R. HILPRECHT.

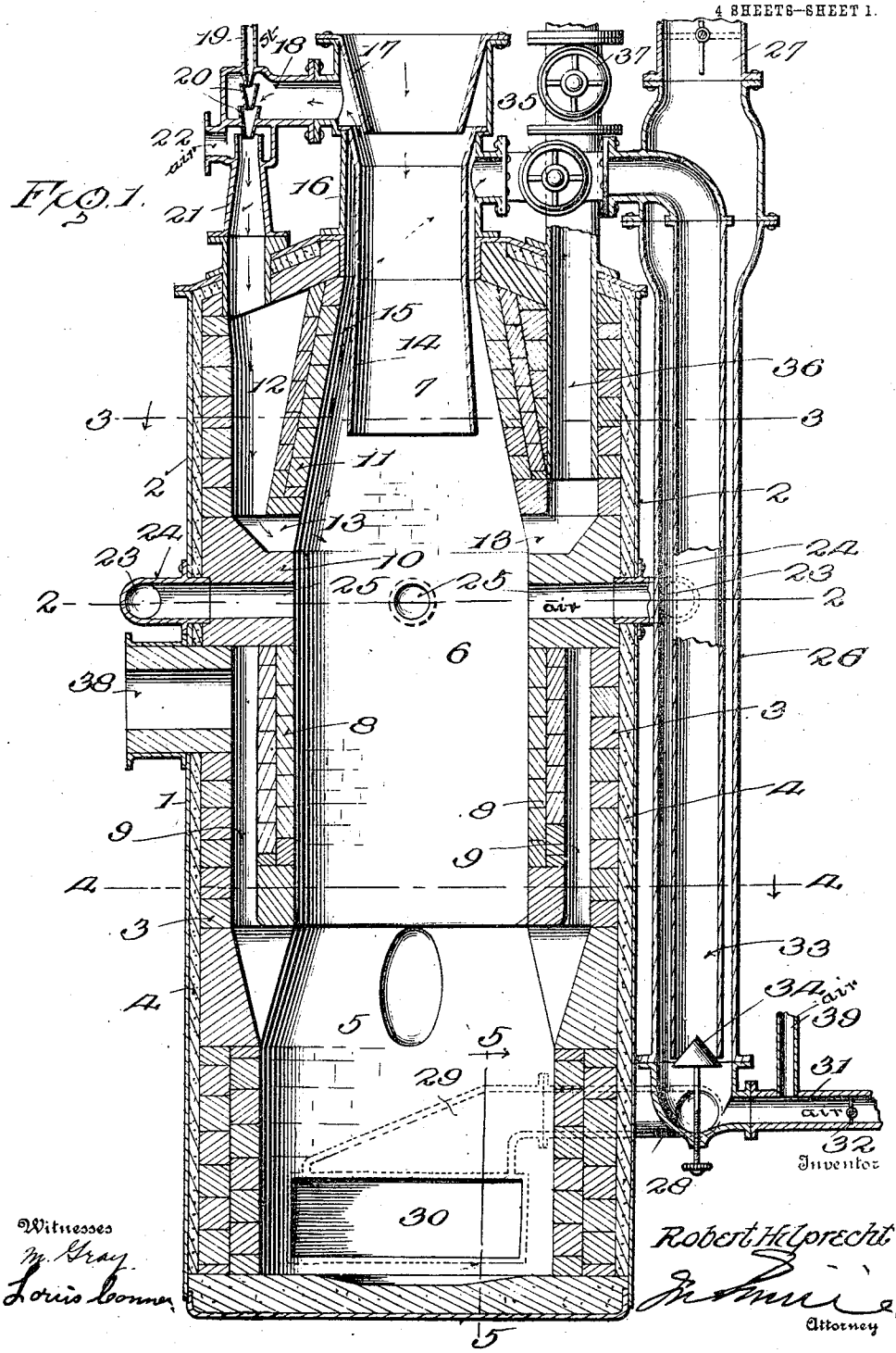
GAS PRODUCING FURNACE.

APPLICATION FILED DEC. 17, 1909. RENEWED NOV. 7, 1910.

**979,951.** Patented Dec. 27, 1910.

4 SHEETS—SHEET 1.

FIG. 1.

