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G. S. MERRILL.

PROCESS OF COKING.

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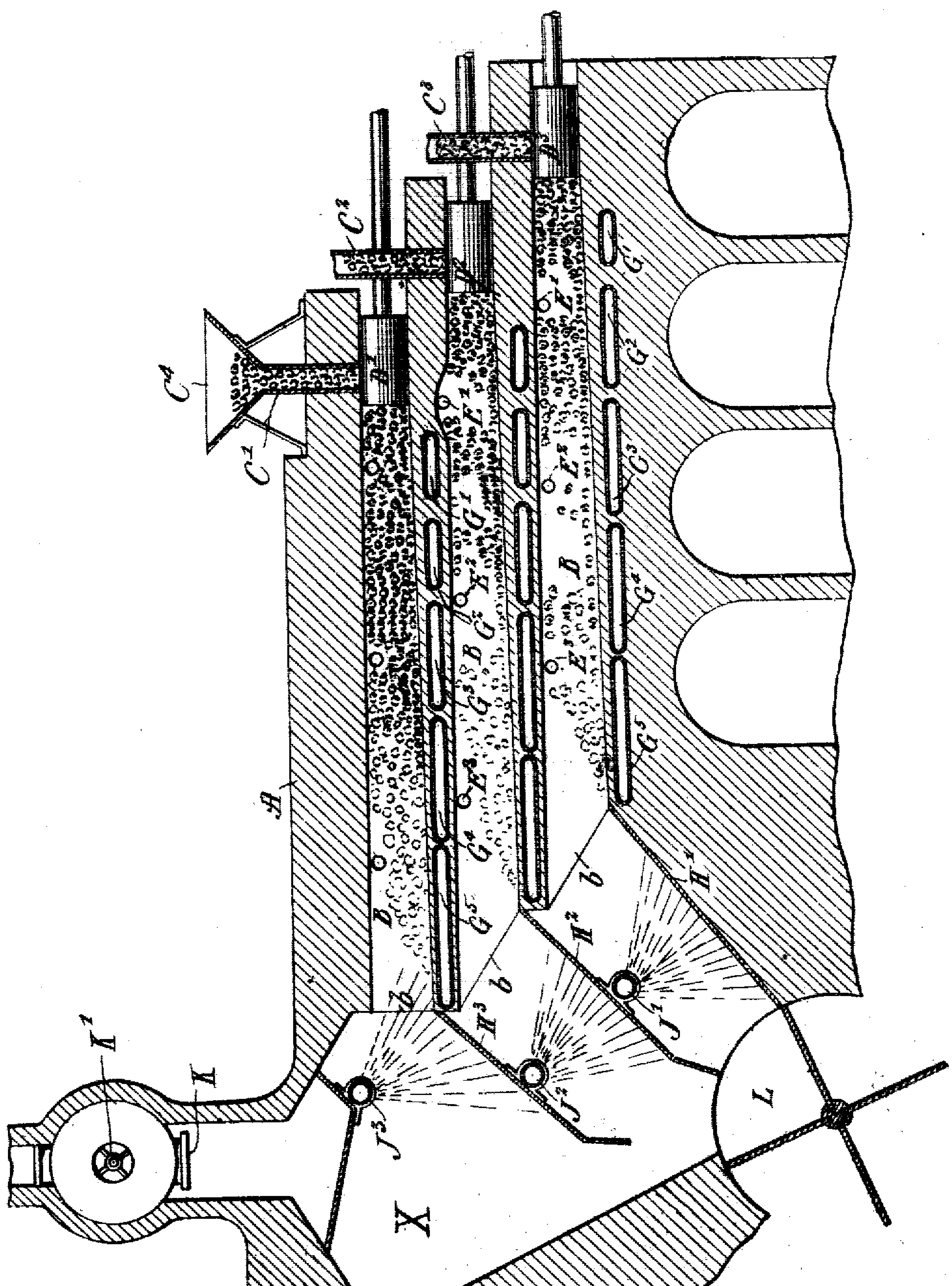

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PROCESS OF COKING.

No. 815,453. Specification of Letters Patent. Patented March 20, 1906.

Application filed December 12, 1903. Serial No. 184,859.

To all whom it may concern:

Be it known that I, GEORGE SPENCER MERRILL, a citizen of the United States, residing and having a post-office address at Peace Dale, in the county of Washington, State of Rhode Island, have invented certain new and useful Improvements in Processes of Coking, of which the following is a full and true description, reference being had to the accompanying drawing, which diagrammatically illustrates a vertical section of a plant which utilizes the features of my new process.

This invention relates to the production of coke from coal, and has for some of its objects, first, to more speedily and economically produce coke; second, to increase the output of a plant; third, to produce a better quality of coke; fourth, to render the process of coking practically continuous instead of intermittent, as heretofore; fifth, to render unnecessary the exclusion of air from the oven, as heretofore practiced; sixth, to provide a process which will by producing therefrom coke practically free from sulfur and other undesirable substances enable coal-bearing sulfur to be used for making coke; seventh, to produce a coke of any desired hardness, especially from coal heretofore unavailable because of the spongy nature of the coke produced; eighth, to separately draw off from a mass undergoing coking the richer and the leaner gases; ninth, to subject various portions of a mass of coal to heat of different intensities; tenth, to provide a process in which the gases are continuously drawn from the material undergoing coking.

