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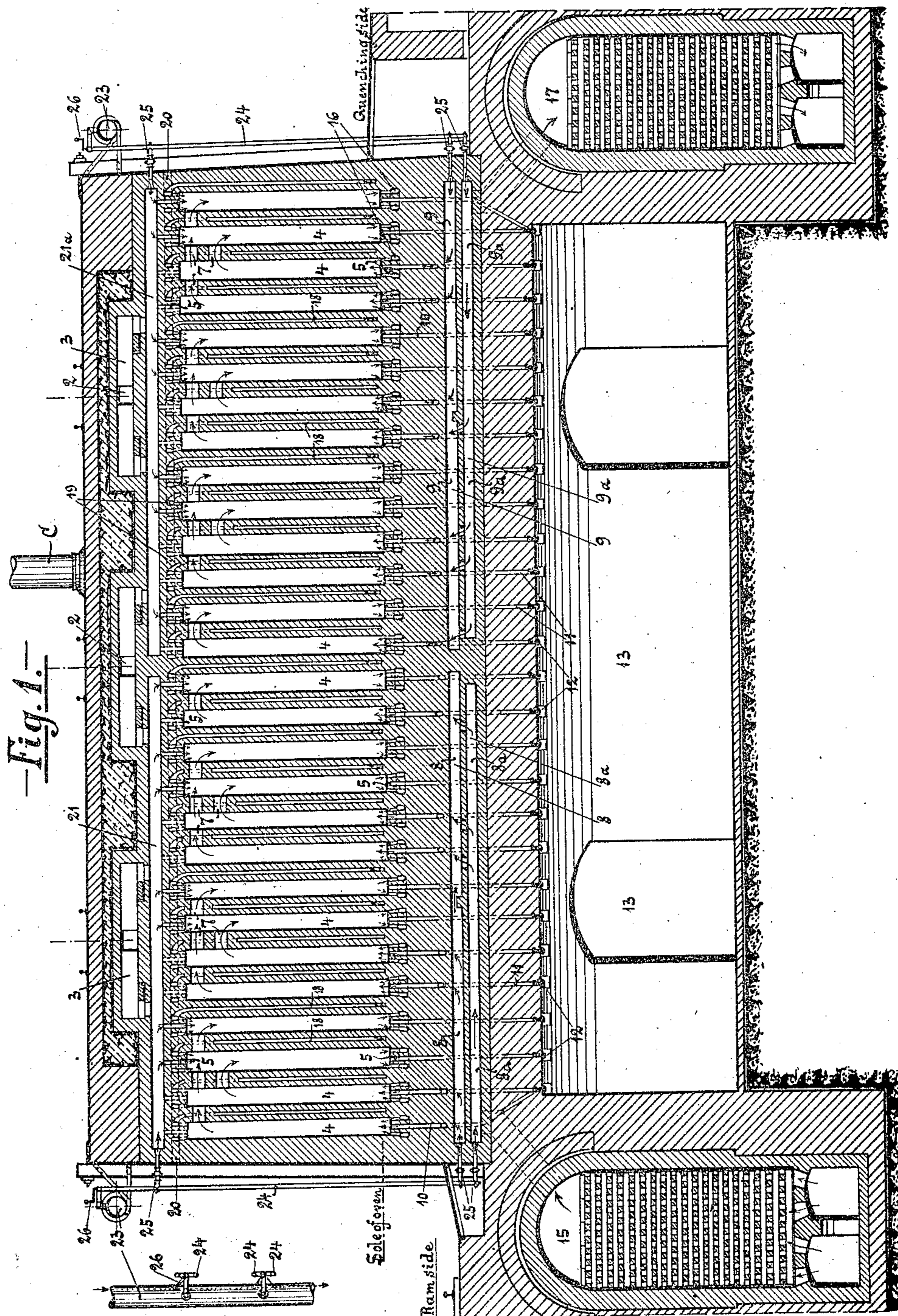
W. MUELLER.

COKE OVEN.

APPLICATION FILED APR. 6, 1909.

Patented May 17, 1910.

