Nov. 8, 1932. R. M. FOLSOM 1,886,948

METHOD OF CHARGING COKE OVENS

Filed May 4, 1927 5 Sheets-Sheet 1

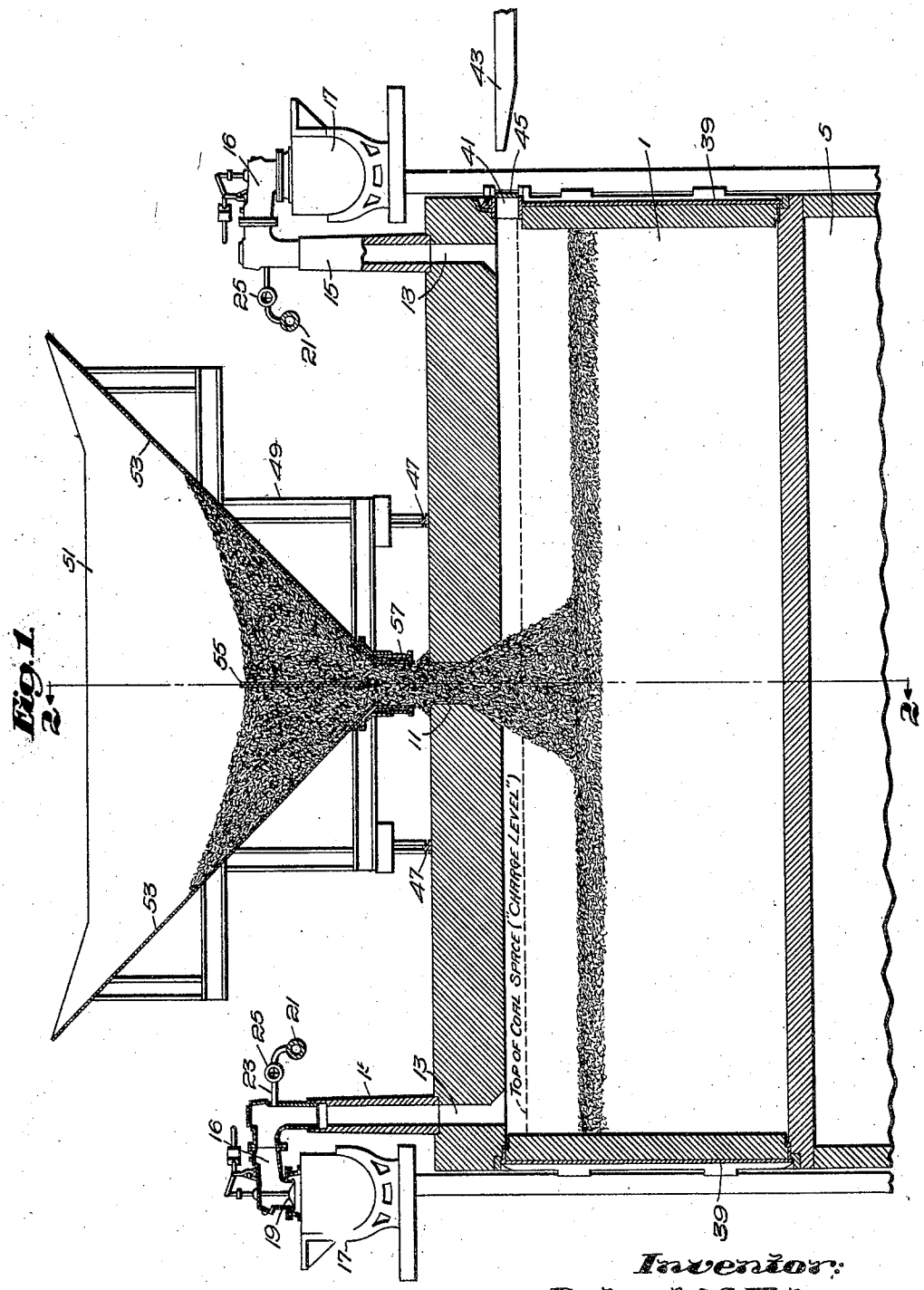


Fig. 1

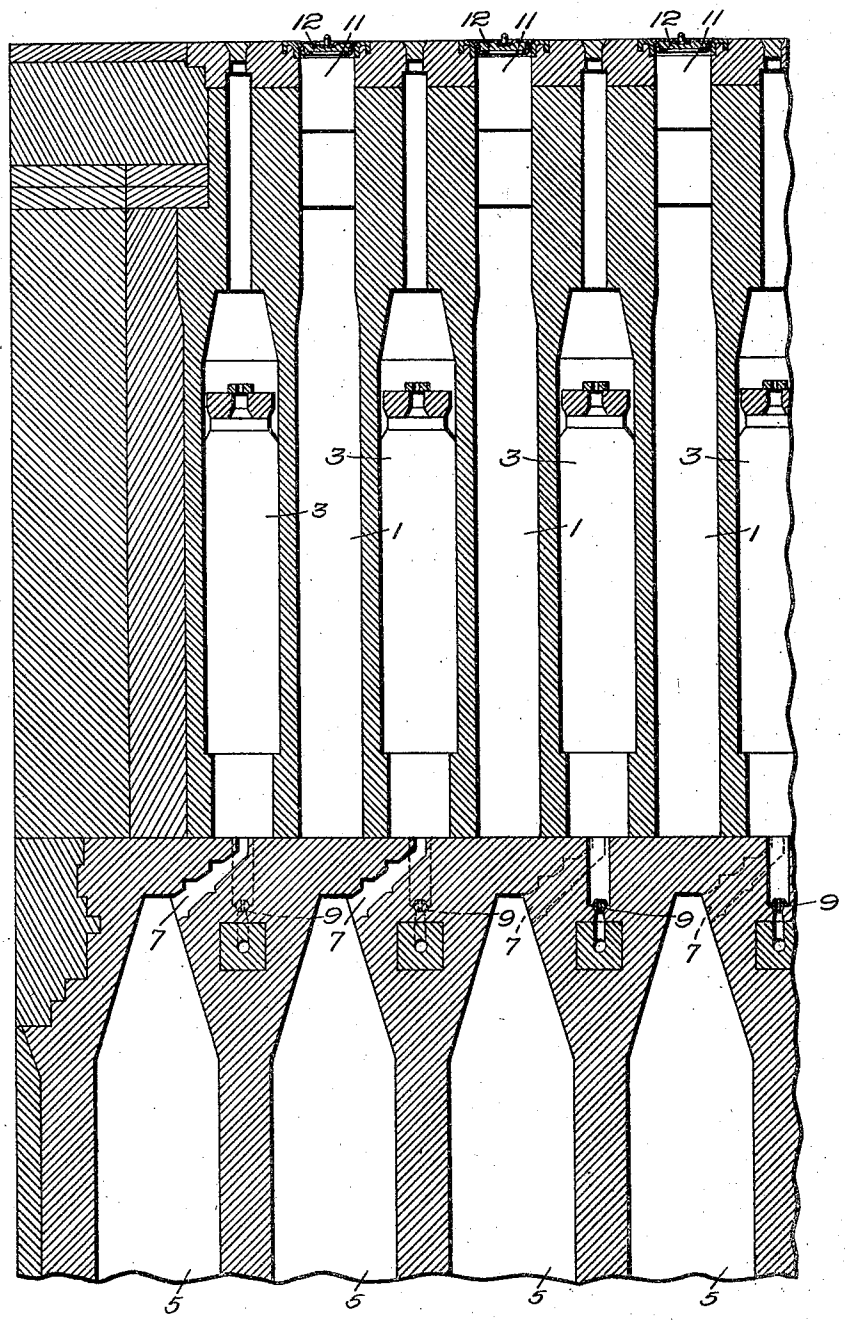
Inventor:
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Atty's

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Fig. 2.



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Fig. 5.

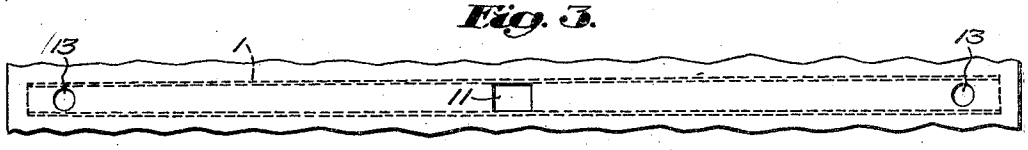


Fig. 8.

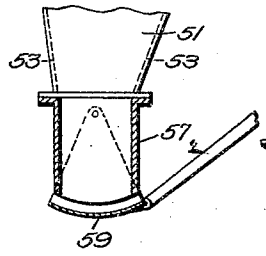


Fig. 7.

