No. 630,885. Patented Aug. 15, 1899.

E. C. HEGELER.

GAS PRODUCER FOR METALLURGICAL PLANTS.

(Application filed Nov. 26, 1894.)

(No Model.) 2 Sheets—Sheet 1.

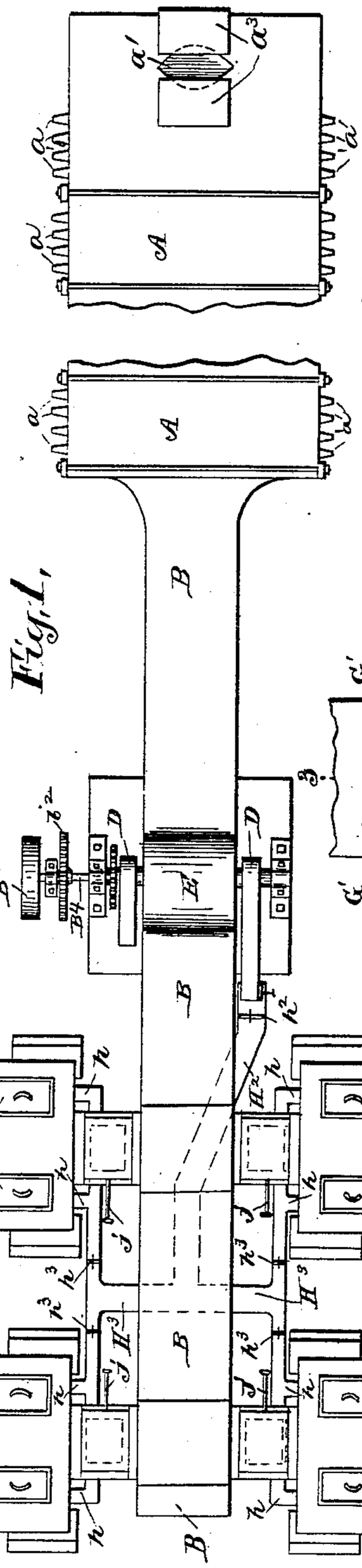

Fig. 1.

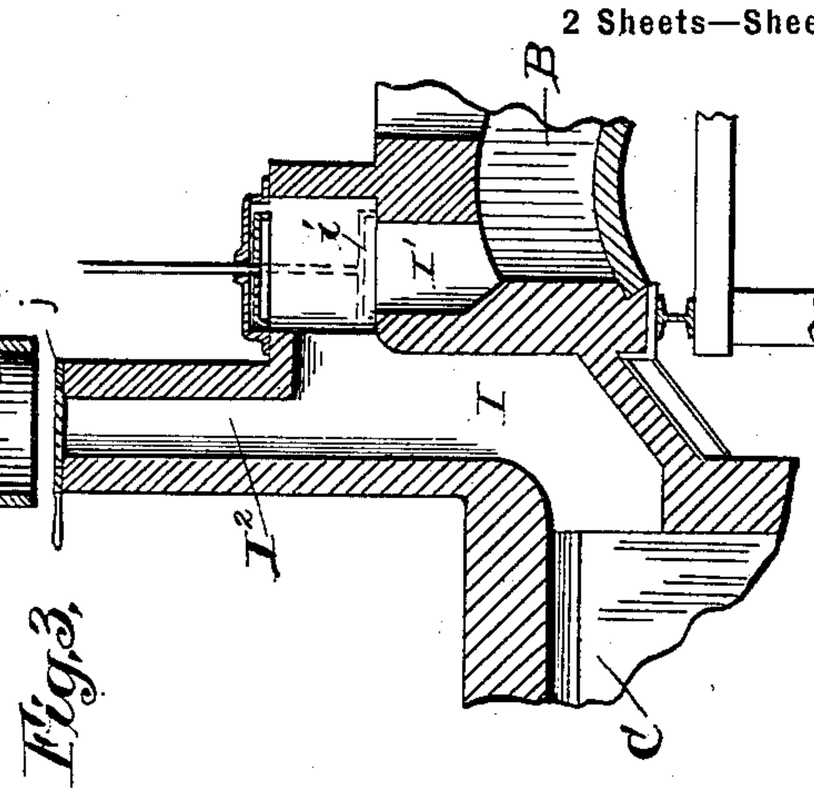

Fig. 3.

