No. 680,914. Patented Aug. 20, 1901.

G. F. & H. N. GRAY & R. SOUTH.

BRICK KILN.

(Application filed Apr. 8, 1901.)

(No Model.) 2 Sheets—Sheet 1.

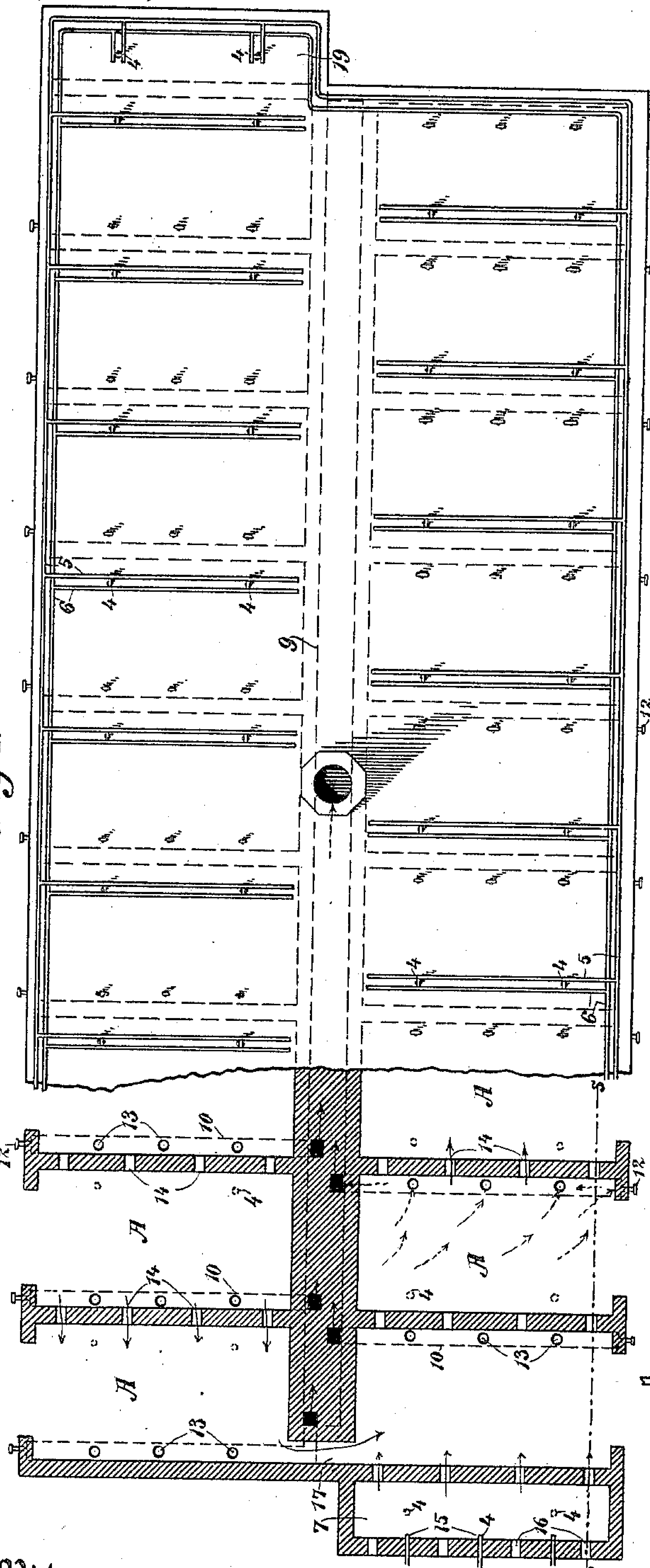

Fig. 1.