4 SHEETS—SHEET 1.



Witnesses:
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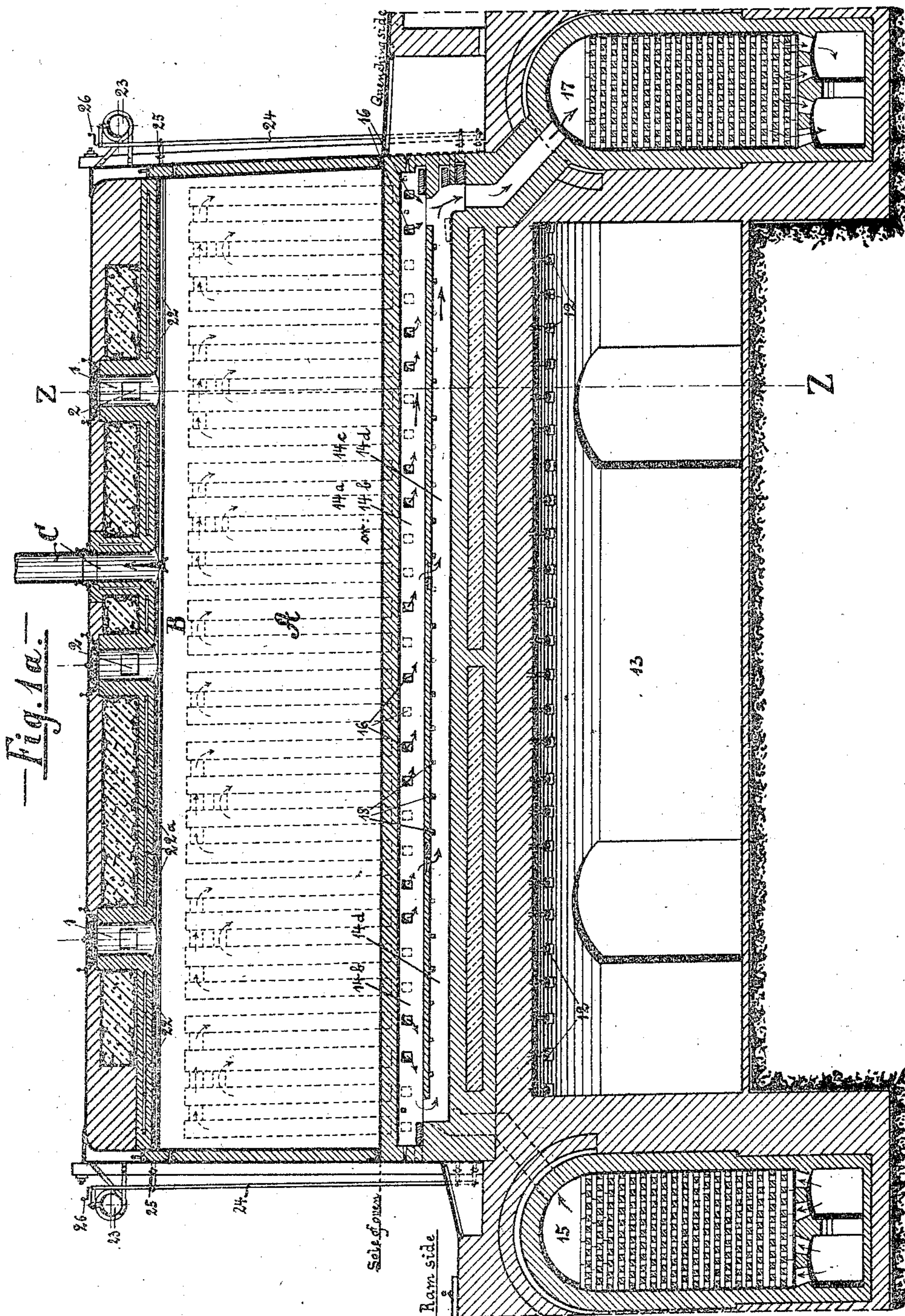
