No. 793,305. PATENTED JUNE 27, 1905.

E. KÖRTING.

GAS PRODUCER.

APPLICATION FILED FEB. 24, 1902.

Fig. 1.

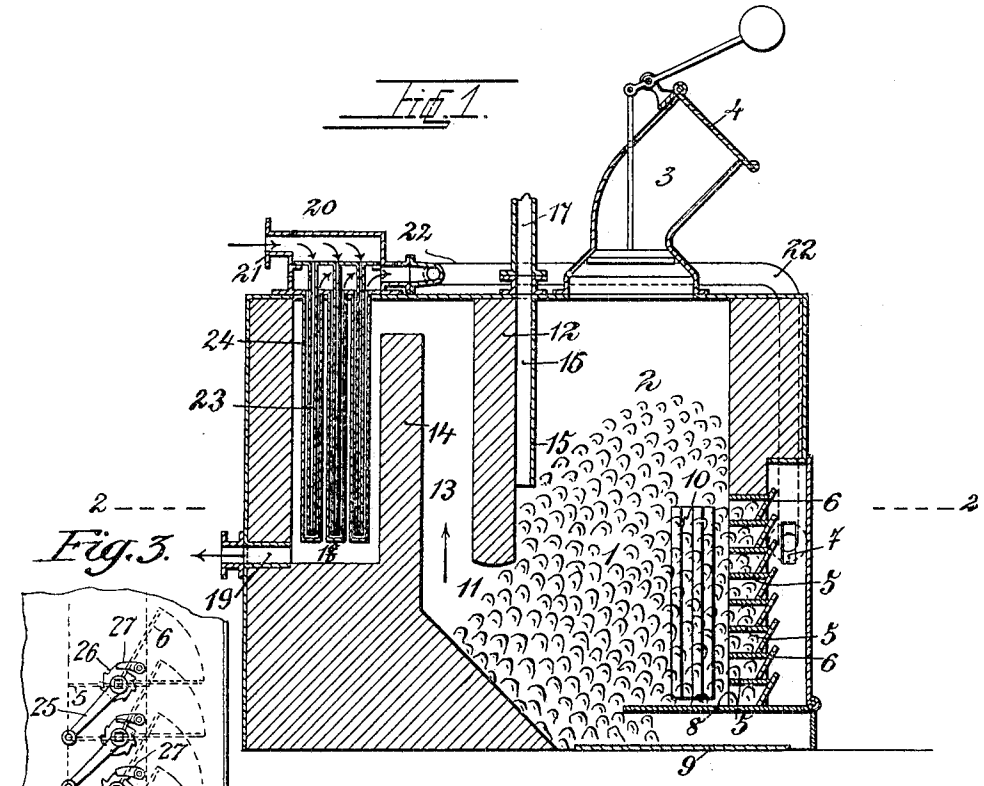



Fig. 3.

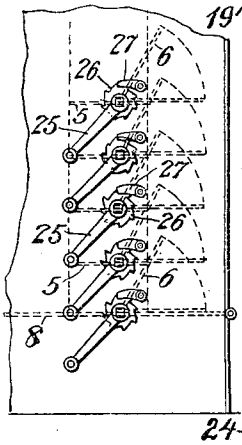
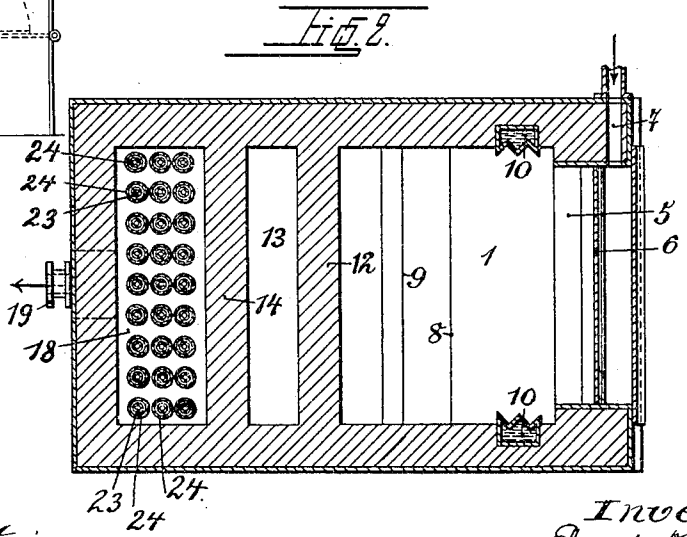



Fig. 2.




