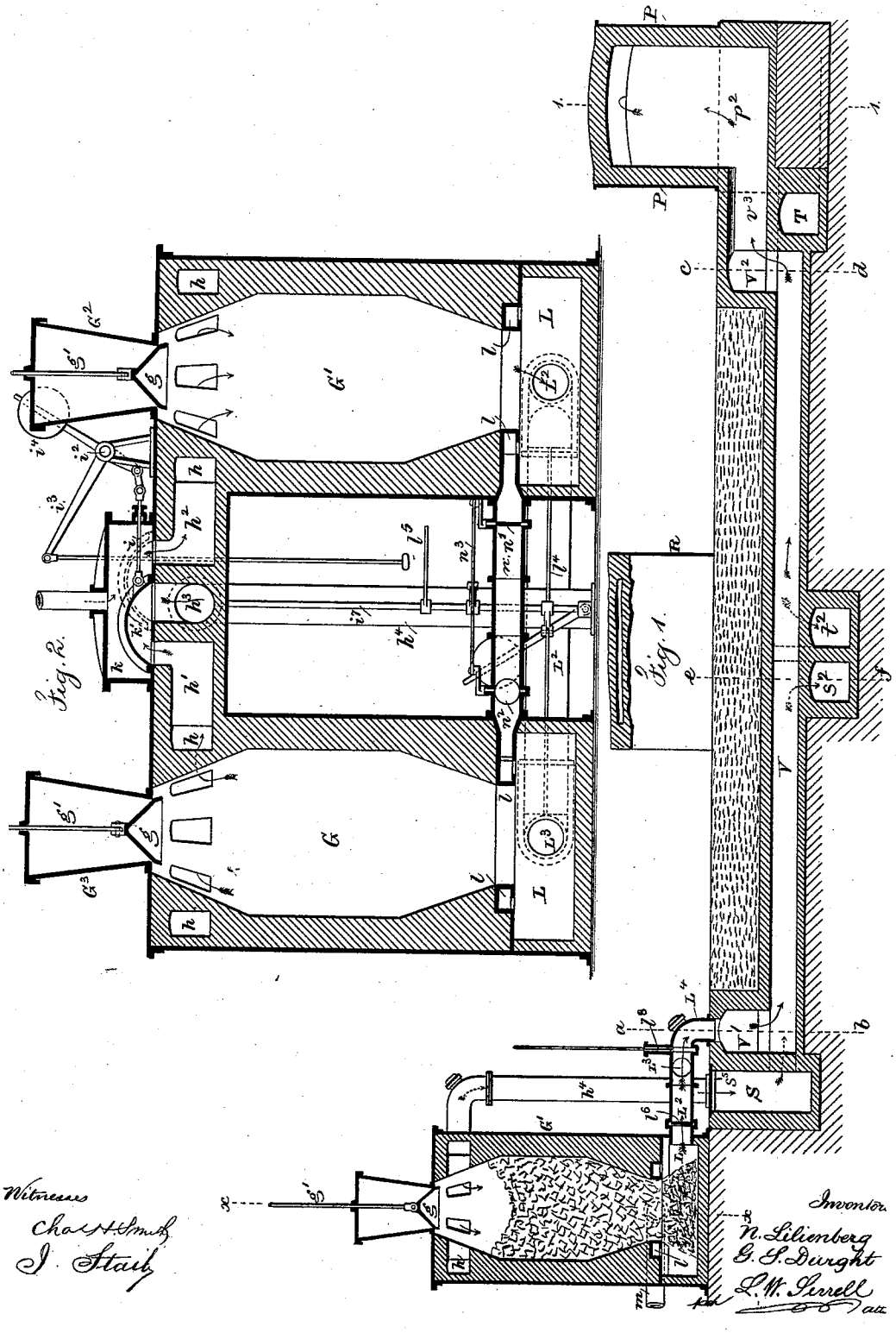
(No Model.) 3 Sheets—Sheet 1.