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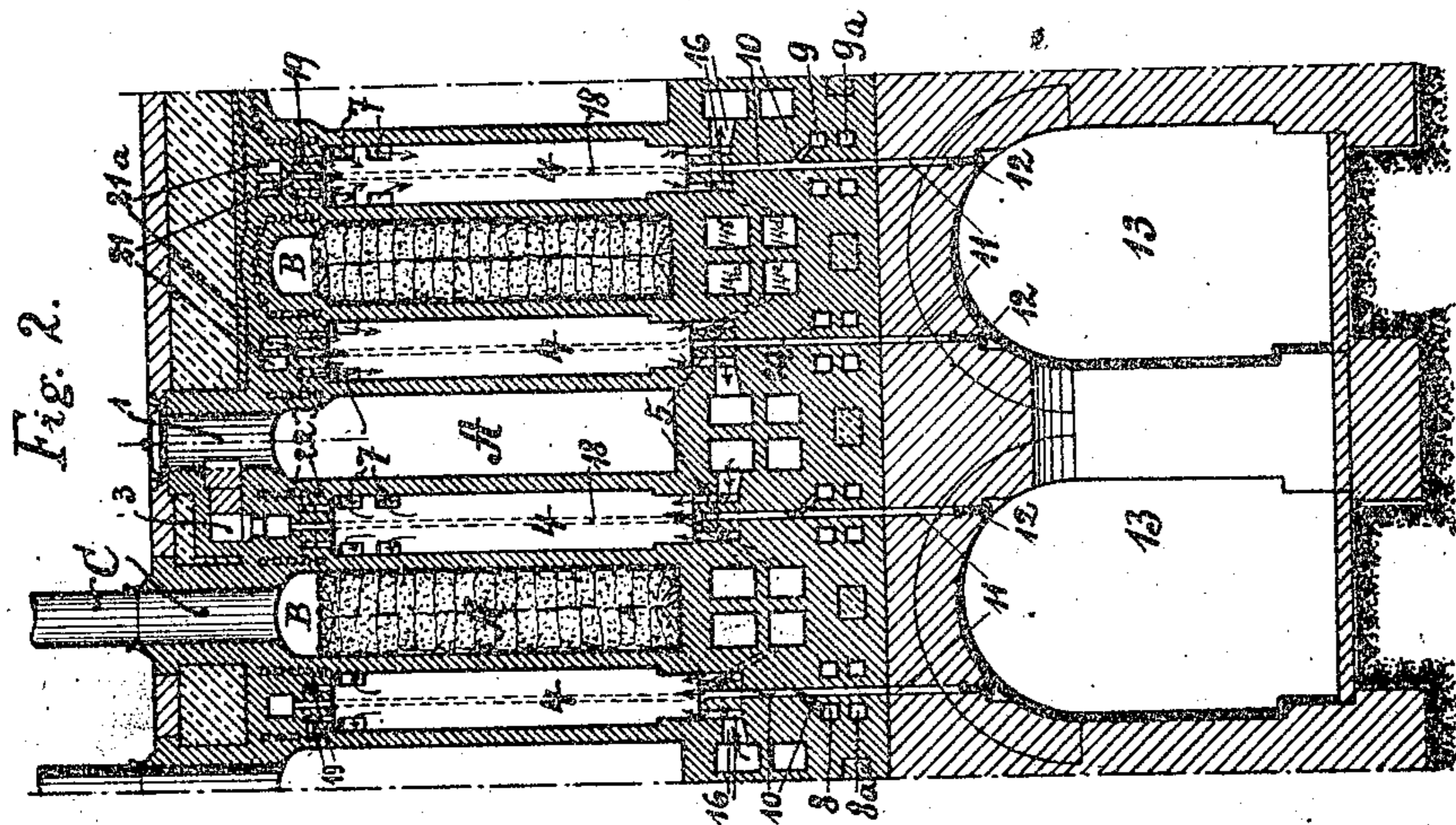
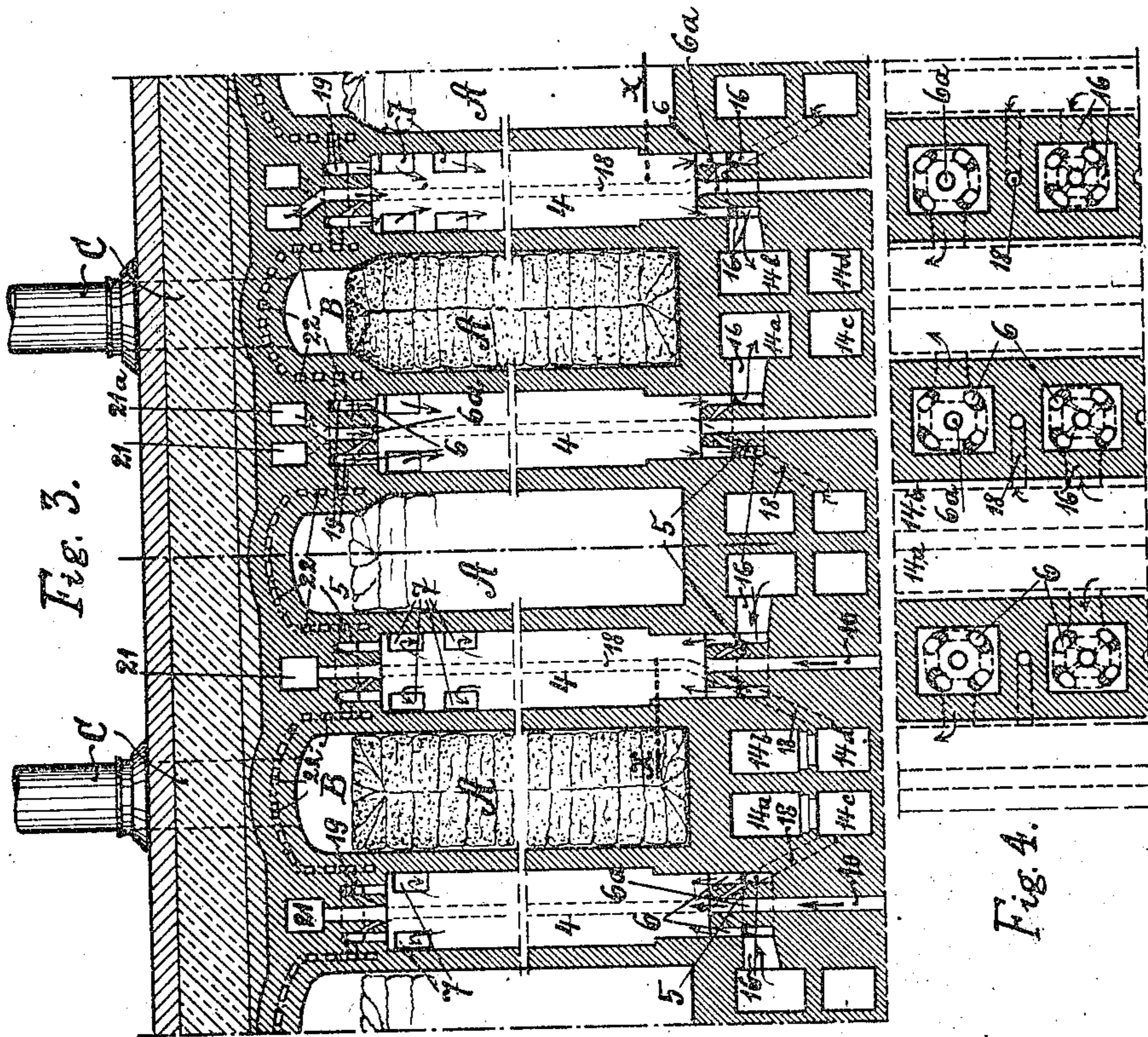
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