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No. 793,305. Patented June 27, 1905.

# UNITED STATES PATENT OFFICE.

ERNST KÖRTING, OF HANOVER, GERMANY.

## GAS-PRODUCER.

SPECIFICATION forming part of Letters Patent No. 793,305, dated June 27, 1905.

Application filed February 24, 1902. Serial No. 95,152.

*To all whom it may concern:*

Be it known that I, ERNST KÖRTING, a subject of the King of Prussia, German Emperor, residing at Hanover, Germany, (whose post-office address is Allecstrasse No. 2, Hanover, Prussia, German Empire,) have invented a new and useful Gas-Producer, of which the following is a specification.

This invention relates to that class of gas-producers in which the front side of the gasifying or generating chamber is formed by a vertical grate composed of horizontal bars, so that the fuel to be gasified is furnished with air in horizontal direction.

It consists in the improvements hereinafter more fully described and by which the producer is enabled to do its work in a more perfect manner than heretofore.

The principal feature of my invention consists in that the exit-opening for the gas generated is located in the rear wall of the gasifying-chamber at about half the height of the grate, or, in other terms, in the line in which said wall would be intersected by a horizontal plane passing through the center of the grate or thereabout. By thus locating the gas-outlet I cause the gases produced in the several horizontal zones of the body of fuel opposite the grate to gradually converge inward, while the tarry and watery vapors resulting from the imperfect gasification which takes place in the higher zones to which air has no access are caused to pass down into and through incandescent strata of fuel, whereby the watery vapors are reduced to free hydrogen, their oxygen being consumed by and generating carbonic acid and carbonic oxid from the incandescent fuel, and the tarry vapors are decomposed to permanent hydrocarbons and carbon, the hydrogen and hydrocarbons resulting from the reduction of these vapors mixing with the carbonic oxid generated.

As with the construction contemplated of the producer, slag and ashes are caused to form in vertical zones one behind the other—that is to say, slag in the zone adjacent to the grate and ashes in the zone behind—both kinds of residues can be withdrawn separately from each other through special doors without impairing the proper working of the producer.

To this end another feature of my invention consists in arranging at the bottom of the grate two parallel plates which are horizontally extended into the gasifying-chamber and of which the upper one is shorter and serves to support the forming slag, whereas the lower one is longer and serves for supporting the forming ashes, which are withdrawn through the channel formed by the said plates, the slag being removed from the upper plate.

If fuel is to be gasified which is in a very wet state, or if the fuel is bituminous, a very considerable amount of imperfectly-decomposed products and watery vapors are produced, which are liable to disturb and render irregular the action of the producer. To get rid of this, a third feature of my invention consists in providing in proximity to the rear wall of the generating-chamber a separate eduction-channel which communicates at its lower end with that portion of the fuel which fills the chamber above the grate.

As slag only forms in the foremost vertical zone of the fuel—that is, in the zone adjacent to the grate which is the hottest zone—adherence of the slag, which is more or less fluid, to the side walls of the gasifying-chamber is restricted to areas of but small width. To prevent the slag from adhering to said walls and to secure thereby proper substitution of the burned fuel by the unburned descending from the top part or supply-shaft, a fourth feature of my present invention consists in constructing the side walls of the gasifying-chamber at those places with hollow internally-cooled metal plates, whereby the adjacent slag is cooled and caused to contract, so as to separate from the wall. By these means a great deal of trouble is removed.

With producers of the present class it is of high importance that the several horizontal zones of the fuel are supplied with such an amount of air as is most suitable for each. To obtain this, a fifth feature of my present invention consists in combining with each air-inlet formed by the opening between two succeeding grate-bars a damper, slide, or equivalent means for regulating the area of said opening.