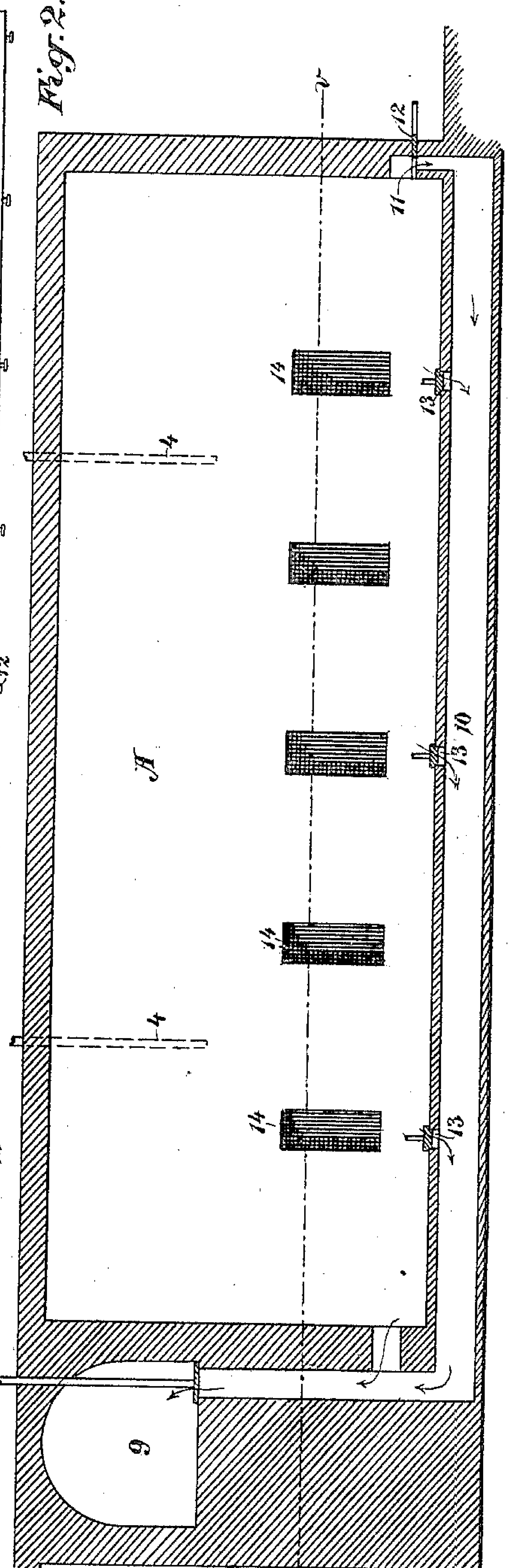

Fig. 2.

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Fig. 3.

