has a burning-gallery, which is divided into sections, to which the gas is admitted successively, and also constructed with suitable openings or doorways for the admission of atmospheric air. The gas is admitted through walls, by which the burning-gallery is divided into sections, and which, to this end, are provided with vertical flues, these walls being also provided with perforations for the passage of atmospheric air, so that a continuous draft may be established throughout the burning-gallery, and so that the gas is caused to mix with the air and become ignited as they escape together from the walls. The vertical gas-flues in the walls receive the gas from a supply-flue, having suitable branches and valves, and which is adapted to be connected with a gas-generator.

In the drawing, the letter A designates a gas-generator for producing carbonic oxide from coal or other substance, and the construction of which is sufficiently well known not to require any description. B is a condenser, which is arranged to receive the gas escaping from the generator A, and in which steam, tar, and other impurities that may be contained in the gas are condensed. C is a supply-flue, which serves to conduct the gas to the kiln. This supply-flue C is preferably placed under ground, as seen in Fig. 1, and it extends entirely around the kiln, as shown in dotted outline in Fig. 2, being provided with various branches, which will be hereinafter specifically referred to.

The kiln is constructed principally of a burning-gallery, D, of one or more smoke-chambers, G, and a chimney, H. The burning-gallery D may be made either circular or oblong, (as shown in the drawing,) or elliptic, or of any other selected shape. It is divided into a series of sections by walls E, which are perforated so that they do not disturb the continuity of the gallery. The gallery, however, is adapted to be shut off at different points by means of a gate, S, Fig. 2, which is made detachable, so that it can be moved from one section to another, being placed alongside the walls E, and access being had thereto through doorways *o* formed in the outer wall of the kiln. The sections of the burning-gallery are marked 1 to 16 respectively. From each section of the burning-gallery D extends a smoke-flue, F, which leads into the smoke-chamber, G, and each of the smoke-flues F is provided with a valve, Z, Fig. 1, by which they may be opened and closed at will. In the present example each section of the gallery D has three walls, E. Their number, however, may be more or less, according to the kind of ware to be burned in the kiln. The gas-supply flue C is provided with branches *q*, (see Fig. 2, lower right-hand side,) the number of which branches corresponds to the number of sections in the burning-gallery. A communi-

cation between these branch flues *q* and the main flue C may be established or interrupted at will through valves *r*. From each of the branch flues *q* extend a series of smaller flues, *s*, which run along under each section of the gallery, and these last-named flues *s* communicate with each other through passages *t*, of which there are as many as there are walls E in the gallery, one being immediately below each wall. The passages *t* extend upward into the interior of the walls E, (best seen in Fig. 5,) where they form vertical flues *u*, which are faced on one side with perforated bricks *w*, through which the gas is admitted to the kiln, and on the other side with solid bricks *x*. The walls E are built up almost entirely of perforated bricks, part of which pass all the way through the walls, as at *v*, Fig. 6, and serve to establish a communication of one side thereof with the other. The rest of the perforated bricks, marked *w*, are those before mentioned as establishing a communication between the flues *u* and the exterior of the walls. Those parts of the burning-gallery D which are not accessible from the doorways *o o*, on account of the walls E, are charged with goods through openings *p* (see Fig. 3) formed in the arch of the burning-gallery. Instead of these openings, however, doorways may be made in the outer wall of the kiln to communicate with that part of each section of the gallery situated between the walls. In the arch of the burning-gallery D are also formed loop-holes *y* for controlling the fire.

The operation of our kiln is substantially similar to that of the said Frederick E. Hoffman's kiln, which is described in his Letters Patent above mentioned, differing from it, however, in the application of gas instead of solid fuel. We begin by shutting the gate S between the sections 1 and 16, leaving open the doorways *o o* of sections 1 and 2, and closing all the rest of the doorways in the usual manner, with bricks having clay spread over them. The smoke-flue F of section 16 is opened by lifting its valve Z while the remaining smoke-flues are closed.

A continuous draft of air is then allowed to pass through the burning-gallery in the direction of the arrows marked on it in Fig. 2, entering by the open doorways of sections 1 and 2, thence passing throughout the gallery, and finally leaving it through the open smoke-flue F of section 16. In passing through the burning-gallery the air goes through the perforated bricks *v* in the walls E, so that if gas is allowed to escape from the flues *u* in such walls, a mixture of the gas with the air takes place. The gas is intended to be admitted to each section of the gallery successively, and to this end the feed-walls E are each provided with a valve, *r*, as before stated; or, in other words, the burning is carried on only in one section at a time. Say that section 1 is empty and to be filled with goods to be burned while the burning is going on in section 9, sections 2, 3, 4, 5, 6, 7, and 8 being full of burned goods, and sections 10, 11, 12, 13, 14, 15, and 16 full of goods to be burned. It is obvious that during the time section 2 is being emptied, the atmospheric air entering through the open doorways of sections 1 and 2, before reaching section 9, is compelled to pass through the burned goods in the intervening sections, thereby gradually cooling the goods and itself taking up heat, so that when the air enters section 9 it is intensely heated. If the gas-supply valve *r* of section 9 is opened (all the other gas-valves being closed) the gas discharges into section 9 through the perforated walls E, and as the gas comes in contact with the hot atmospheric air coming from section 8 it is instantly ignited. It will be noticed that the gas, while ascending in the flues *u* of the walls E, is also heated before being ignited. The intensity of the fire is regulated by the quantity of gas admitted by the valve *r* as well as by the draft of air permitted by the smoke-valve Z of section 16. The products of combustion are carried, by the draft from section 9, through the remaining sections of the kiln, (10, 11, 12, &c.,) thereby heating the raw goods contained in them, and becoming themselves gradually cooled, until such products finally escape through the smoke-flue F of section 16 into the smoke-chamber G, and thence to the chimney.