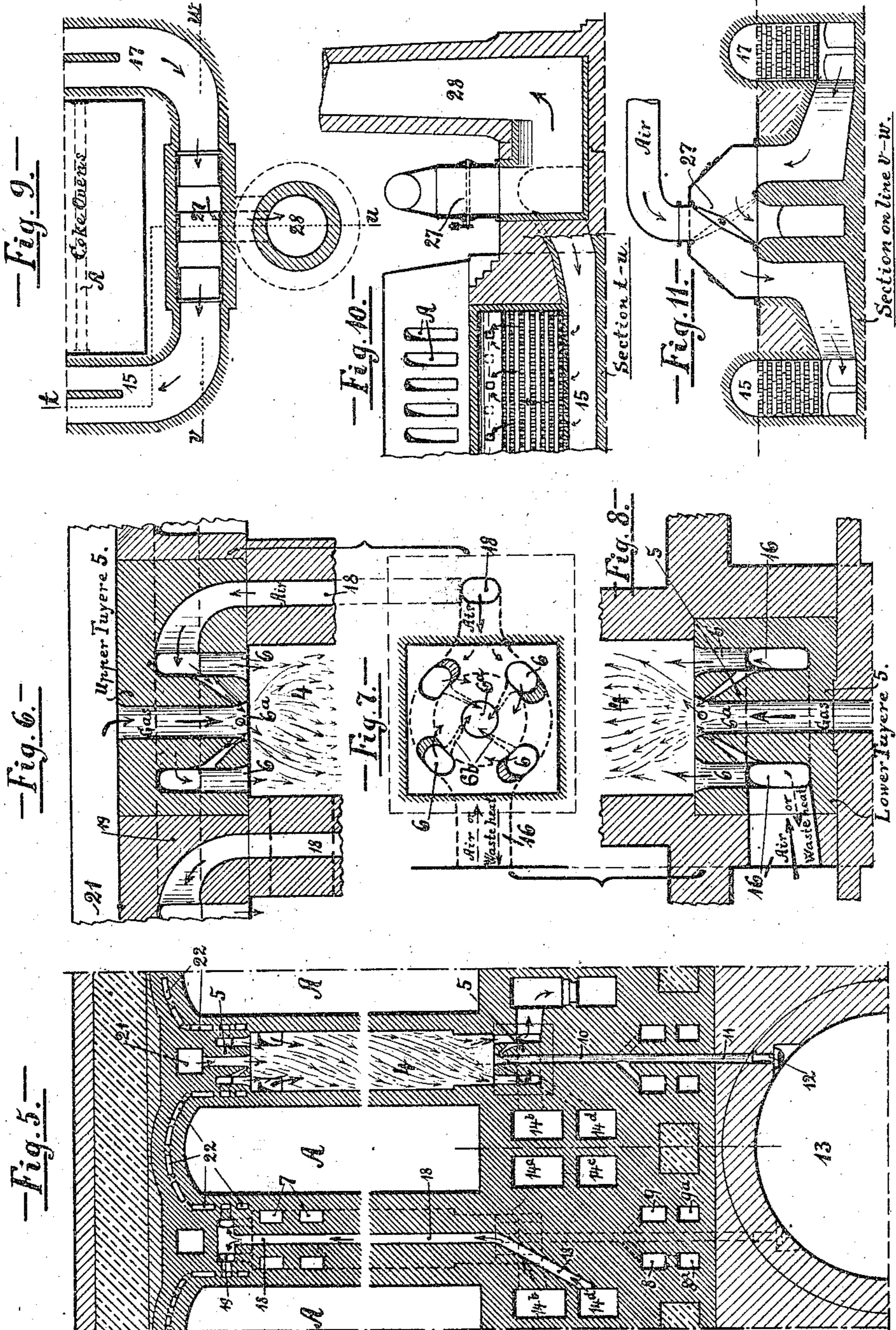
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UNITED STATES PATENT OFFICE.