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Fig. 4.

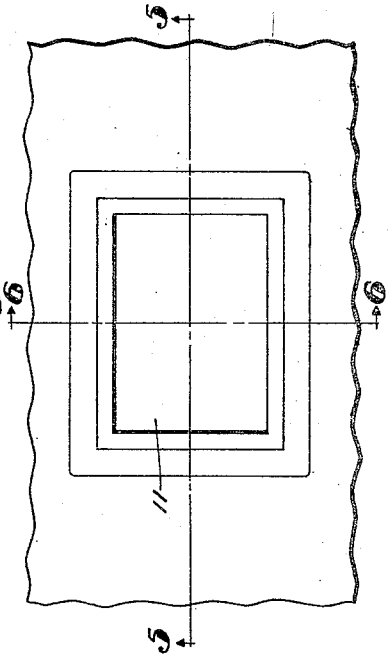


Fig. 5.

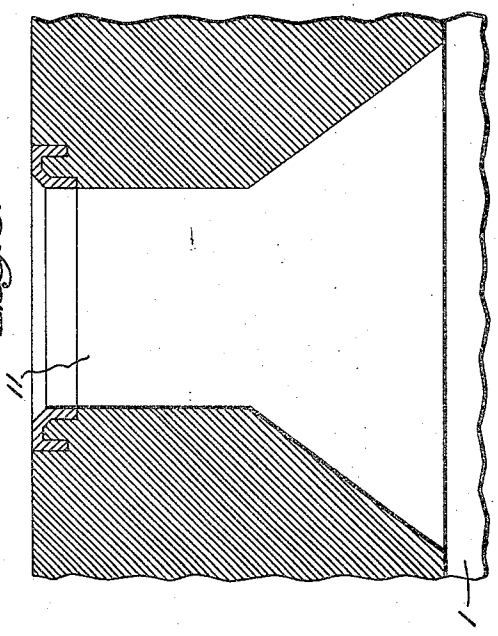
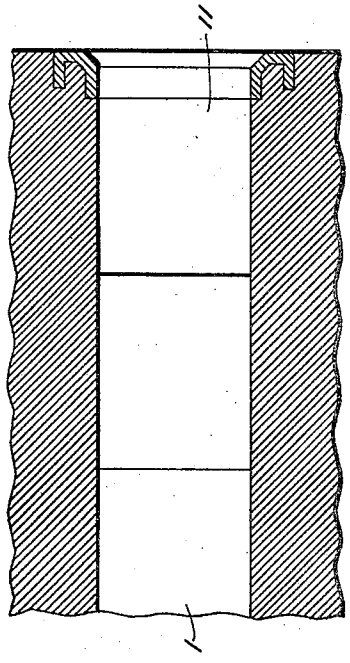


Fig. 6.



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METHOD OF CHARGING COKE OVENS