In its preferred embodiment my new process consists in treating the coal in a horizontally-disposed layer having but little depth as compared with that of the prior processes and subjecting such layer to heat. As a result the layer will be cooked more rapidly, and the released gases, sulfur, &c., will have to pass upwardly through about twelve inches of coal instead of through six or seven feet, as formerly required, and there will be less opportunity for the sulfur to deposit upon or return to the coke.

In practice in order to prevent oxidation it is essential that air shall be excluded as far as possible from the mass which is being cooked. Prior to my present invention this has been accomplished by hermetically sealing the retort-oven after charging the same. By my process, however, great care in sealing is unnecessary, one preferred step consisting in drawing away from the oven under treatment any air which might enter the same.

The preferred embodiment of my process is a continuous method of coking, consisting in heating a mass of coal, removing coke from one portion thereof, and supplying coal to another portion without interrupting the coking. This continuous treatment, as hereinafter pointed out, is most advantageously carried out when the mass of coal is arranged in a horizontal layer, but is applicable also to layers or masses, however disposed, by removing coke from one end of the layer and supplying coal to the other end, thus keeping the oven always filled, or nearly so. To effect the discharge and supply spoken of, the layer of coal may be periodically or continuously moved or permitted to move, as hereinafter described.

In the accompanying drawing I have shown diagrammatically a vertical section of the parts of a coking plant useful in carrying out my new process in detail.

A indicates an oven of masonry and provided with a plurality of chambers B. These will preferably be rectangular in cross-section and preferably of a gradually-increasing height from the supply end to the discharge end. The chambers will preferably be of a greater length than width, the length and width varying in various ovens according to the output desired. They may be disposed in tiers or side by side or in rows. As shown, the upper chambers may overhang those underneath. Coal will be supplied to one end of each chamber by means of troughs C' C^2 C^3 or other suitable apparatus leading from one or more coal-bins C^4. Any suitable means for supplying the amount of coal necessary may be employed; but as rough determinations will be found sufficient special valves, weights, cut-off apparatus, &c., may be dispensed with, and the plungers D' D^2 D^3 may be used as the sole supply-controlling means. Said plungers, which are shown in their advanced position in the drawing, will snugly fit in the supply end of the chambers and will tightly move therein. In shape the plungers may be long metallic shells, each being advanced and retracted periodically or continuously by any suitable mechanism. For this purpose a shaft provided with a number of eccentrics may be employed. The plungers may be advanced and retracted simulta-

neously or in any desired order. The chambers B are of gradually-increasing area from the supply to the discharge end in order to prevent undue packing of the coke while being moved therethrough. When, as shown in the drawing, the floors of the chambers are downwardly inclined, the discharge of coke will be facilitated.

At the top of each chamber or at the side or sides thereof near the top openings E for leading off the gases communicate with pipes E′ E² for carrying off said products to apparatus for recovering tar, ammonia, &c.

In order to heat the coal in the chambers B, burning gas may be circulated through tile-pipes G′ G², &c. These are located above and below the horizontally-disposed layer, and where a number of superimposed chambers are used a single line of tile-pipe may be located between the bottom of one chamber and the top of another and may be so placed as to contribute heat to one or both chambers.

H′, H², and H³ are inclined grates constituting discharge-platforms, and spraying devices, such as perforated pipes J′ J² J³, are located in position to quench coke resting upon or passing over the grates.

L indicates any suitable form of tilting or moving discharge device adapted to be operated automatically by the weight of large quantities of coke or otherwise. For this purpose I contemplate using two or more huge buckets rocking or rotating upon a common shaft, the whole quite closely fitting the masonry of the floor, so as not to admit any undesirable quantity of air. The discharged coke may directly fall from the grates into the tilting device, or conveyers may be used for this purpose.

It will be noticed that there are a succession of tile-pipes G′, G², G³, G⁴, and G⁵ under each of the chambers. I have shown five in the drawing annexed. The heat in pipe G² may be more intense than in pipe G′, the heat in pipe G³ more intense than in pipe G², and so on. As a result the material undergoing coking will be subjected as it is moved through the chamber to heat increasing in intensity, and all of the volatile products or material capable of being driven off as gases will be freed from the coal and led off for utilization. In the production of coke some of the gases are driven from the coal at a comparatively low heat, others at a higher heat, and so on. As the heat increases more and more of the volatile ingredients are driven off from the coke. This, it is obvious, will be effected by the arrangement spoken of.

It is obvious from the foregoing description that by regulating the heat in each of the tile-pipes G′, G², G³, G⁴, and G⁵ the different gases in the coal can be driven off at the desired points. It is also obvious that there is great advantage in having the said tile-pipes transverse to the line of travel of the material being coked and also in having the tile-pipes independent of each other, for the reason that with the transverse and independent tile-pipes the heat at the different points along the coking-chamber can be regulated at will and can be changed at one point or points and allowed to remain the same at others.