As with my improved producer a very perfect reduction to carbonic oxid and hydrogen takes place it is of high importance to recover the heat carried away by the gases and to return it to the gasifying-chamber, and in order to provide this a sixth feature of my invention consists in constructing the producer with a recovering-chamber through which the gases are caused to pass as they escape from the gasifying-chamber and in which there is located a preheater for the combustion-air to pass through before it reaches the grate.

In order that my invention may be fully understood, I have represented on the annexed sheet of drawings an improved gas-producer showing the several features as disclosed in the preceding part of this specification.

Figure 1 is a vertical section through the producer; and Fig. 2, a horizontal section on line 2 2, Fig. 1. Fig. 3 is an elevation of a portion of the producer, showing means for regulating the openings between the grate-bars.

1 is the gasifying or generating chamber of the producer, and 2 the vertical shaft for charging the fuel from above by means of the hopper 3, provided with a double lid 4 4′ of known construction.

5 represents the horizontal bars of the grate, and 6 represents dampers for regulating the openings between said bars. These dampers may be pivotally mounted and provided with means for adjusting them, as shown by Fig. 3. As here shown, the pivots 24 of the dampers carry outside one of the producer-walls operating-handles 25 and ratchet-wheels 26, with which ratchet-wheels pawls 27 coöperate to hold the dampers in the desired positions.

7 is the opening through which air is admitted in front of the grate.

8 is the upper fire-plate for supporting the slag-producing portion of the fuel or that adjacent to the grate, and 9 the lower fire-plate for supporting the rear portion of the fuel or that which leaves behind ashes.

10 represents the internally-cooled hollow iron-plates inserted in the side walls of the generating-chamber 1 adjacent to the slag-forming zone in order to prevent the slag forming from adhering to said walls. I prefer to provide the iron plates 10 with vertically-corrugated outer surfaces to increase their cooling-surface.

11 is a horizontal slit in the rear wall 12 of the gasifying-chamber. This slit is located at a level which corresponds with the horizontal middle line of the grate, or nearly so, and constitutes the opening through which the gases produced pass from the generating-chamber 1 into the eduction-channel 13, extending upward between the rear wall 12 of said chamber and a parallel wall 14. In front of the rear wall 12 is arranged a vertical plate 15, extending through the entire width of the generating-chamber and down to some distance from the upper edge of the slit 11, so that a channel 16 is formed, the lower end of which communicates with the upper portion of the fuel and allows the imperfectly-gasified products generated in said portion to pass out into the eduction-pipe 17.

18 is a chamber separated by the wall 14 from the gas-eduction channel 13 and communicating with the latter at the top, while at its bottom it is provided with a gas-outlet 19. In this chamber is located an air-preheater 20, which is supplied at one end with atmospheric air through pipe 21 and communicates at the opposite end through pipe 22 with the air-supply opening 7 in front of the grate.

The operation of this gas-producer is as follows: The combustion-air in passing through pipe 21, preheater 20, and pipe 22 arrives in hot state in front of the grate, and by the horizontal bars 6 of the latter it is caused to subdivide into a corresponding number of horizontal currents which penetrate the fuel in horizontal direction. Owing to the location of the gas-exit slit 11 those air-currents are caused to change from their initial horizontal direction and gradually converge, as indicated by dotted lines in Fig. 1. That portion of the fuel which is adjacent to the grate is burned with the production of carbonic dioxid ($CO_2$) and water ($H_2O$), while in the rear portion of the fuel a more complicated process takes place—that is to say, in the lower zone—that is, the one traversed by the gases produced in the fore part of the chamber and which is in the state of incandescence—perfect reduction to carbonic oxid (CO) and hydrogen (H) is produced, whereas the fuel occupying the upper zone undergoes only a low degree of distillation, with the effect of giving off vapors of tarry products and water. The products of this upper zone may be allowed to escape through the eduction-pipe 17 or may be caused to pass down to the slit 11 through the incandescent layers, with the effect of being decomposed into carbonic oxid, hydrogen, and hydrocarbons. The amount of air to be admitted to the several zones of the fuel is regulated by means of the dampers 6. In the vertical zone adjacent to the grate a vertical stratum of more or less fluid slag results, but is prevented from adhering to the side walls of the generating-chamber 1 by the cooling action of the internally-cooled iron plates 10 and sinks down to the supporting-plate 8, from which it is withdrawn. The rear portion of the fuel is reduced to ashes, which are supported by the plate 9 and are removed therefrom through the channel formed by the plates 8 and 9. The hot gases generated in the chamber 1 escape therefrom through the slit 11 and pass through the channel 13 into the top of chamber 18, where they descend and finally pass out through the pipe 19. The combustion-air enters through pipe