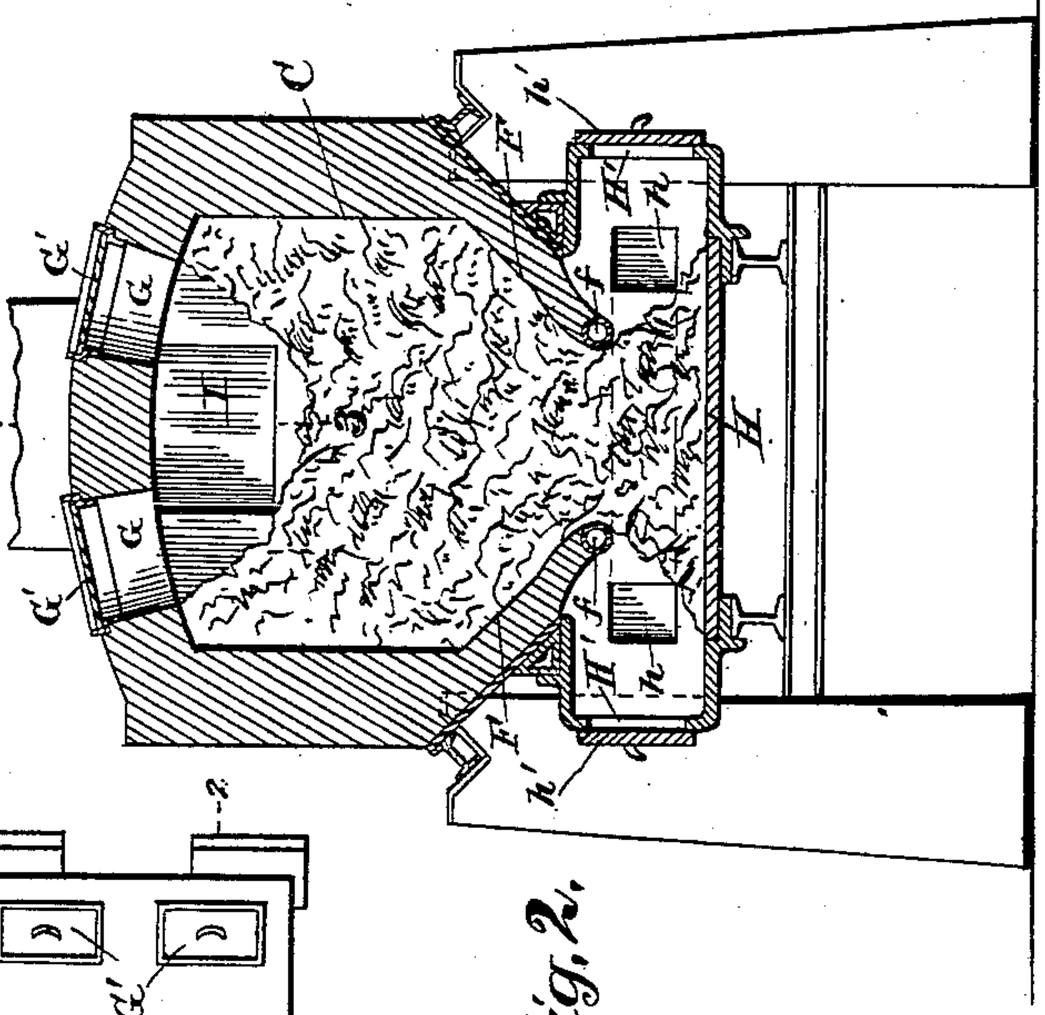

Fig. 2.