A body of coal undergoing heating gives off gases which gradually grow leaner or contain less of the by-products, and this condition is taken advantage of by me in the preferred embodiment of my process, wherein I separate the leaner gases from the rich gases, enabling the latter to be separately utilized. This may be done with the form of oven illustrated by me by connecting the openings E′ and E² with one or more pipes leading to one place of storage or utilization and by connecting the opening E³ with a pipe leading to another point of storage or utilization of the leaner gases. Draft devices will preferably be provided for drawing the gases through the various pipes. As stated, the richer gases may be treated for the extraction of tar, &c., or for illuminating. The leaner gases may be used in any way desired—for instance, for heating the first pipe G′ of the series.

In carrying out my process chambers or ovens B are filled with coal, or nearly so, by the operations of the plungers D′ or otherwise. In its forced passage through the heated chambers or ovens, due to the advancing movements of the plungers, the volatile matter in the coal is released, so that when the coal reaches the end of the oven it is thoroughly coked and is discharged as coke through the mouths *b*. The pressure exerted by the advancing movements of the plungers necessary to force the mass of coal through the ovens can be utilized to compact the coal while being coked, and thus overcome any tendency to produce a soft or spongy coke. The hardness of the coke may be determined by regulating the pressure thereon while being produced, as by giving the floor of the oven a desired incline. Upon retracting the plungers coal is fed from the troughs C⁴ into the space left empty by the plunger. Coke discharged from the chambers falls upon the grates H′, &c., and is quenched by water or steam from the spray-pipes J′, &c. The quenching of the coke may be commenced while it is still in the ovens or be entirely carried on while the discharged coke is on the grate

The throwing of water upon the hot coke will result in great quantities of steam, and to prevent this from passing through the material which is being coked I provide exhausting apparatus, useful also to prevent air entering the coking-chambers.

Preferably the rear of the oven is entirely

inclosed within a compartment or chamber X, built of air-tight masonry and provided with an exhaust-opening K, communicating with a pipe, and fan K'. The only air, therefore, which may reach the oven will come through the tilting discharge device, and this will be drawn off without passing into the coking-chambers by means of the port K and fan K'.

The delivery device L will, it is obvious, be operated only by large quantities of coke and independently of the discharging operations of the plungers.

My new process has many important advantages. It is practically continuous, both in the production of coke and in the discharge of the gases useful for producing by-products. It is more speedy than prior processes by reason of the fact that the layer of coal is of comparatively small depth, thus permitting a more rapid and perfect throwing off of all volatile matter in the coal, and consequently a more rapid, uniform, and thorough coking of the coal. The oven is not cooled down to effect charging or discharging, and no heat is wasted. A better quality of coke, especially in freedom from sulfur, is produced. Supply, coking, discharging, quenching, and delivery are all conveniently managed. Material quantities of air are excluded at all times from oven and from the coke therein. Steam due to quenching is drawn off without depositing any undesirable material. A thin layer is heated in the direction of its height, and to more quickly coke the layer it is heated above and below. The leaner gases are separated from the richer gases. The heating of the coke may be regulated in order to drive off more of the volatile products than heretofore. A serviceable coke may be produced from coal not now available for coking.

What I claim is—

1. The process of coking, which comprises the subjecting of a substantially horizontal layer of coal to successive degrees of heat, regulating said degrees of heat independently of each other, so that the different gases in the coal will be given off at determined points, and collecting said gases as they are given off.

2. The process of coking which comprises the subjecting of a substantially horizontal layer of coal to successive degrees of heat, regulating said degrees of heat independently of each other, so that the different gases in the coal will be given off at determined points, subjecting said layer to a spray of water, and withdrawing by suction the steam so generated.

3. The process of coking which comprises the subjecting of a moving layer of coal which is at all points of its travel inclosed from contact with the atmosphere, to successive degrees of heat, drawing off the gases in the order in which they are produced, subjecting the moving layer to a spray of water and removing by suction the steam so generated and any air which may be present, substantially as described.

4. The process of coking which consists in inclosing a horizontal moving layer of heated coal, withdrawing at determined places the gases as they are given off, and withdrawing at a different place by suction any air which may gain access to said inclosed coal, substantially as described.

5. The process of coking which comprises the subjecting of a moving layer of coal to successive degrees of heat and regulating said degrees of heat independently of each other, so that the different gases in the coal will be given off at determined points.

6. The process of coking which comprises the subjecting of a moving mass of coal to successive degrees of heat, regulating said degrees of heat independently of each other, so that the different gases in the coal will be given off at determined points, subjecting said mass to a spray of water, and withdrawing by suction the steam so generated.

In witness whereof I have hereunto signed my name this 9th day of December, 1903.

GEORGE SPENCER MERRILL.

In presence of—

W. H. BERRIGAN,

THOS. J. MAGUIRE.