N. LILIENBERG & G. S. DWIGHT.

GAS PRODUCER FOR METALLURGIC OPERATIONS.

No. 329,058. Patented Oct. 27, 1885.



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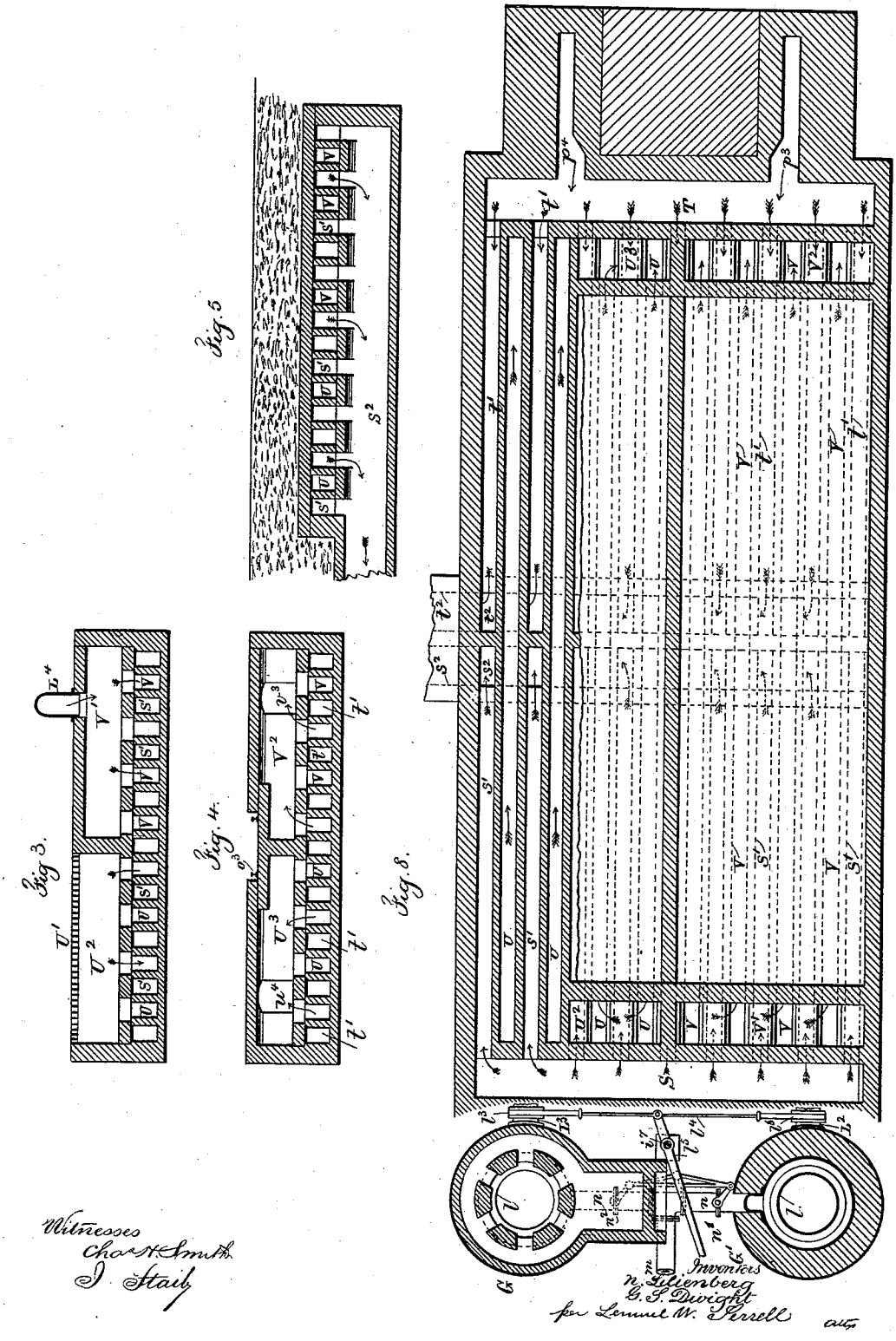

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GAS PRODUCER FOR METALLURGIC OPERATIONS.