21 in the preheater 20, in which it first passes down through the inner pipes 23, then upward through the pipes 24, surrounding the pipes 23, and finally into the pipe 22, by which it is conducted to the opening 7. By this construction of the preheater a very efficient recovery of the heat is obtained on the counter-current principle.

What I claim, and desire to secure by Letters Patent of the United States, is—

1. In a gas-producer the combination with the gasifying-chamber, the supply-shaft, the vertical grate and the opening for admitting air in front of the grate, of a vertically-narrow discharge-opening located in the rear wall of the gasifying-chamber at about the level of the center of the grate, substantially as and for the purpose stated.

2. In a gas-producer the combination, with the gasifying-chamber, the supply-shaft, the vertical grate, the opening for admitting air in front of the grate, and the exit-opening for the gases in the rear wall of the gasifying-chamber, of two parallel horizontal plates extending at the lower end of the grate into the gasifying-chamber, the lower plate serving to support the rear or ash-producing portion of the fuel and the upper plate being shorter than the lower plate and serving to support the forward or slag-producing portion of the fuel, substantially as and for the purpose stated.

3. In a gas-producer, the combination with the gasifying-chamber, the supply-shaft, the vertical grate, the opening for admitting air in front of the grate, and the discharge-opening for the gases in the rear wall of the gasifying-chamber, of vertically-arranged hollow internally-cooled metal plates arranged in the side walls of the gasifying-chamber at the place of the slag-forming zone, substantially as and for the purpose stated.

4. In a gas-producer, the combination with the gasifying-chamber, the supply-shaft, the vertical grate, the opening for admitting air in front of the grate, and the discharge-opening in the rear wall of the gasifying-chamber, of means for regulating the width of the openings separating the bars of the grate, substantially as and for the purpose stated.

5. In a gas-producer, the combination with the gasifying-chamber, the supply-shaft, the vertical grate, the opening for admitting air in front of the grate, and the gas-discharge opening arranged in the rear wall of the chamber at about the level of the center of the grate, of a channel extending down in front of said rear wall to a distance above the gas-discharge opening, substantially as and for the purpose stated.

6. In a gas-producer, the combination with the gasifying-chamber, the supply-shaft, the vertical grate, the opening for admitting air in front of the grate, and the gas-discharge opening, of a vertical channel communicating at its lower end with the discharge-opening, a heat-recovering chamber communicating at its top with said channel, an air-preheater located in the heat-recovering chamber, and a pipe connecting the exit-opening of the preheater with the opening for admitting the combustion-air in front of the grate.

7. In a gas-producer, the combination with the gasifying-chamber, the supply-shaft, the vertical grate, and the opening for admitting air in front of the grate, of a gas-discharge opening located in the rear wall of the gasifying-chamber at about the level of the center of the grate, means for regulating the openings of the grate, a channel extending down in front of the rear wall of the gasifying-chamber to some distance above the gas-discharge opening, a heat-recovering chamber arranged behind the gasifying-chamber and provided with an exit-opening at the bottom, a channel connecting the top part of the heat-recovering chamber with the gas-discharge opening in the rear wall of the gasifying-chamber, an air-preheater located in said heat-recovering chamber, a pipe connecting the exit-opening of the air-preheater with the opening for admitting air in front of the grate, internally-cooled metal plates arranged in the sides of the gasifying-chamber at the plate of the slag-forming zone, and two parallel plates extending in horizontal direction from the bottom of the grate into the gasifying-chamber, the upper plate being shorter than the lower plate, substantially as and for the purpose stated.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

ERNST KÖRTING.

Witnesses:
LEONORE KASCH,
C. C. STEVENSON.