WILHELM MUELLER, OF DUSSELDORF, GERMANY.

COKE-OVEN.

958,154.

Specification of Letters Patent.

Patented May 17, 1910.

Application filed April 6, 1909. Serial No. 486,248.

To all whom it may concern:

Be it known that I, WILHELM MUELLER, a subject of the German Emperor, and residing at Dusseldorf, Germany, have invented certain new and useful Improvements in Coke-Ovens, of which the following is a specification.

My invention relates to regenerative coke ovens or gas retort furnaces, and the main object is to construct and provide such ovens and furnaces in which exclusively that part of the walls beside the coking-charge is heated intensely continuously and uniformly, whereas the gas-collecting chamber located above the charge is insulated from the heat of the walls and ceiling and is cooled, in order, on the one hand, to produce a gas of high calorific and illuminating value by means of conveniently regulatable, uniform heating by an optionally high temperature of the walls, and on the other hand to protect the gas thus obtained from decomposition in the chamber above; which was caused heretofore owing to the top-part of the chamber being overheated.

The methods of heating the walls of the ovens in coke ovens known heretofore, particularly in regenerative ovens, are all imperfect, because half or a quarter of a wall is heated with fresh gas and air only from below alternately, whereas the other portion of the wall receives only the waste heat of the former portion which is lower in temperature by several hundred degrees, the consequence of which is that, on account of this alternating heating, the oven walls are subjected to continuously fluctuating temperatures, whereby leaks and cracks are produced more and more in the fireproof masonry of the walls with increasing duration of working, so that the coking-period and the quality of coke and gas gradually deteriorate considerably. These defects are entirely done away with by the present improved construction, and a short duration of coking, good quality of coke and gas, and a higher yield of by-products are obtained.