While the combustion is going on in section 9, the contents of section 10 become heated by the waste heat of section 9 carried along by the draft. When the goods in section 9 are sufficiently burned, the gas-valve *r* of this section is shut and that of section 10 opened. The fire then burns in section 10 instead of 9, as before. At the same time the shutter S is taken out of its place between the sections 16 and 1, and moved between sections 1 and 2, section 1 being by this time filled with raw goods and its feed-door closed. The discharge-valve Z of section 16 is, at the same time, closed and that of section 1 opened, and, by this means, the products of combustion are caused to pass also through section 1, so that the moisture is taken from the goods contained in this section. Section 2 is, in the meantime, emptied of burned goods and the doorway of section 3 opened, so as to permit of also taking out the burned goods contained in this section, which will have by this time sufficiently cooled down.

While the goods are being taken from section 3 section 2 may refilled with raw goods. In this way the operation of the kiln goes on, the fire being allowed to advance from section to section, and the shutter S being removed, as the gas-supply valves are successively opened, while a corresponding change is made in the escape-valve Z, and one doorway is closed and another opened. The length of time required for the firing of each section of the kiln varies with the different kinds of ware to be burned, some requiring a longer, and others a shorter, time of burning.

It is evident that the gas is not liable to take fire in the vertical flues *u* of the walls, owing to the fact that they are open only on one side, and no atmospheric air is admitted to them.

The perforations *v*, in the bricks of the walls, should be sufficiently large or numerous as to let so much atmospheric air pass through each wall as is required for the combustion of the gas. When three walls are made to each section the gas discharging at the first wall should consume only about one-third of the atmospheric air, that discharged at the second wall another third, and that discharged at the third wall the last third part.

While the perforations *v* of the walls should be made as large as possible, the outlet-orifices of the flues *u* are preferably made small, in order to admit the gas in numerous but small jets into the kiln.

Instead of supplying each section of the burning-gallery with gas through one valve, *r*, as in the present example, each of the perforated walls E may have its own gas-valve; but in this case there must be as many branch flues *q* as there are perforated walls.

The shutter S is preferably made of sheet-iron, but it may also be made of cloth, or even of paper, hung up and pasted against the walls next to the doorways. When paper is used it is simply torn off each time a section of the kiln has been filled with goods.

Our invention is applicable to kilns made with a burning-gallery of limited length, in contradistinction to a continuous or endless gallery, such limited gallery being made in a straight line or any desirable curve. This class of kilns, however, cannot be kept in continuous operation, and are hence adapted only for a small production.

In case such a kiln is desired, it is so constructed that a fire may be lit at one end of the gallery and allowed to progress through the gallery and to go out on arriving at the other end of the same, the gallery being made to terminate in a flue leading into a chimney.

A smoke-chamber is not required for such a kiln, the one smoke-flue just mentioned going directly into the chimney, where it is provided with a suitable valve for regulating the draft.

The gas-supply flue C must in all cases be made to accommodate itself to the shape of the kiln.

It may be mentioned that the gas-flue C can be provided with safety-valves to prevent explosion of the gas.

In order to augment the formation of gas in the generator A a blower may be applied thereto, or to the gas-flue C, or any other suitable device adapted to increase the draft may be used.

We are aware that kilns for burning stoneware, porcelain, &c., with gas have been heretofore constructed, but so far with little success, owing to the imperfect distribution of the gas in the kiln, as well as on account of its imperfect mixture with the atmospheric air necessary for its combustion.

The principal advantage of our kiln, compared with other gas-kilns for burning pottery-ware, &c., consists in avoiding a concentration of the heat or flame at any single point, as is the case in other gas-kilns, and whereby those parts of the kiln itself, as well as its contents, which are exposed to such concentrated heat, are greatly injured or destroyed.

What we claim as new, and desire to secure by Letters Patent, is—

1. The combination, with a burning-gallery, D, either continuous or limited in length and divided into sections, of a suitable gas-generator, and of a flue, C, which communicates with the several sections of the burning-gallery through suitable valves for admitting the gas successively to said sections, substantially in the manner shown and described.

2. In a kiln for burning bricks, pottery-ware, and other similar articles with carbonic oxide or other combustible gas, a burning-gallery, D, which is divided into sections and provided with suitable openings or doorways for the admission of atmospheric air, constructed with division-walls E, each having flues *u* for the admission of gas, and having perforations *v* for the passage of atmospheric air, the whole being adapted to operate substantially as described.

3. In a kiln for burning bricks, pottery-ware, and other similar articles with carbonic oxide or other combustible gas, the combination of a burning-gallery, D, divided into sections and provided with suitable openings or doorways for the admission of atmospheric air, and its division-walls E, having flues *u* in addition to perforations *v*, and a gas-supply flue, C, having suitable branches for supplying the different sections of the gallery, substantially as described.

This specification signed by us this 19th day of February, 1876.

HERMANN SEGER. [L. S.]
HELMUTH DUEBERG. [L. S.]

Witnesses:
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JULIUS ARON.