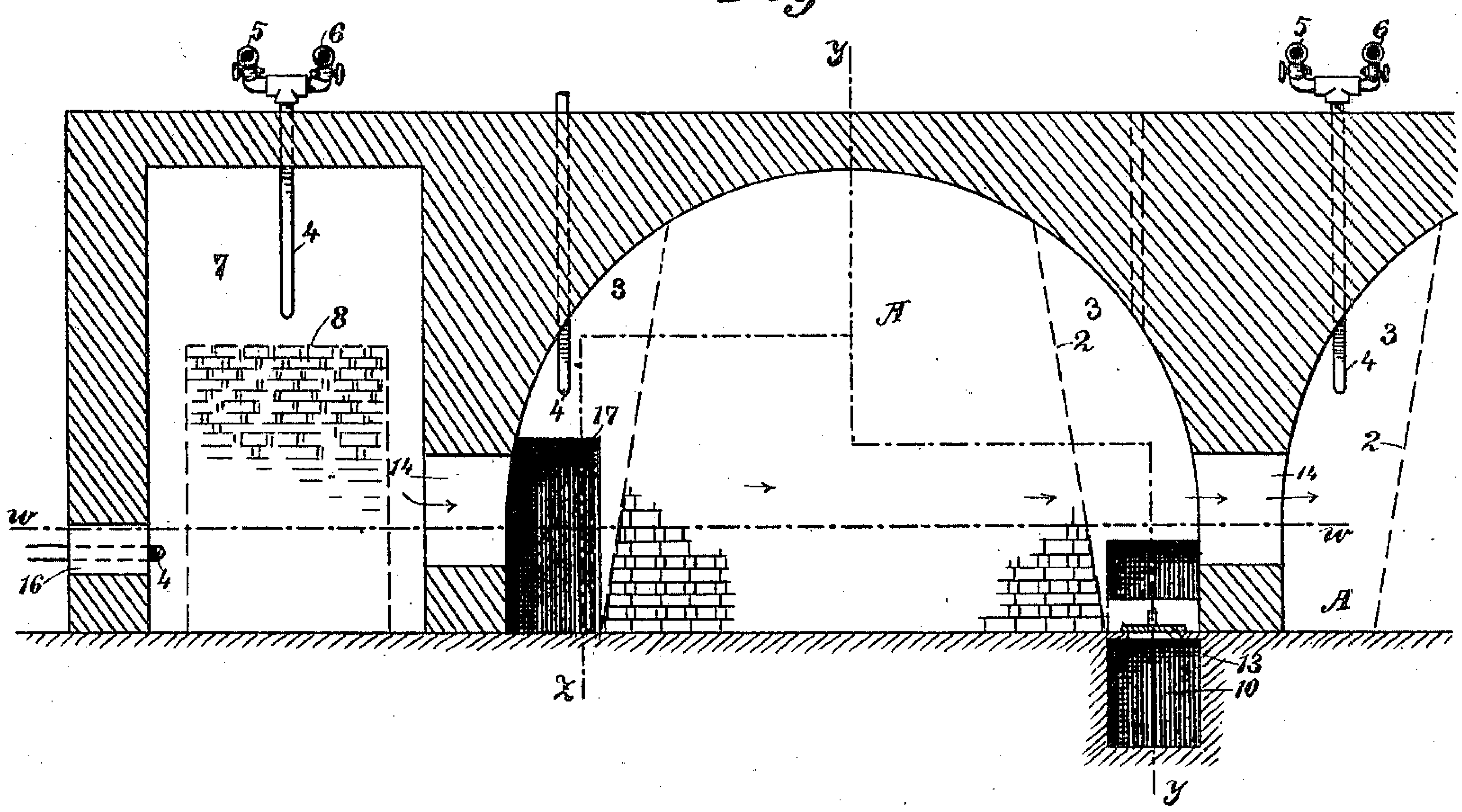
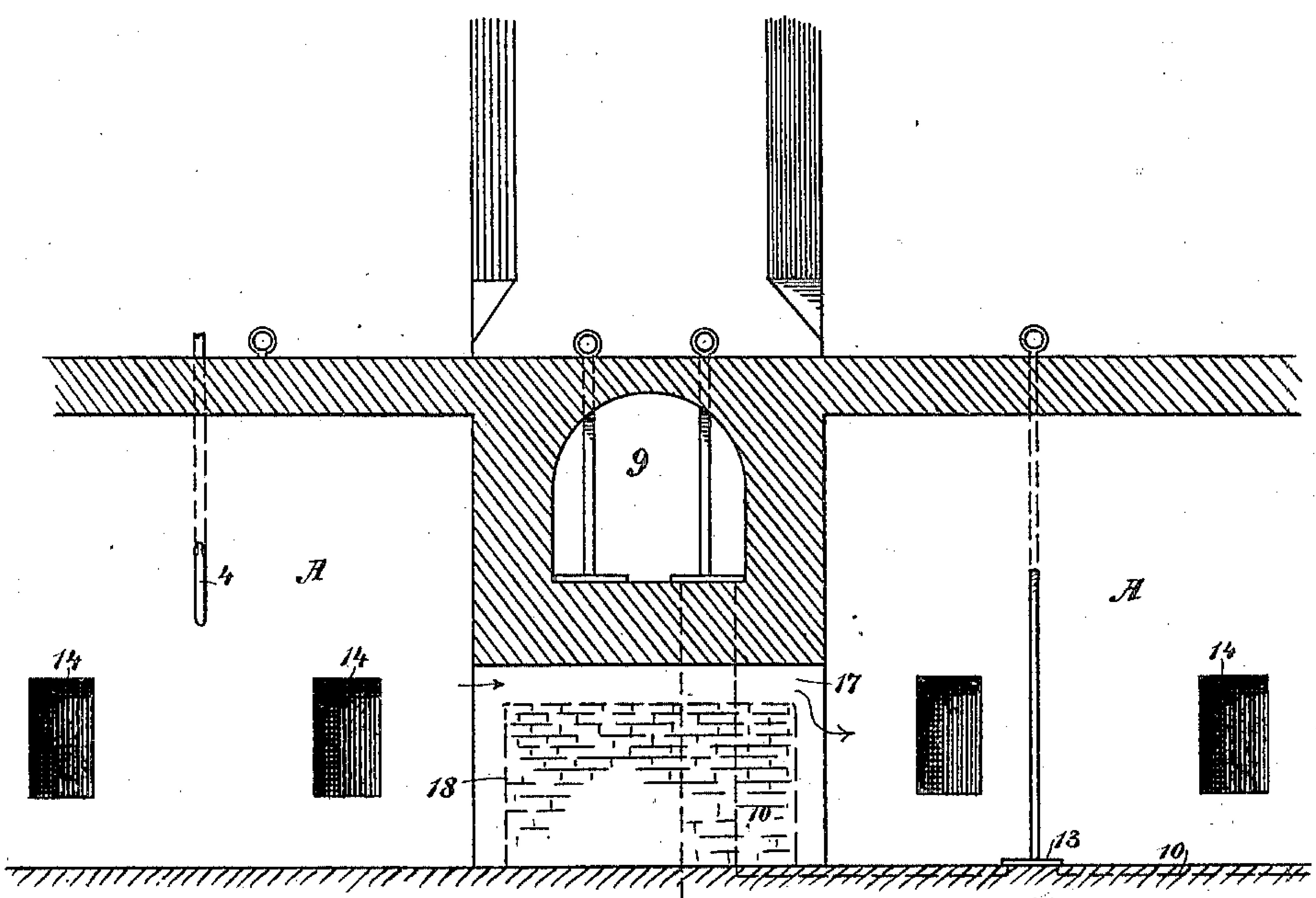