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Fig. 7.

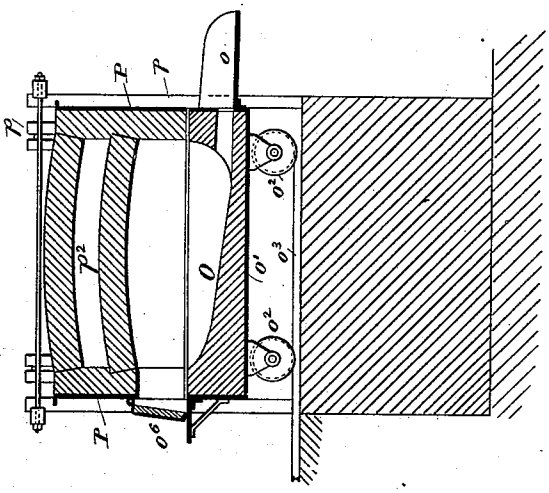
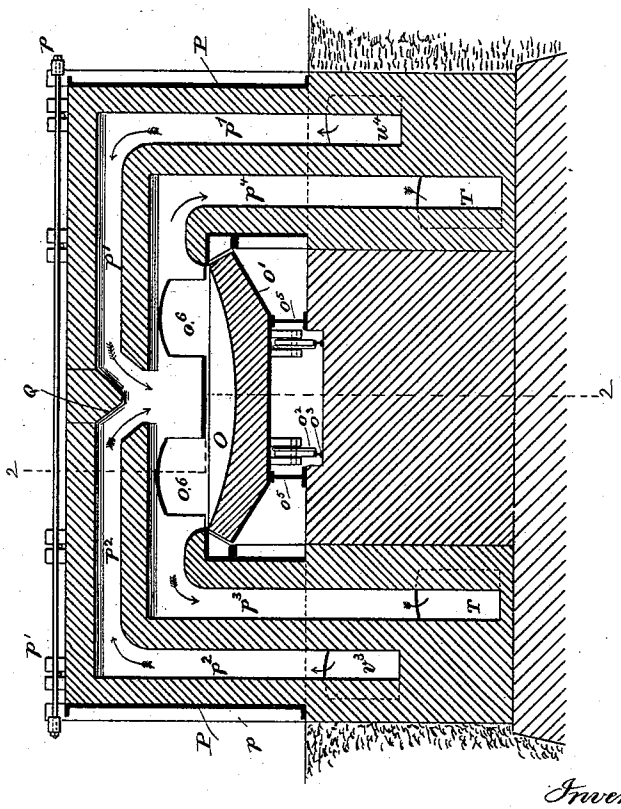


Fig. 6



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UNITED STATES PATENT OFFICE.

NILS LILIENBERG AND GEORGE SPRING DWIGHT, OF NEW YORK, N. Y.

GAS-PRODUCER FOR METALLURGIC OPERATIONS.

SPECIFICATION forming part of Letters Patent No. 329,058, dated October 27, 1885.

Application filed February 27, 1885. Serial No. 157,199. (No model.)

To all whom it may concern:

Be it known that we, NILS LILIENBERG and GEORGE S. DWIGHT, of the city and State of New York, have invented an Improvement in Gas-Producers for Metallurgic Operations, of which the following is a specification.

The object of this invention is to consume fuel gradually and produce a heating-gas containing a large volume of hydrogen, and to raise this gas to a high temperature previous to its combustion in the presence of highly-heated atmospheric air, and also to make use of the heated gases, in their progress to the chimney, for heating up the air-blast and gases, so as to economize the heat, and to produce an intense flame adapted to the melting of iron, steel, or other metals.