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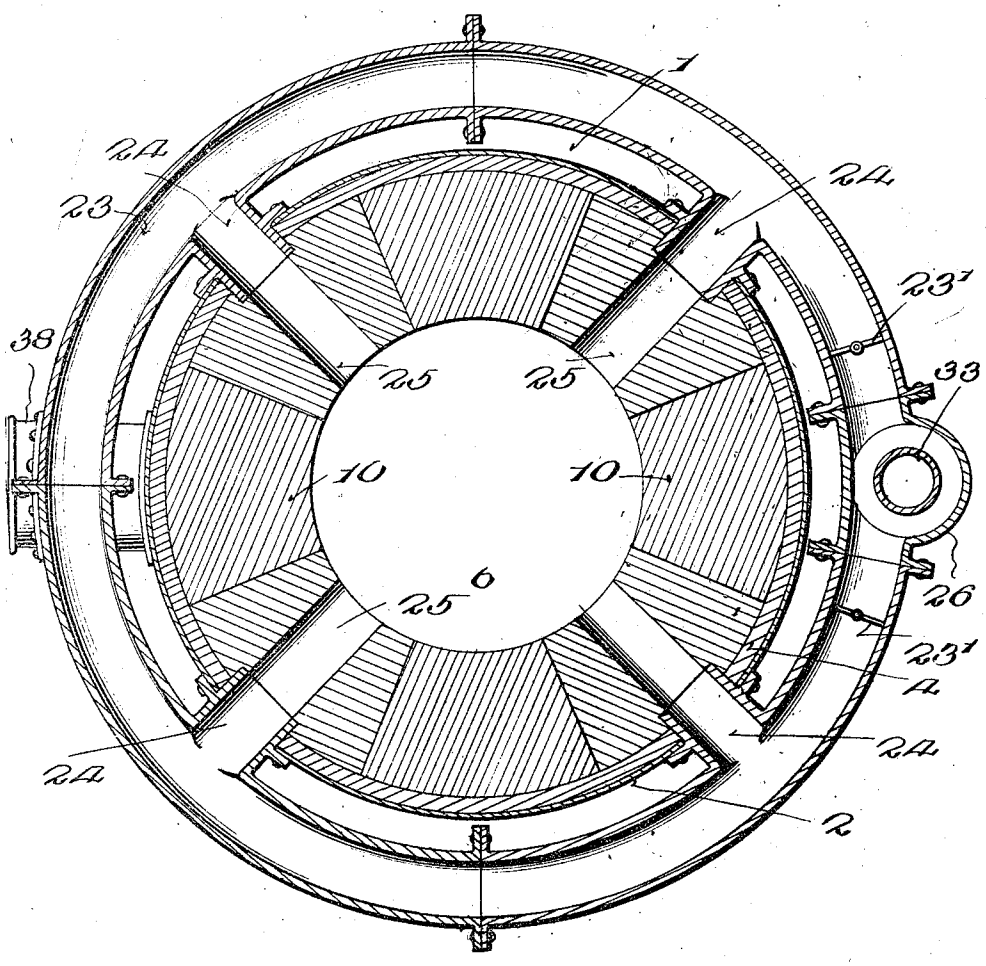
4 SHEETS—SHEET 2.

FIG. 2.