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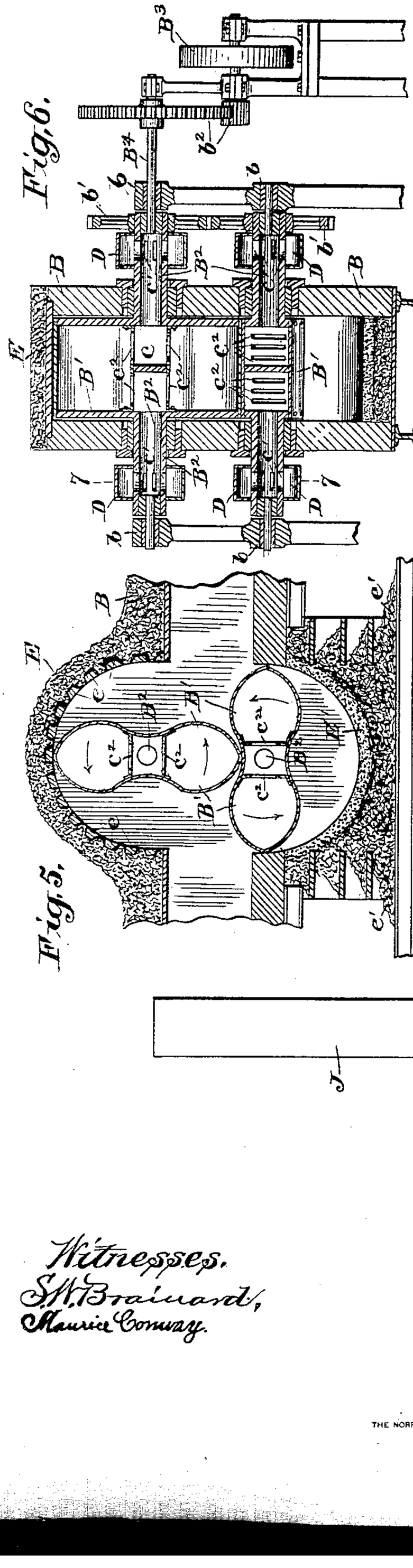

Fig. 6.

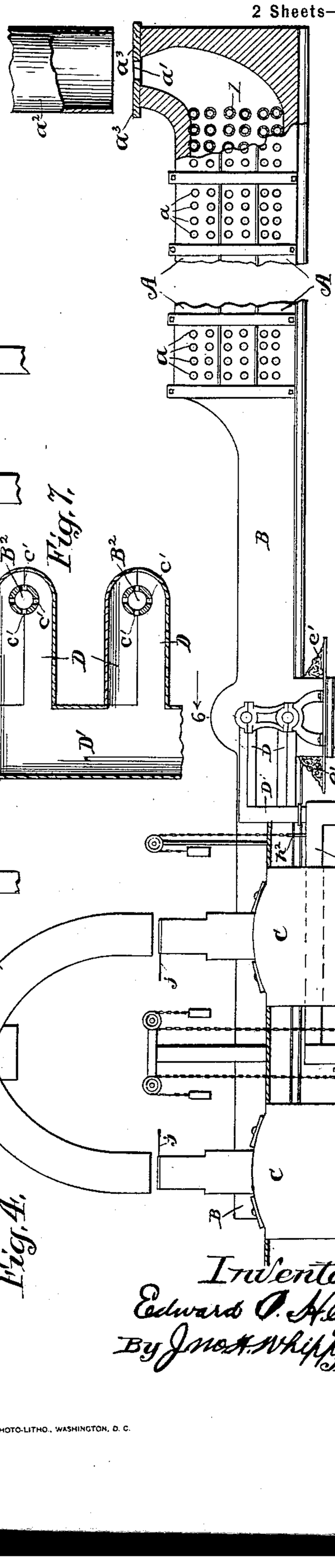

Fig. 7.

Fig. 5.

Fig. 4.

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UNITED STATES PATENT OFFICE.

EDWARD C. HEGELER, OF LA SALLE, ILLINOIS.

GAS-PRODUCER FOR METALLURGICAL PLANTS.

SPECIFICATION forming part of Letters Patent No. 630,885, dated August 15, 1899.

Application filed November 26, 1894. Serial No. 530,013. (No model.)

To all whom it may concern:

Be it known that I, EDWARD C. HEGELER, of La Salle, in the State of Illinois, have invented certain new and useful Improvements in Metallurgical Plants, of which the following is a specification.