In the drawings, Figure 1 is a vertical section of the apparatus. Fig. 2 is a cross-section through the generators at the line *x x*. Fig. 3 is a cross-section through the flues at the line *a b*. Fig. 4 is a cross-section at the line *c d*. Fig. 5 is a cross-section at the line *e f*. Fig. 6 is a cross-section at 1 1, Fig. 1, through the melting-furnace. Fig. 7 is a section of the same at the line 2 2, Fig. 6; and Fig. 8 is a plan view partially in section.

G G′ represent two generators, which are preferably circular in form, and made of brick-work within metallic cases. The upper and lower portions of each generator are contracted, and there is a flue, *h*, around the upper portion of such generator, with lateral openings into the generator, and two escape-flues, h' h^2, pass off toward each other, and between them is a lateral flue, h^3, passing off to a descending flue, h^4, and thence to the chimney, as hereinafter described. Above the flues h' h^2 h^3 there is a dome, *k*, into which steam is supplied from any suitable boiler, and within this dome is a movable valve, k', actuated by a rod, *i*, rock-shaft i^2, and lever and handle i^3, and there is a counter-weight, i^4, upon the rock-shaft i^2, which serves to insure the complete movement of the valve and hold it in either position. This valve k' is hollow, and of a length adapted to extend across and connect the upper ends of the flues h' h^3, as shown in Fig. 2, or it may be moved into the position shown by dotted lines to open the communication between the flues h^2 h^3. It is now to be understood that when this valve is in the position shown in Fig. 2 steam from the dome *k* passes down through the flues h^2 *h* into the generator G′, and down through the fuel in the same, so that the steam is decomposed, the oxygen combining with the incandescent fuel, and the hydrogen, commingled with carbonic oxide and other products of combustion, passing off, as hereinafter described. During this same time the fuel in the generator G is being consumed and its heat intensified by air supplied at the bottom and passing up through the fuel, the products of combustion going by the flues *h* h' through the valve k' to the flue h^3, and away by the descending flue h^4. When the steam-valve k' is moved, the operations are reversed, and the heating-gas is generated in G while the fire is being intensified in G′. Fuel is supplied periodically to these generators, as required, by a hopper, G^2, to the generator G′, and a hopper, G^3, to the generator G. Each hopper is provided with a movable bottom, *g*, at its lower end operated by a rod, g'. These movable bottoms when raised act as valves to close the communication between the hoppers and the generators. When depressed, the fuel is discharged from the hoppers to the generators. The lower part of each generator is contracted, and there is an annular air-pipe, *l*, beneath this contraction, and there is a chamber, L, below each generator, forming an ash-pit, and also a gas-flue. To the flue or chamber L, below the generator G, is connected a branch pipe, L^3, and to the chamber L, below the generator G′, is connected the flue L^2. These flues L^2 and L^3 lead to the gas-pipe L^4. There are valves l^3 l^6 in the branch pipes L^3 L^2, respectively. The valves l^3 l^6 are connected by a rod, l^4, and this is moved by a lever, l^5, and shaft i^7, and these are made so that when one valve is withdrawn to open the branch pipe L^3 the valve to the branch pipe L^2 is closed, and vice versa. l^8 is a valve in the pipe L^4 for closing the outlet of gas from the generators. Air is supplied by the pipe *m* from any suitable blowing apparatus, and there are branch pipes *n* leading to the annular pipes *l*, and in these branch pipes *n* are valves n' n^2. These valves are preferably provided with crank-arms connected by a rod, n^3, and from the vertical shaft i^7 there is an arm connecting with the rod n^3.

The parts are constructed and placed in

such a manner that by moving the lever l^5 and shaft i^7 the four valves l^5 l^6 and n' n^2 are simultaneously operated. When n' is closed, n^2 is open to admit air into the generator G, and the gas-valve l^5 is simultaneously closed, the gas-valve l^6 being opened. In this position of the valve air will be passing in by the valve n^2 into the generator G to intensify the fire, and the heating-gas generated in G' will be passing off by the valve l^6. When the lever l^5 and shaft i^7 are moved and the positions of the valves reversed, the fire will be intensified in G' by air admitted by the valve n', and the heating-gas from the generator G' will pass off by the valve l^5.