In order that the invention may be clearly understood I will now explain the same with reference to the accompanying drawings in which one constructional form of my improved regenerative coke oven is represented by way of example.

In said drawings: Figure 1 is a vertical longitudinal section through the coke oven taken through the center of the combustion chambers, and Fig. 1^a is a like view taken through the center of a coking chamber or retort; Fig. 2 is a vertical transverse section taken on line Z—Z of Fig. 1^a, and Fig. 3 is a like view of a slightly modified form on an enlarged scale, the bottom portion being omitted, whereas Fig. 4 is a horizontal section on line X—X of Fig. 3. Fig. 5 is a view similar to that shown in Fig. 3, but showing in addition the lower part of the coke-oven; the left-hand side is a section through the intermediate binder bricks of the wall showing flue 18, whereas the right-hand shows how the upper gas and air supply is arranged and how the combustion gases pass downward and escape through the lower twyer 5 into the sole channels 14; Figs. 6, 7 and 8 are vertical sections through the upper twyer, plan view, and vertical section through the lower twyer, respectively, Fig. 7 showing both twyers in plan; Fig. 9 is a sectional plan view of the end part of the battery of coke ovens A in Fig. 1 and shows the connection of the two regenerators with the reversing valve and smoke stack, whereas Figs. 10 and 11 are sections on the bent line *t—u*, and in the plane *v—w* in Fig. 9, respectively.

Similar reference characters indicate corresponding parts in all figures.

Referring to the drawings, the coking chambers or retorts A are provided with charging holes 1 at the top of the oven. The side walls of the coking chambers are formed by a series of vertical heating or combustion flues 4. In contradistinction to known methods of supplying gas and air from below only, the combustion flues in my improved coke oven are provided at their lower as well as at their top ends with special twyers or blast nozzles 5 for supplying and mixing gas and hot air. The twyers for the lower and upper supplies are constructed in such manner as to convey the gas and air currents into the heating flues in a direction parallel with each other, in order to prevent any formation of small flames or flame-torrents. A very intimate mixture of gas and air is, however, attained by arranging that the air-passages 6 pass spirally around the

gas-nozzles 6^a into the combustion flue, as clearly shown in Figs. 3, 4, 6, 7 and 8. Namely as these figures show, the construction of the twyers admits of a supply of hot air at any pressure by means of a blower, because as a current of air enters into the flues 4 it is broken up while flowing through four openings 6 around the stream of gas by means of small ducts 6^b which open somewhat tangentially and slantingly into the gas nozzle 6^a; the stream of gas is broken up by the air entering it in this manner and a rotary movement is produced owing to the tangential arrangement of the small ducts 6^b (Fig. 7) whereby the gas is mixed more intimately with the hot air issuing from the larger openings 6. Owing to the adequate width of the supply and discharge openings 6 and 16, the twyers admit of an adequate supply of air closely corresponding to the requirements, say about four times the quantity of heating gas that enters, whereby the pressure of gas and air is kept equal. The air supply openings 6 and 16 in the twyers are likewise well adapted for the discharge of the products of combustion.

In addition, the waste gases from the combustion flues are not collected, as in the manner known heretofore, in a long horizontal channel that runs at the top of the flues, but in my improved oven every two, four or six flues are connected only at their upper ends by passages 7, so that the upper part of the walls of the coking chambers are stronger and more durable. As clearly shown in Fig. 1, in some of the walls of the coking chambers I prefer to provide these passages 7 superposed in pairs in order to prevent the waste gases which flow from the second heating flue of a set of connected flues being-throttled.

Underneath the combustion flues are arranged side by side and superposed the gas-supply channels 8, 8^a and 9, 9^a. The superposed channels are connected in such manner as to enable the gas supply by way of the valves or stopcocks 25 to be suitably regulated for each three or four combustion flues. Suitable connecting passages 10 lead the gas upward from the channels 8 and 9 through nozzles 6^a into the combustion flues.

The object of providing four gas supply channels 8, 8^a and 9, 9^a is that the channels 8 and 8^a, or 9 and 9^a alternately may together supply gas to a group of four or three heating flues; in this manner more or less gas can be supplied, according to the kind of coal, either at the front end or toward the middle as desired. If only one supply channel were provided for each side it would not be possible positively to control the heating in this manner, as I cannot otherwise regulate the gas for the flues located toward the center.