My invention relates to plants in which a gas-combustion chamber is used in conjunction with a gas-producer connected by a flue with the combustion-chamber, so that the hot uncooled gas from the producer may be conveyed by the flue to the combustion-chamber to be burned in the same for creating the requisite heat therein. The gas is produced from bituminous coal in the producer by fire in the bottom, beneath which air is introduced. The gas-flue is connected with the top of the producer and leads directly therefrom to the entrance of the combustion-chamber, and the feeding and stoking openings are placed in the top of the producer or above the point where the air is introduced beneath the fire. To furnish a uniform supply of uniformly rich gas without interruption in plants of this class is a desideratum. The gas should be under a uniform pressure above barometric pressure at the entrance of the combustion-chamber and should have an approximately uniform temperature, as much as is practicable and without losing any of the heat it has when produced. The coal is subject to baking and clinkering in the producer and requires frequent stoking to prevent the dwindling of the gas both in quantity and quality. The feeding and stoking openings of the producer must be kept closed in order to obtain the pressure above barometric pressure at the entrance of the combustion-chamber. To make stoking and feeding possible, the blast under the producer has to be interrupted or reduced for that purpose, so that the gas does not drive through the feeding and stoking openings toward the operator. Also for clinkering the producer the blast has to be interrupted, bringing with it both a reduction of the pressure and quality of gas at the entrance to the combustion-chamber. When thus the feeding and stoking openings are open, more or less air will enter into them, either burning the gas and producing a high temperature in the gas-flue or, if the temperature of the gas be below the ignition-point on its contact with air, explosions in the gas-flue are liable to result. Soot adhering to the walls also forms in the gas-flue and obstructs the draft. If much air enters at the feeding and stoking openings, it is liable to burn, producing temporarily a high temperature in the gas-flue.

The object of my improvements is to provide means in plants of this class whereby an approximate equilibrium between interior pressure of the producer and the exterior barometric pressure at the feeding and stoking openings may be produced whenever desired, so that neither blowing out of gas nor drawing in of air sufficient to cause burning in the gas-flue will occur when said openings are uncovered without interfering with the pressure at the entrance of the combustion-chamber. With this object attained the requisite stoking and feeding to prevent dwindling of the gas is made practicable and an approximately uniform movement of the gas toward the combustion-chamber is secured for any desired period, together with an approximately uniform temperature in the gas-flue. I attain the object and secure these results by the means illustrated in the accompanying drawings, in which—

Figure 1 is a plan view of a plant embodying my improvements. Fig. 2 is an enlarged vertical section on the line 2 2 of Fig. 1 looking in the direction indicated by the arrows. Fig. 3 is a detail showing a fragment of a vertical section taken on the line 3 3 of Fig. 2. Fig. 4 is a side elevation of the plant. Fig. 5 is a detail showing a fragment of an enlarged longitudinal section of that part of the gas-flue in which a blower is located. Fig. 6 is a detail showing an enlarged transverse vertical section through the gas-flue and blower, the section being located on the line 6 6 of Fig. 4 and representing the part seen by looking in the direction indicated by the arrows. Fig. 7 is a detail showing a section on the line 7 7 of Fig. 6.

In the drawings, A designates the combustion-chamber, B the gas-flue, and C a gas-producer which comprises a battery of four members.

The combustion-chamber, as here shown, comprises a long low chamber built upon the ground and provided with a series of separate

retorts *l*, placed in each side and provided with detachable spouts *a*, projecting outwardly. The flue communicates with the combustion-chamber at one end in the ordinary way, so that the gas from the flue can enter and pass through the space between the retorts in the combustion-chamber, where it is burned in the ordinary way for heating the retorts the burned gases passing out at an opening a' in the top of said chamber, over which a sheet-iron chimney a^2 is suspended in a manner to allow air to enter it at the bottom for producing a cooling effect in the chimney. The opening a' may be more or less closed for regulating the pressure in the combustion-chamber by fire-clay bricks or slabs a^3, adapted to slide over the same.

I introduce a rotary blower in the gas-flue between the gas-producer and combustion-chamber for drawing the gas from the producer and forcing it into the combustion-chamber. The blower is run at uniform speed and will produce a uniform movement of gas in the flue. This automatically retards or promotes movement in the producer, accordingly as there is a tendency to produce more or less than the required amount of gas. The blower in the gas-flue will therefore coöperate with the blast beneath the fire to lessen or promote the production of gas in accordance with the amount the blower takes away, and when used with the means for increasing or diminishing the draft-openings beneath the fire, so as to admit more or less air, accordingly as there comes less or more than the amount taken away by the rotary blower, the required equilibrium in the upper part of the producer may readily be secured and maintained while the feeding and stoking openings are uncovered. This result is produced by the conjoint action of the means employed to simultaneously operate upon the draft in the producer both above and beneath the fire and at places in opposite directions from the feeding and stoking openings.