It will be observed by reference to Fig. 2 that each chamber L beneath the generator is sufficiently large for a heap of ashes therein to accumulate and support the fuel in the generator, and the air issuing from the annular pipe l passes downwardly into this chamber and ascends through the fuel, so that the combustion thereof is rendered perfect. When a heating-gas is being produced in a generator, the gases pass down into such chamber L, and are led away, as aforesaid.

At a suitable distance from the generators there is an open hearth or furnace for the metallurgic operations. We prefer to make use of a hearth, O, having a discharge-trough, o, at one end, the hearth being made of silicious or basic materials within a casing or car, o', on wheels o^2, which rest upon a track, o^3, and can be moved back or forward thereon.

We make use of a furnace-casing, P, supported by the bars and tie-rods p, and within these are fire-brick partitions, forming inlet-flues p' p^2 and outlet-flues p^3 p^4. The inlet-flues p' p^2 extend across above the hearth O, and there is a central opening and a deflector, Q, by which the flame is directed downwardly upon the materials to be melted upon the hearth O, and the flame and products of combustion pass away by the flues p^3 p^4.

Upon reference to the cross-section, Fig. 6, and the longitudinal section, Fig. 7, it will be seen that the flues p' p^2 p^3 p^4 are at opposite sides of the hearth O, and that this hearth is introduced into an opening provided for it crosswise of the furnace. When this hearth O is rolled into its place, a luting of clay is to be applied all around upon its upper edges, and the hearth is to be raised up bodily, so that the luting is compressed against and unites with the stationary portions of the furnace, and the bearers o^5 are to be slipped in beneath the hearth O to retain it in the elevated position. When the hearth requires to be relined or repaired, the bearers o^5 are to be removed and the hearth O allowed to drop down with its wheels upon the track. This breaks away the luting and allows the hearth to be easily rolled out from beneath the stationary portions of the furnace. The arches, provided with stoppers at o^6, give access to the hearth O for introducing the material to be melted and for stirring the same. It is now to be understood that heating-gas is to be admitted through the flue p^2 and air through the flue p', and these combine and burn together in an intense flame as they pass through the opening beneath the deflector Q. The gas is derived from the pipe L^4, and both the air and the gas are in a highly-heated condition before commingling and burning. The flues s^2 t^2 and chimney R, through which the products of combustion ascend, are about midway between the furnace P and the generators G and G', and at one side of ranges of flues passing horizontally, or nearly so, between such generators and the furnace. The products of combustion descending by the flues p^3 p^4 from the furnace, and the products of combustion descending by the flue h^4 from the generators, are led to the chimney R, and in their passage thereto the heat is transferred to the air and gases, respectively, reaching the furnace P through the flues p' p^2, so that the products of combustion escaping up the chimney R are comparatively cool. To accomplish this object the waste heat from the generators, as it passes down the flue h^4, enters a transverse passage-way, S, and from that passes into the numerous horizontal flues s', and these flues s' open into a flue, s^2, leading across beneath them to the base of the chimney. In like manner the products of combustion from the furnace P descend by the flues p^3 p^4 into the transverse channel T, and from there pass by the numerous flues t' to the transverse flue t^2 beneath them to the base of the chimney. There is a range, U V, of numerous horizontal flues placed intermediately to the flues s' t' and extending nearly the whole length between the cross-channel S and the cross-channel T. Half of these flues are allotted to air, the other half to gas. The gas from the pipe L^4 passes into the cross flue or channel V'; thence through the flues V up into the cross flue or channel V^2, and by the longitudinal flue v^3 into the bottom portion of the ascending flue p^2 to the furnace, as aforesaid, and in its travel said gas becomes highly heated by its proximity to the flues s' t'. In like manner the air passes in through a grating, U', into a cross flue or channel, U^2, and through the numerous flues U to the cross flue or channel U^3, and by the longitudinal channel u^4 to the base of the flue p', the air becomes highly heated from the proximity of the flues U to the flues s' t', so that the air and gases are highly heated and combustion is very perfect when the air and gases burn together over the hearth, as before described. If the products of combustion passing away from the generators G G' by the flue h^4 are not perfectly consumed, atmospheric air may be admitted into the cross-channel S, so that any carbonic oxide may be consumed and increase the heat in the flues s'. We have shown gratings at s^3, through which such air may be admitted.