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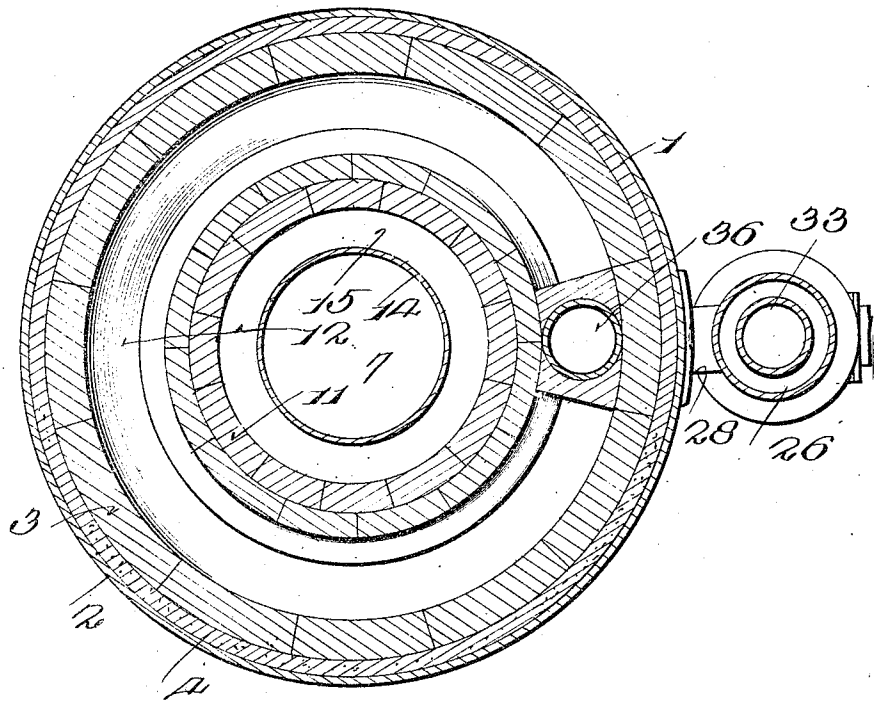
4 SHEETS—SHEET 3.

FIG. 3.

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4 SHEETS—SHEET 4.

FIG. 4.

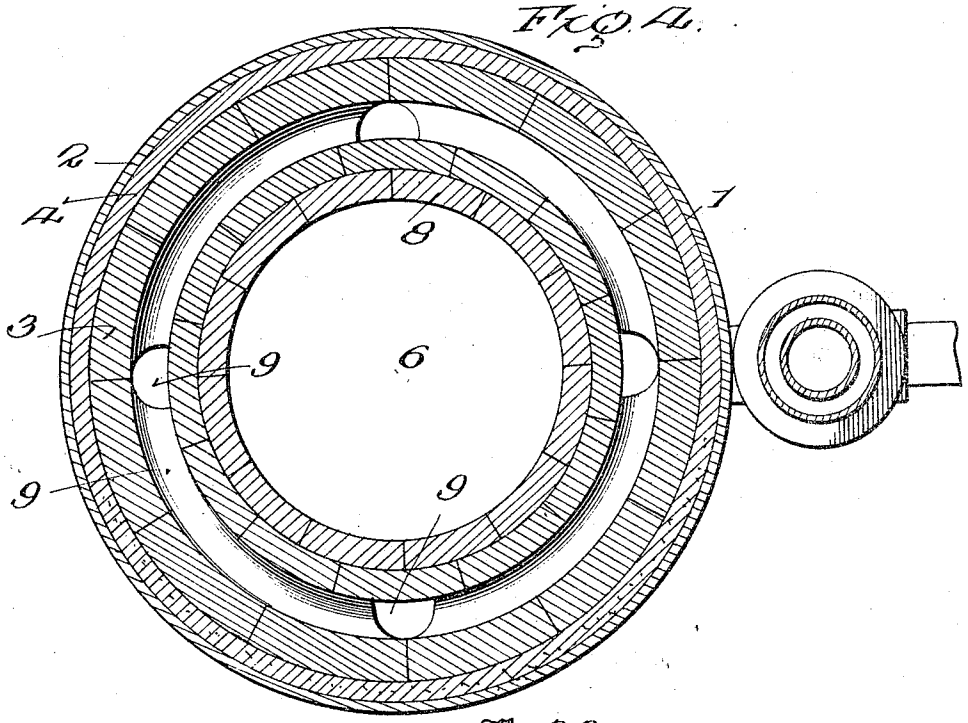
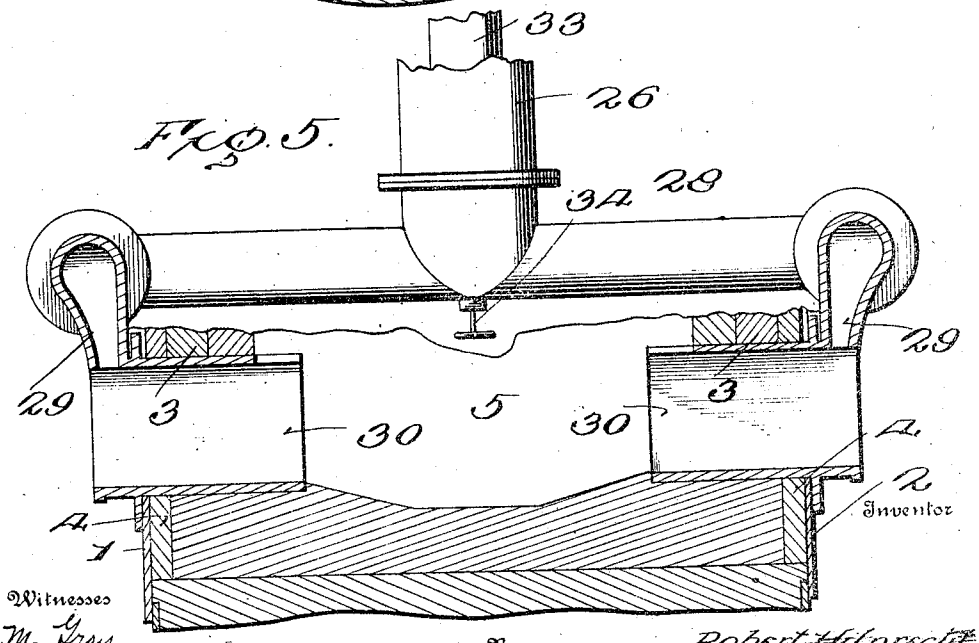