To avoid the passages 10 becoming clogged

up with naphthalene or graphite, openings 11 having removable plugs 12 are arranged in the foundation arches 13 which enable all the vertical combustion flues 4 to be readily inspected from time to time.

The sole channels 14^a, 14^b, 14^c, 14^d alternately serve for supplying the hot air for combustion from the one regenerator 15 through lateral passages 16 and the twyers 6 to the heating flues 4, and for conveying the waste hot gases from the combustion flues to the other regenerator 17.

The sole channels 14 can be alternately connected by a flue, which is regulatable by a damper, with the regenerators 15 or 17. At the end of the battery of ovens the two regenerators 15 and 17 are connected in the usual known manner (see Figs. 9, 10 and 11) with the smoke stack 28; at the junction of the flues is a reversing valve 27 which alternately connects one of the two regenerators with the smoke stack 28, and the other with an air supply pipe. The air is supplied through the air pipe and reversing valve by a fan or blower not shown in the drawing, which forces the air through the regenerator where it is heated and on into the sole channels 14 and combustion flues 4. The waste gases passing from the combustion flues and sole channels to the other regenerator are drawn off by the draft of the smoke stack.

The four sole channels are required arranged superposed in pairs, as shown, in order that the waste gases may be drawn away from both the front and the rear end of the sole of the oven, which would not be possible if only two sole channels were provided.

From the sole channels 14^c or 14^d a part of the hot air is led through small passages 18 formed in the intermediate binder-bricks of the wall (see Figs. 3, 4 and 5) and ascending into the air flues 19 around the upper twyers 5, in order to supply auxiliary hot air through openings 6 to the downwardly-flowing products of combustion. If no air be supplied from the sole channels 14^c or 14^d to flues 18 and 19, the supply can take place through a hole 20 from both ends of the oven, in which event the flues 19 run the whole length beside the upper twyers throughout the oven.

In the uppermost part of the oven above the twyers 5 of the heating flues are arranged one or two gas-supply channels 21 and 21^a which are connected to those flues 4 which have in them a downward draft of combustion. The passages 2 and channels 3 which connect the charging holes 1 with the upper gas supply channels 21, are only used when the oven is being started, or in the event of the oven being worked without recovery of the by-products, to convey the crude gas from the coking chamber directly into the combustion flues 4.

The arrangement of one or two gas sup-

ply channels above the heating flues is quite optional, for the heating gases in the upcast flues are all under pressure and only the downcast flues have a draft from the chimney, but as the upper extra supply of gas is blown in at the same pressure as the gas from below, the pressure in the upcast flues is canceled above and the extra gas flows automatically only into the flue having a downward flow of gas therein. It is therefore not absolutely necessary to arrange two upper channels 21.

In connection with the upper air channels 19, beside and in the arch of each coking chamber A, the crude gas collecting room or space B above the coking charge is surrounded at its sides and ceiling by hollow blocks or tiles, or by several brick walls made of fireproof material which conduct heat badly, forming small ducts or channels 22. These channels are interconnected by small ducts 22^a (Fig. 1^a) and extend so far down the side of the combustion flue toward the charge as is preferable having regard to the shrinking of the coking mass. Also, if preferred, the gas collecting space B can be made smaller than the coking chamber A below it, as clearly shown in Figs. 2 and 3 at the right-hand side, in order to have more space for the channels 22 and to charge the chamber equally full every time. The channels 22 which communicate with the air flues 19, as shown in Fig. 5, serve on the one hand for utilizing the excessive heat of the oven ceiling for preheating the air for the upper supply, and on the other hand keep radiated heat away from the collecting spaces B.

The advantage of this over other arrangements known heretofore is that not only is all heating of the sides of the gas collecting spaces B avoided, but also the heat of radiation at the sides and ceiling of the oven is reduced as much as possible by the flues 22. The collecting spaces B thus cooled have a far lower temperature than the charge below them, and the generated gases therefore pass out of the coking charge the whole length of the chamber directly into the cooled collecting spaces, so that the valuable illuminating constituents of the evolved gases cannot be decomposed.