The blower comprises wings B′, supported on the shafts B^2, which are extended transversely through an enlarged part of the flue adapted to the wings and supported in suitable bearings *b*. The wings are operated in unison by spur-wheels b' on the shafts B^2. One of the shafts is connected with suitable gearings b^2, adapted to be operated by a pulley B^3, upon which a belt from the power-shafting is to be applied. The blower thus placed in the gas-flue between the producer and the combustion-chamber is subjected to the heat of the gas passing through the flue, but through its use this heat becomes controllable, so as not to be destructive to the blower itself, as stoking can be done at any time and the irregularities causing the high temperatures of the gas in the flue be overcome. However, still further to secure the blower against accidental high heats and for keeping the shafts, spur-wheels, journals, and bearings cool I make the shafts B^2 hollow along that part which passes through the gas-flue and projects for some distance upon each side, there being a partition *c* midway of the hollow and the outer parts B^4 being solid. At the ends outside the flue said shafts have slots or openings c' communicating with the hollow of the shafts. The wings are also made hollow, and the openings c^2 in the shafts upon each side of the partition *c* are made to communicate with the hollow of the wings. Hollow boxings D are placed upon said shafts so as to cover the openings c', and a blast-pipe D′ is connected with said boxings, whereby a current of cold air or other cooling fluid or liquids may be forced in at one side by an ordinary blower, (not shown,) passing through the hollow of the shafts and out upon the opposite side.

The wings of the blower rub or move relatively to one another at the point of approximate contact, and thereby cleanse each other of all accumulations of soot upon their adjacent faces, except to the extent of such small increment as will make them fit more closely together, which, being a non-conductor, will tend to protect the blower by preventing its absorption of heat from the gas.

The soot accumulations upon the interior of that part of the flue where the blower is located will be subject to being forced outward against the wall by the action of the wings, and thus tend to produce objectionable pressure upon or contact between the wings and flue. To obviate any difficulty on this account, I provide a yielding section or part to the bottom and top of the flue where the blower is located, which as a safety-valve will give way before any objectionable pressure or contact is created in this way and also in case of accidental explosions. Such safety-valve may be provided by forming part of the arch E over the wings of cross-bars *e* laid sufficiently close to support a layer composed of a mixture of clay and coal-dust, which will be of sufficient weight and strength to resist the gas-pressure and yet will yield to any outward pressure resulting from soot accumulations being forced outward by the action of the wings of the blower. The bottom part E′ may be made of a layer of similar composition supported on a bed of dust e' piled upon the floor under the gas-flue. Such yielding parts of the flue will not only adapt it to utilize the soot accumulations for maintaining a close fit of the wings in the flue, but will afford means of easy access to the interior of the flue for cleaning or repair.

The producer-chambers have their bottoms contracted, as shown at F, so as to leave an opening in the center. This opening is surrounded by a water-pipe *f*, which communicates at both ends with a tank, (not shown,) so that the heating of the part surrounding said opening will cause a constant circulation of water from the tank, and thereby prevent the edges of the opening from burning out.

Feeding and stoking openings G are provided at the top of the producer, with suitable covers G′. Bituminous coal fed in at the feeding-openings as it is being gradually changed into gas by fire in the bottom of the producer will settle down and rest upon a hearth H, where the coked part of it is burned.

The hearth is inclosed by side and end walls H′, which are united at the bottom of the producer-chamber, so as to form a blast-chamber at each side of the coal on the hearth, into which a blast may enter beneath the fire from blowpipes *h*, which have slide-valves for regulating the blast. Said blast-chambers are provided with doors *h′* for removing the clinkers forming on the hearth.

A blast for the battery of producers may be supplied from a common blowpipe H^2, communicating with an ordinary blower (not shown) and having branches H^3 communicating with the several blast-chambers, a slide-valve h^2 being provided for simultaneously regulating the blast-pressure in all of the branches. Each of the branches leading to the separate members of the producer also has a slide-valve h^3, so that the blast to each member of the producer may be separately diminished or cut off entirely.