FIG. 5.

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# UNITED STATES PATENT OFFICE.

ROBERT HILPRECHT, OF LANSING, MICHIGAN.

## GAS-PRODUCING FURNACE.

979,951. Specification of Letters Patent. Patented Dec. 27, 1910.

Application filed December 17, 1909, Serial No. 533,737. Renewed November 7, 1910. Serial No. 591,117.

*To all whom it may co ncern:*

Be it known that I, ROBERT HILPRECHT, a resident of the United States, and subject of the Emperor of Germany, residing at Lansing, in the county of Ingham and State of Michigan, have invented certain new and useful Improvements in Gas-Producing Furnaces, of which the following is a specification.

This invention relates to an improvement in gas making machines, being particularly directed to a producer in which the gas is manufactured or liberated by combustion of coal products.

The main object of the present invention is the provision of a gas producer in which the products of combustion are so treated that the gas previous to its delivery from the producer is entirely freed of tar, whereby the improved machine serves in effect as a combined producer and cleaner.

A further object of the invention is the provision of means whereby the maximum combustion in the producer is maintained approximately at the point where the tar and gas is distilled from the coal product so that the distillate may be readily directed to the point of maximum combustion to consume the tar.

The invention will be described in the following specification, reference being had particularly to the accompanying drawings, in which:—

Figure 1, is a vertical longitudinal sectional view of my improved gas making machine. Fig. 2 is a horizontal sectional view on the line 2—2, of Fig. 1. Fig. 3, is a horizontal sectional view on the line 3—3, of Fig. 1. Fig. 4 is a horizontal sectional view on the line 4—4, of Fig. 1. Fig. 5 is a sectional view on the line 5—5, Fig. 1.

The improved gas producer, as is clearly shown in the accompanying drawings, is in the nature of a furnace 1, made up of an external shell 2, of sheet iron or the like, within which is a lining 3 of fire brick or other refractory material. Between the fire brick and shell is a filling of asbestos or other non-heat conducting material 4.

The interior of the furnace is arranged to provide what will be hereinafter termed a lower fire chamber 5, an upper fire chamber 6, and a coal supply chamber 7, these chambers being arranged in vertical alinement centrally of the furnace. Above the lower fire chamber and interiorly of the furnace there is arranged a cylindrical section of fire brick 8, disposed in spaced relation to the lining 3 to form a gas chamber 9. At the upper end of the section 8 there is arranged a transverse section 10 of refractory material, which is practically an extension of the lining 3 and forms a closure for the upper end of the gas chamber 9. Above the section 10 there is arranged a conical section of refractory material 11, which is disposed in spaced relation to the lining 3 to provide a combustion chamber 12, said lining section 11 being formed adjacent its connection with the section 10 with a series of openings 13 which lead directly into the upper fire chamber 6, to provide communication between the combustion chamber and the fire chamber.