The operation of my improved coke oven is as follows: The coking chambers A are charged with coal in the usual manner. The gases generated in the coking chambers are conducted from the collecting spaces B through vertical pipes C to the condensation plant. After the separation of the by-products, the gas for heating the oven is conducted through pipes 23 along the side of the battery of ovens, and small branch pipes 24 provided with valves or stopcocks 25 conduct it into the upper channel 21 as well as into the bottom channels 8, 8^a, 9, 9^a

in each half of the oven wall. If now, for example, the regenerative system is used, the gas passes from the channels 8 or 9 through the twyers 5 alternately into half the number of flues in one wall, i. e. into one side of one, two or three pairs of heating flues 4. Just below the sole of the oven, hot air also enters from the one regenerator 15, and sole channel through the twyers 6 and mixes with the burning gas flowing upward. The products of combustion are then conducted through the passages 7 into the next flues of one, two or three combined pairs. Since much of their heating power is lost on the way upward, each of the flues having a downward combustion receives from the channels 19 and 21 an auxiliary supply of fresh gas and hot air, in order to keep the temperature as high as that in the upward flues. The waste gases finally descend through the lower twyers and passages 16 to the sole channels and then through the other regenerator 17, to the smoke stack 28.

After the reversal of a suitable three-way cock 26 in the gas-supply pipe and of the reversing valve 27 of the two regenerators 15 and 17 alongside the battery, the supply of gas and air flows in the reverse direction with regard to the direction of flow of the gases in the combustion flues. If no regenerators be employed for heating the air, the direction of flow of the supply of gas and air and that of the products of combustion remain always the same.

The supply of gas and air to every set of three or four flues can be readily controlled and regulated at will by the pipes and stopcocks or dampers in the sole channels so that a very uniform distribution of gas and air is attained. Therefore, and on account of the improved situation of the lower, and particularly of the upper gas and air supply twyers, which enables an exceedingly high temperature to be applied exclusively to the coking charge and prevents other parts of the oven, particularly the gas-collecting space B being heated, the improved coke oven can be run with a considerable saving of fuel owing to the more perfect combustion of the gas mixed with the highly heated air. Besides economy in fuel gas being realized, on account of the high temperature which is obtainable at the side of the charge of coal, and having regard to the cooled gas-collecting room, the yield of gas of a higher illuminating and calorific value, as well as of ammonia and benzols is materially increased.

Owing to the more complete, uniform, speedy and economical coking process in my improved coke oven as compared with others known heretofore, I am enabled not only to get better and more increased products of distillation, but also a good sound coke can be obtained from a low grade coal on ac-

count of the good control and easy application of a high temperature to the charge if required.

Having now particularly described my invention, what I claim and desire to secure by Letters Patent is:—

1. The combination in a coke oven, of a plurality of vertical heating flues forming the sides of coking chambers, means to supply gas and air to the lower and upper part of each of said heating flues, passages connecting gas supply channels connected with the upper ends of said heating flues, a plurality of superposed supply channels connected with the lower part of said heating flues, passages for cleaning and inspecting leading from the foundation vaults into the heating flues, subdivided hot-air or waste-heat sole channels, each said sole channel having four subdivisions and passages connecting said sole channels with the lower ends of the heating flues, air-passages connecting the lower sole channels to the air-ports and the supply channels of the upper air flues to the heating flues, means for closing and regulating said gas supply channels and said sole channels, and means for reversing the gas and air supply.

2. The combination, in a coke oven, of a plurality of vertical heating flues forming the sides of coking chambers, each of said heating flues having a twyer at the top and bottom of the same, gas-supply channels

opening into the top and bottom of said heating flues, a plurality of small cooling channels, around the top or gas-collecting space of each coking chamber arranged, substantially as shown, extending down the sides of the coking chambers, and air-supply channels connected with said cooling channels and said twyers, as set forth and for the purpose specified.

3. The combination, in a coke oven of a plurality of vertical heating flues forming the sides of coking chambers, each of said heating flues having a twyer at the top and bottom of the same, gas-supply channels opening into the top and bottom of said heating flues, a plurality of small cooling channels around the top or gas-collecting space of each coking chamber arranged, substantially as shown, extending down the sides of the coking chambers, and air-supply channels connected with said cooling channels and said twyers, the top or gas-collecting space of each coking chamber being smaller than the coking chamber proper below it, substantially as set forth and shown in the accompanying drawings.

In testimony whereof, I affix my signature in the presence of two witnesses.

WILHELM MUELLER. [L. S.]

Witnesses:

OTTO KÖNIG,
WILLY KLEIN.