It will now be apparent that this apparatus

is adapted to the furnishing of a heating-gas continuously to the hearth O, because the dampers can be changed instantaneously and the steam directed through the generator G or G′ while the other generator is being heated up.

We are aware that a generator has been employed for the production of a heating-gas to be used in metallurgic operations, and that steam has been caused to pass down through the incandescent fuel while producing this heating-gas, and the temperature of the fuel has been augmented by shutting off the steam and admitting atmospheric air.

We claim as our invention—

1. The generators G G′, having flues *h h′ h²* *h³*, in combination with the steam-dome and the slide-valve within the dome, and means for actuating such valve, substantially as specified.

2. The generators G G′, the chambers L beneath the same, and the annular air-pipes *l*, in combination with the air-pipes *n m* and valves *n′ n²*, the gas-pipes L^2 L^3, the valves l^3 l^6, and mechanism for operating the same, substantially as set forth.

3. The combination of the generators G G′ and flues *h′ h² h³* with the steam-supply and valve *k′*, the air-pipes *n l*, the chambers L beneath the generators, the gas-pipes L^2 L^3, the air and gas valves, and mechanism for actuating the same, substantially as set forth.

4. The combination, with two adjacent generators and mechanism, substantially as specified, for admitting steam and air alternately, of a furnace or hearth for metallurgic operations, and connections for conveying the gases from the generators, and adjacent flues for heating the atmospheric air in its passage to the furnace, so that the gas and heated air commingle and burn at a central point over the hearth, and flues for conveying away the products of combustion from the furnace, substantially as specified.

5. The combination, with two adjacent generators for alternately producing a heating-gas by steam passed through incandescent fuel, of a furnace for metallurgic operations, flues for conveying the gas from either of the generators to the furnace, and contiguous flues through which air passes to the furnace, and contiguous flues through which the products of combustion pass for heating the gases and air by the waste heat, substantially as set forth.

6. The combination, with two generators, and mechanism, substantially as specified, for operating the same alternately, of a furnace for metallurgic operations, the flues *s s′* for the waste heat from the generators, the flues *t t′* for the waste heat from the furnace, a chimney, and the flues V V′ for gas, and the flues U U^3 for air, the same being contiguous to the flues through which the products of combustion pass, so that the air and gas reach the metallurgic furnace in a highly-heated condition, substantially as specified.

7. The adjacent generators G G′, having flues *h*, and the flues *h′ h²*, escape-flue *h³*, and means for supplying steam and heating the generators alternately for the production of a heating-gas, in combination with flues for the waste products of combustion, adjacent flues for air and gas, the flues P′ P^2 P^3 P^4, the deflector Q, and the hearth O, for metallurgic operations, there being an opening beneath the deflector and over the hearth, at which point the gas and air commingle and burn, substantially as specified.

8. In an apparatus for producing gas for metallurgic operations, the combination of two adjacent gas-generators, flues *h′ h² h³*, for the products of combustion, and a valve for the admission of steam, air-pipes, and pipes for conveying away the gases, and valves for the respective pipes, and flues by which the generators are alternately heated up and gas produced, and a furnace or hearth for metallurgic operations, and air and gas flues leading from the generators to the furnace, substantially as specified, whereby a heating-gas is produced nearly continuously, and supplied, together with heated air, to the metallurgic furnace, substantially as specified.

Signed by us this 10th day of February, A. D. 1885.

NILS LILIENBERG.
GEORGE SPRING DWIGHT.

Witnesses:
W. F. DURFEE,
THEODORE DWIGHT.