The coal supply chamber is in the form of a metallic sleeve-like section 14 which depends within the conical section 11 and is of less diameter than the minimum diameter of said section, thereby providing what will be hereinafter termed a gas space 15 between the sections 11 and 14. The supply section 14 is supported upon a sleeve-like casting 16 which rests upon and is secured to the upper portion of the furnace, said casting having a diameter approximating the minimum diameter of the section 11 so that between the wall of the casting and the supply section 14 there is provided what may be termed a continuation of the gas space 15. The casting section 16 is extended above the upper end of the supply section 14 and is formed to receive and support a hopper 17 whereby the coal product may be delivered to the supply section 14. A lateral pipe section 18 is supported by the sleeve casting 16 and is in open communication with the supply section 14 by virtue of the reduced diameter of the lower end of the hopper, and said pipe section supports an injector pipe 19 leading to the interior of the pipe section from any suitable source of compressed air or steam supply. The pipe section 18 is, through the medium of a series of injector nozzles 20, in communication with a feed pipe 21 which lead through the upper wall of the furnace into the combustion chamber 12, said feed pipe 21 being in communication with the atmosphere through a lateral by-pass 22.

Encircling the furnace at a point about midway of the upper fire chamber 6 is a blast ring 23 having a series of radial pipe

sections 24, which extend into the lining section 10 and communicate by means of openings 25 in said section 10 with the upper fire chamber 6. At one side of the furnace there is erected a stand pipe 26 open at the upper end to the atmosphere, the air supply through which is controlled by means of a damper 27 arranged in said upper end. The stand pipe 26 leads to and is in direct communication with the blast ring 23, extending above and below the same, as shown. At the lower end the stand pipe communicates with a lower blast ring 28, which encircles the furnace and at appropriate points is in communication through depending supply ducts 29 with blast pipe sections 30 extending through the wall of the furnace and into the lower fire chamber at the lower portion thereof. The stand pipe, at the lower end, is also in communication with an air supply pipe 31, controlled by a damper 32 and in communication with any suitable source of air under pressure, as a blower or the like.

Within the stand pipe 26 is arranged a gas transferring pipe 33, which is closed against the stand pipe except at the lower end of said transferring pipe, and the communication at this point is controlled through the medium of a valve 34. The gas transferring pipe extends at the upper end laterally through one wall of the stand pipe and is in communication with the gas space 15 at the upper portion of the furnace, a valve 35 controlling this communication at will.

An escape pipe 36 is arranged in the combustion chamber 12 and thereby in open communication with the interior of the furnace through the openings 13. The escape pipe 36 leads to a chimney or other escape flue and is controlled by a valve 37. A gas supply pipe 38 is arranged in communication with the gas chamber 9, preferably at the upper portion of the latter, and if desired the initial blast supplied by the blower through pipe 31 may be supplemented by an additional pressure pipe 39 leading from a steam supply.

With the parts of the furnace constructed and arranged as described the operation is as follows: The soft coal is supplied in desired quantity through the hopper to the supply section 14, assuming the fire to have been already started. The valves 37 and 32 are open and all others are closed. The air blast admitted to the pipe 31 is directed to the lower fire chamber through the blast pipes 30 and to the upper fire chamber through the laterals 25 from the blast ring 23, reaching both fire chambers through the stand pipe 26. When the fire has reached a point sufficient to generate gas, as shown by the gas testing cocks (not illustrated), the interior of the furnace will present a hot fire mass from the bottom of the furnace to practically the lower edge of the supply section 14, and the products of combustion will be escaping through the pipe 36. The injector is then operated through pipe 19, drawing off the tar and smoke by suction through the supply section 14, the pipe 18, and by means of the pipe 21 directing the same back into the combustion chamber 12. The gas products are thus consumed by the fire in the upper fire chamber and by the heat in the combustion chamber, as there is no other course of travel for the material. The gas supply pipe 38 is connected through a vaporizer, not shown, directly to the gas engine designed to utilize the gas generated in the producer. When the gas is in sufficient quantity to operate the engine, the latter is started and the valves 32 and 37 are closed, the remaining valves being opened. The suction induced by the engine is then, by reason of the peculiar construction described, entirely sufficient for maintaining the producer in operation for delivering a practically clean gas, as it will be understood that the suction of the engine will draw air from the atmosphere through the stand pipe 26 and thereby supply both the blast rings 23 and the lower blast ring 28 with air for combustion purposes. The gas after being cleaned by burning the tar and the like therefrom in the upper fire chamber will, under the suction of the engine, be directed through the gas space 15 and through the gas transferring pipe 33 to and through the lower blast ring 28, reaching the interior of the furnace and being directed to the gas chamber 9 and so through the feed pipe. It is, of course, understood that the gas in its travel through the lower fire chamber will not deteriorate as the material in said chamber is practically a clear coke. As the supply of gas generated, cleaned, and delivered to the gas chamber 9 depends particularly upon the condition of the fire, and such condition is primarily controlled by the supply of air delivered through the blast rings, it is obvious that the suction from the engine, or more directly the pull of the load on the engine controls the gas supply. By arranging the gas transferring pipe within the stand pipe I am enabled to utilize the heat from the gas traveling in the former to the air passing through the latter, thereby delivering the air supply to the fires in a heated condition, facilitating combustion.