Fig. 4.



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UNITED STATES PATENT OFFICE.

GEORGE F. GRAY, HARRY N. GRAY, AND RICHARD SOUTH, OF SAN FRANCISCO, CALIFORNIA.

BRICK-KILN.

SPECIFICATION forming part of Letters Patent No. 680,914, dated August 20, 1901.

Application filed April 8, 1901. Serial No. 54,848. (No model.)

To all whom it may concern:

Be it known that we, GEORGE F. GRAY, HARRY N. GRAY, and RICHARD SOUTH, citizens of the United States, residing in the city and county of San Francisco, State of California, have invented an Improvement in Brick-Kilns; and we hereby declare the following to be a full, clear, and exact description of the same.

Our invention relates to improvements in brick and other burning kilns for similar purposes in which there are a number of adjoining chambers adapted to communicate with each other through suitable doors or openings and also communicate with a common flue or smoke chamber and chimney.

Our invention consists in an improved construction of the burning-chambers, the arrangement of the brick or wares to be burned therein, so as to provide open combustion-chambers, and a means for burning oil or liquid hydrocarbon as a fuel in the place of coal or other solid fuel.

It also comprises a novel arrangement of passages connecting the burning-chambers with the escape-flue, whereby the "water-smoke," as it is technically called, is carried away from the "green" material without injuriously affecting the contents of the chamber.

It further comprises a means of communication for keeping up the heat in passing from the series of chambers upon one side of the kiln to those upon the other, whereby the corners may be turned without the loss of effective heat.

It further comprises a means for supplementing the heat passing through the successive chambers for the purpose of starting the burning in the first instance and thereafter to assist in keeping up the heat and turning the corners.

Our invention also comprises details of construction, which will be more fully explained by reference to the accompanying drawings, in which—

Figure 1 is a plan view of the kiln, part of it shown in horizontal section on line *v v* of Fig. 2 and *w w* of Fig. 3. Fig. 2 is a vertical section through a chamber on line *y y* of Fig. 3. Fig. 3 is a similar view on line *s s* of Fig. 1. Fig. 4 is a section on line *x y* of Fig. 3.