By making the producer-chamber larger or increasing the number of its members so as to produce a more abundant supply of gas with less motion in the producer the rarefied column of air or gas inside the producer may be made to furnish a sufficient draft without the aid of a blast beneath the fire, and in such case the admission of air beneath the fire at the bottom of the producer may be regulated and made to coöperate with the blower in the flue to produce an approximate equilibrium of interior and exterior pressure at the feeding and stoking openings G, as before described, so that there will be no objectionable blowing out of gas or drawing in of the air at the feeding and stoking openings when open by clearing or more or less choking the draft or clinkering openings with ashes.

Each member of the producer is connected by means of a short flue I with a port I′ of the gas-flue B, which port is controlled by a valve *i*, and also with a port I^2 of an escape-chimney J, which latter port is controlled by a slide-valve *j*.

When the blower in the gas-flue is out of repair, it is contemplated to provide a temporary by-flue around the blower, by means of which the gas may be carried around the blower while the repairing is being done. The battery-producer in such case may be worked by means of the valves controlling the communication of the several members with the gas-flue and the escape-chimney, whereby any single member of the producer may be cut out during the feeding, stoking, and clinkering thereof, the other members furnishing the supply of gas in the meanwhile, the blast beneath the fire in the bottom thereof being of sufficient strength and being adapted to be turned on with increased force at the same time.

By means of the battery-producer and the separate connection described of each of its members with the gas-flue any of the members may be cut out of the battery-producer while being stoked, fed, or repaired, the others keeping up the supply in the meanwhile by means of increased blast or draft applied to them in the manner described, and upon the cutting out of any single member the draft in the rest will be automatically regulated by the rotary blower in the gas-flue, as stated.

The temperature and consequent density of the gas in the gas-flue may be kept uniform by the regulation of the feeding, stoking, and draft beneath the fire in the manner described, and in aid of such regulation pyrometers may be placed in the gas-flue and arranged to indicate changes of the temperature of the gas therein.

The invention is not limited to a battery of gas-producers thus equipped with means for controlling the pressure of gas in the top of the several producer-chambers by the regulation of pressure beneath and above the fire therein and at places in opposite directions from the feeding and stoking openings in each, as a single member of such producer so equipped constitutes practicable means for the purpose; but the battery thus equipped obviously constitutes the better means for the purpose, because the regulation of the blast beneath the fire in such case, though of importance, would not be as important as in the case of using but a single producer-chamber.

What I claim is—

1. In a metallurgical plant, the combination with a combustion-chamber, of a gas-producer, a gas-flue leading directly from the producer to the combustion-chamber, and a blower in the gas-flue directly intermediate the combustion-chamber and producer, whereby an equilibrium of pressure of the gas in the producer with the outer atmosphere may be produced at the stoking-opening while the plant is in operation, and the gas, as produced, may be delivered directly into the combustion-chamber uncooled and under pressure, as specified.

2. A metallurgical plant comprising a combustion-chamber having a gas-escape opening at one end, a gas-producer having feeding and stoking openings and means for closing the same, and draft-openings beneath the fire-box with means for regulating the draft thereto thereby to establish and maintain an equilibrium of pressure of the gas in the producer with the outer atmosphere at the feeding and stoking openings, and to deliver gas under pressure at the same, a flue directly connecting the combustion-chamber and the producer, and a blower in the flue intermediate of the combustion-chamber and the producer for drawing gas from the producer and forcing it uncooled and under pressure into

the combustion-chamber, also, retarding or promoting movement in the producer according as there is tendency to produce more or less than the required amount of gas, and, further, simultaneously operating upon the draft in the producer both above and beneath the fire and at points in opposite directions from the feeding and stoking openings, substantially as described.

3. A metallurgical plant comprising a combustion-chamber having a gas-escape opening at one end and means for varying the size of the opening whereby to regulate and fix the pressure in the chamber, a gas-producer having feeding and stoking openings and means for closing the same, and draft-openings beneath the fire-box with means for regulating the draft thereto thereby to establish and maintain an equilibrium of pressure of the gas in the producer with the outer atmosphere at the feeding and stoking openings, and to deliver gas under pressure at the same, a flue directly connecting the combustion-chamber and the producer, and a blower in the flue intermediate of the combustion-chamber and the producer for drawing gas from the producer and forcing it uncooled and under pressure into the combustion-chamber, also, retarding or promoting movement in the producer according as there is tendency to produce more or less than the required amount of gas, and, further, simultaneously operating upon the draft in the producer both above and beneath the fire and at points in opposite directions from the feeding and stoking openings, substantially as described.

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