Having thus described the invention what is claimed as new, is:—

1. A gas producing furnace including an upper fire chamber, a lower fire chamber, a coal supply chamber extending within the upper end of the furnace with a gas space surrounding the same, a combustion chamber encircling and in open communication with the upper fire chamber, and means for withdrawing the gas supply from the upper fire

chamber and delivering the same to the combustion chamber.

2. A gas producing furnace including an upper fire chamber, a lower fire chamber, a coal supply chamber extending within the upper end of the furnace with a gas space surrounding the same, a combustion chamber encircling and in open communication with the upper fire chamber, and an injector arranged beyond the furnace and operating to withdraw the gas from the upper fire chamber and deliver the same to the combustion chamber.

3. A gas producing furnace including an upper fire chamber, a lower fire chamber, a coal supply section, said section being arranged within the furnace to provide a gas space between the section and furnace in open communication with the upper fire chamber, a combustion chamber having communication with the fire chamber beneath the lower end of the coal supply section, means for delivering gas from the gas space to the lower fire chamber and an air supply pipe surrounding the gas delivering means.

4. A gas producing furnace including an upper fire chamber, a lower fire chamber, a coal supply section, said section being arranged within the furnace to provide a gas space between the section and furnace in open communication with the upper fire chamber, a combustion chamber having communication with the fire chamber beneath the lower end of the coal supply section, an air supply pipe for delivering air to both the upper and lower fire chambers, and a gas transferring pipe in communication with the gas space and arranged within the air supply pipe.

5. A gas producing furnace including an upper fire chamber, a lower fire chamber, a coal supply section, said section being arranged within the furnace to provide a gas space between the section and furnace in open communication with the upper fire chamber, an air supply pipe for delivering air to both the upper and lower fire chambers, and a gas transferring pipe in communication with the gas space and arranged within the air supply pipe, said transferring pipe having valved communication with the air supply pipe.

6. A gas producing furnace comprising an outer shell, an upper fire chamber, a lower fire chamber, a coal supply section in axial alinement therewith and extending within the upper fire chamber with an annular gas space surrounding the same, means for delivering a blast of air to the upper fire chamber, and a combustion chamber above and in communication with the upper fire chamber below the inner end of the coal supply section, and an escape pipe in communication with said combustion chamber and the interior of the shell.

7. A gas producing furnace having an upper fire chamber, a lower fire chamber, a coal supply section above the upper fire chamber with a gas space surrounding the same, a blast ring encircling the furnace adjacent the upper fire chamber, communicating pipes between the blast ring and upper fire chamber, and an air supply pipe in communication with the blast ring.

8. A gas producing furnace having an upper fire chamber, a lower fire chamber, a coal supply section above the upper fire chamber with a gas space surrounding the same, a blast ring encircling the furnace adjacent the upper fire chamber, communicating pipes between the blast ring and upper fire chamber, an air supply pipe in communication with the blast ring, means for supplying air under pressure in communication with one end of said supply pipe, means whereby the opposite end thereof has valved communication with the atmosphere and a gas transferring pipe communicating with said gas space and arranged within said air supply pipe.

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

ROBERT HILPRECHT.

Witnesses:
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IVA M. SPEARS.