Kilns for burning brick, pottery, and other like materials are variously arranged. In the present construction we have shown two series of chambers arranged parallel with each other and upon opposite sides of a centrally-disposed smoke-chamber, which is constructed between the inner ends of the two lines of chambers and communicates with a chimney, so as to provide sufficient draft for carrying off the smoke and moisture arising from the green wares when the heat is first applied. Suitable passages connect the chambers, so that after the kiln is running there will be a plurality of chambers in operation at one time, one chamber being in full heat and the bricks nearly finished, the next adjacent one being partially baked, the third one, in which the moisture and steam from the fresh material have been nearly evaporated, and the fourth one, into which the heat is beginning to pass for the purpose of driving off steam or so-called "water-smoke." As here shown, there are two parallel series of burning-chambers A, having suitable doors or openings at the side, through which the brick or other wares are introduced and suitably arranged for the purpose of burning. It is customary where coal or other solid fuel is used to build the bricks up closely to the walls of the chambers, sufficient openings and passages being interspersed through the mass to allow the heat to pass and have access to the bricks in the interior. In our apparatus we build the bricks within the chambers in such manner as to leave large open spaces or combustion-chambers between the walls and the piles of brick, which are here shown at 2. Into these spaces 3 thus arranged pipes 4 lead, and thus connect at the top with oil and steam pipes 5 and 6, provided with suitable cocks or controlling-valves, by which a proper admixture of steam and oil is introduced, and thus introduced it is delivered through the pipes into the open combustion-chambers 3, where there is sufficient space to insure a perfect combustion of the fuel. Suitable air-passages admit the necessary amount of air for perfect combustion, which is thus

attained in these open spaces in a manner which would be impossible within the smaller and narrower channels between the bricks. The heat thus produced passes through the channels in the brick piles and insures a hot and clean fire, which is very effective in burning the bricks. Exterior to the first chamber of each series in the direction in which the heat travels is a supplemental chamber 7. This chamber is designed for a preliminary fire and is partially filled with old burned bricks formed into a pile or structure, as at 8, with combustion-chambers upon each side between the structure and the outer walls of the chamber 7 and also between the pile and the top. Into the upper part of this chamber a burner-pipe 4 leads, having a suitable burner or burners at the lower end, and this burner is located in the combustion-chamber in such relation with the interior structure that the latter is intensely heated, and after once being heated it serves as a reservoir to retain and equalize the heat from the burning oil. From this chamber passages lead into the first of the chambers A, and the heat generated in this exterior chamber passes into the first chamber, which being charged with the green bricks arranged as shown at 2 the heat passes around and through these bricks, thus driving off what is termed the "water-smoke." This water-smoke is carried to the central smoke-chamber 9 through a tunnel (shown at 10) having an opening 11 in the wall of the furnace farthest removed from the smoke-chamber. This opening has a controlling-damper, as at 12. Through the floor of the chamber and outside of the pile 2 are made a series of openings 13, each provided with a suitable damper, and these openings communicate with the underground passage 10, so that the first products of the heat applied to the green bricks, which is technically called "water-smoke," is drawn into this passage and thence into the smoke-chamber and to the chimney. A passage of this description is connected with each of the chambers A upon the side farthest from that at which the heat enters, and the tendency of the draft is to carry all the products of combustion across the chamber to the farther side, and thence by the regulating-dampers it is allowed to pass into the underground passage 10 and thence to the smoke chambers and flue. When the first chamber has been heated up by the heat from the supplemental chamber 7, the burners of this chamber may be brought into operation. These burners are preferably located upon the side opposite from the underground passage, so that the heat will be drawn through and across the pile of brick to be burned. As soon as the moisture has been driven off from this pile and the heat begins to be intense enough to commence baking the brick, dampers controlling the passages 14, which connect the adjacent chambers, may be opened and the heat of the first chamber transferred to the second in the same manner to first drive off the water-smoke and then raise the temperature to the baking-point.

When a full series of the chambers are in action, the work progresses from one chamber to another, and each chamber when the baking is completed is allowed to cool down, and the bricks can be removed and another fresh lot put in before the burning has been carried around to this point, so that the kiln may be made continuous.

The chamber 7 has in addition to the burners entering from above a series of openings at the side, as shown at 15, through which other burner-pipes may be introduced, if it is necessary to increase the heat, and draft-openings 16 are also so disposed with suitable dampers, so that sufficient air can be admitted to carry on the combustion.

By the arrangement of the flues 10 and passages 11 and 13 communicating therewith we are enabled to so distribute the water-smoke and moisture which are being driven from the green bricks that there will be no accumulation of hot steam at any one point, which would have a tendency to soften and destroy the bricks before they were sufficiently dried to commence baking.

A great difficulty has been experienced in turning the corner or transferring the heat from the end chamber of one series to the commencing end chamber of the next series. In our invention we connect these two chambers by a tunnel 17 of considerable size, and this tunnel, passing beneath the smoke-chamber at the end, is partially filled with broken or old burned brick, as shown at 18. This mass after being once heated serves as a reservoir to retain the heat and to keep up the temperature, so that the heat passing across this passage from one side to the other will be effective in the first chamber of the next series. In order to supplement this and to increase the heat in the first chamber when necessary, we have shown an additional heating-chamber 19, built outside of the first of the second series of chambers A and having an interior construction similar to that shown at 7, with a similar means for providing a supplemental fire, which is admitted into the first chamber of the second series at the commencement of the operation within that chamber or at any other stage of the operation when found necessary. By this improved construction we are enabled to use oil as a fuel and to burn the bricks in a superior manner.

Having thus described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. The combination in a brick-kiln of two parallel series of chambers, an intermediate longitudinally-disposed smoke-flue, and a chimney with which it connects, passages connecting with said flue and formed beneath each of the chambers upon the side most distant from that at which the heat enters, damper-controlled openings leading through the floor of the chambers into said passages,

open combustion-chambers between the interior structure and the walls of the chamber, and oil-burners located in said combustion-chambers.

2. The combination in a brick-kiln of two parallel series of burning-chambers, with an intermediate smoke-flue and chimney with which it is connected, passages connecting with said flue beneath the sides of the chamber most distant from that at which the heat enters, and damper-controlled openings through the floor of the chamber connecting with said passages, combustion-chambers between the interior structure and the walls of the chamber, one or more pipes by which liquid hydrocarbon is delivered into said combustion-chamber, and burners therefor connected with said pipes upon the side opposite to the discharge-openings.

3. The combination in a brick-kiln of two parallel series of chambers, with an intermediate smoke-flue and a chimney with which it connects, passages beneath the floor of the kiln connecting with said flue, with damper-controlled openings through the floor upon the side most distant from the heat, and passages through the walls by which heat from one chamber is admitted to the next, and a preliminary heating-chamber located outside of the first of the series, with communicating passages thereto, said chamber adapted to contain a central structure of burned bricks, one or more oil-supply pipes and burners therefor, an open combustion-chamber between the central structure and the walls of the chamber, and air-inlet openings in the sides of said chamber.

4. The combination in a brick-kiln of two parallel series of chambers with an intermediate smoke-flue and chimney with which it is connected, passages through which heat is conducted from one chamber to the next, and passages beneath the floors of the chamber connecting with the smoke-flue having damper-controlled openings leading into said passages upon the side most distant from the heat-inlets, oil-conducting pipes and burners, open combustion-chambers formed within the chambers, a tunnel connecting the end chamber of the first series with the corresponding end chamber of the second series, said tunnel having a structure composed of previously-burned brick, occupying the lower portion, and serving as a heat-retainer whereby the heat may be transmitted from one side to the other of the kiln without loss.

5. The combination in a brick-kiln of two parallel series of burning-chambers with intermediate smoke-flue and chimney with which it is connected, damper-controlled passages between the chambers through which the heat is successively transmitted, open combustion-chambers formed in each of the burning-chambers, oil-burners and supply-pipes leading into a combustion-chamber, supplemental passages beneath the floors of the chambers connecting with a smoke-flue and having openings through the floors connecting therewith, tunnels connecting the end chambers of the kiln, said tunnels having a heat-retaining centrally-located structure extending therethrough and supplemental chambers exterior to the first chamber of each series, said supplemental chambers being formed with a central heating mass of burned bricks and having oil-burners and supply-pipes located in the open combustion-chambers around said structure and air-inlet openings thereto.

In witness whereof we have hereunto set our hands.

GEORGE F. GRAY.
HARRY N. GRAY.
RICHARD SOUTH.

Witnesses:
LEE D. CRAIG,
A. G. COOMBS.