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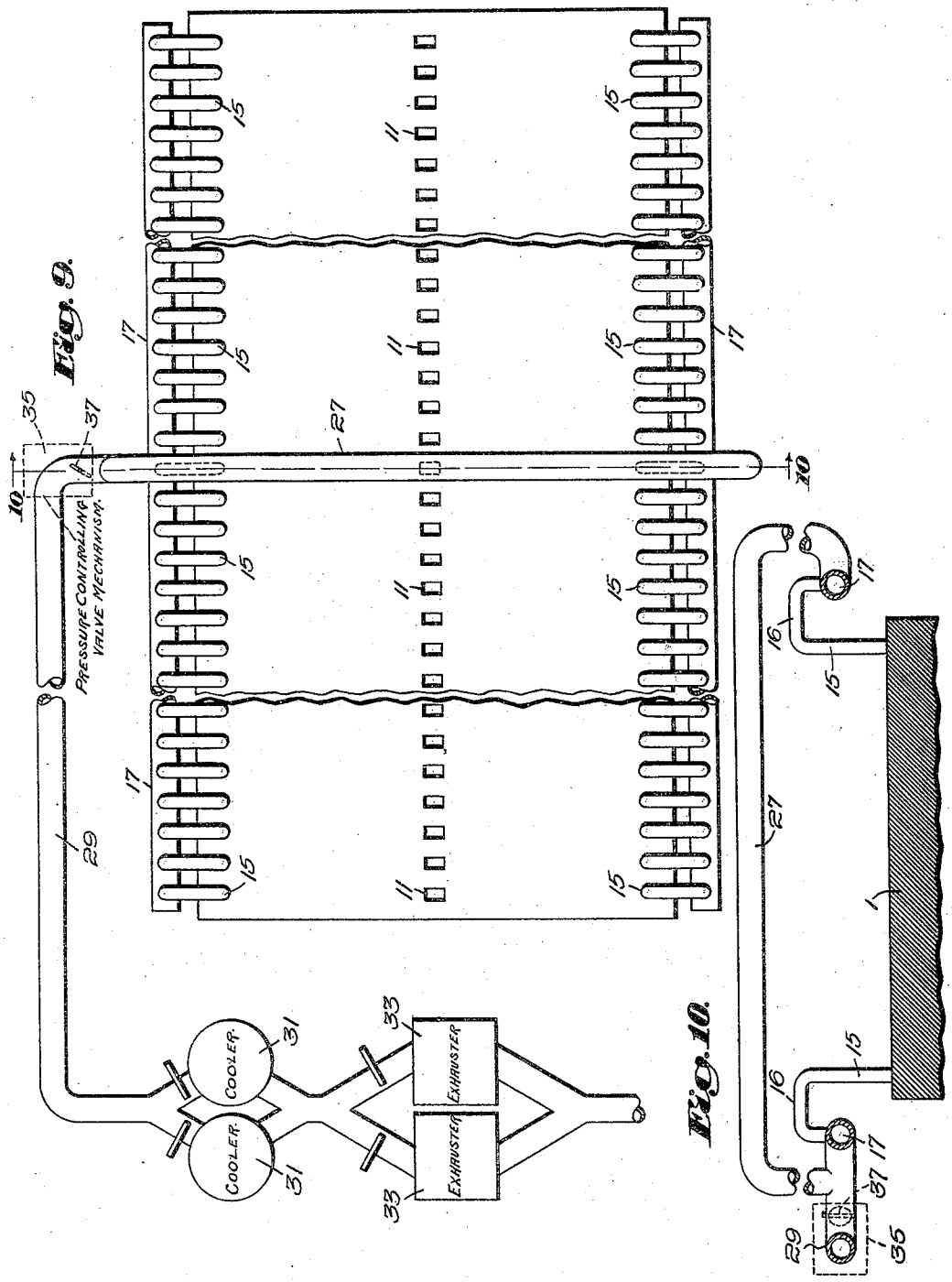


Fig. 9.

Fig. 10.

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Patented Nov. 8, 1932

1,886,948

UNITED STATES PATENT OFFICE

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METHOD OF CHARGING COKE OVENS

Application filed May 4, 1927. Serial No. 188,764.

My invention relates to methods of producing gas and coke, and among other things is particularly concerned with an improved way of charging a retort coke oven.

The invention will be best understood from the following description when read in the light of the accompanying drawings illustrating an example of apparatus for carrying out the improved method, while the scope of the invention will be more particularly pointed out in the appended claims.

In the drawings:—

Fig. 1 is a longitudinal section of an oven and coal hopper constructed according to the invention with associated apparatus shown in elevation, this figure indicating the charge of coal flowing into the oven;

Fig. 2 is a section of the oven on the line 2—2 of Fig. 1;

Fig. 3 is a plan of the roof of an oven constructed according to Fig. 1;

Fig. 4 is a plan on an enlarged scale of the roof of an oven at the charging hole;

Figs. 5 and 6 respectively are sections on the lines 5—5 and 6—6 of Fig. 4;

Fig. 7 is an elevation on an enlarged scale of the larry car as viewed from the right in Fig. 1;

Fig. 8 is a section of the chute and valve of the larry car hopper on the line 2—2 of Fig. 1;

Fig. 9 is a schematic diagram of one form of piping for the apparatus; and

Fig. 10 is a section on the line 10—10 of Fig. 9.

I will first describe by reference to the drawings a preferred example of apparatus for use in carrying out the improved method, it being understood that I am not limited to this example.

The drawings show a battery of narrow, high-chambered, horizontal coke ovens 1 separated by combustion chambers 3. Beneath the coke ovens and combustion chambers are parallel cross regenerators 5 of known construction for heating the air supplied the combustion chambers by way of the ducts 7, the fuel for combustion purposes being supplied by gas nozzles 9. Herein each oven adjacent the center of its length is provided with a charging opening 11 having a removable cover 12, while near opposite ends respectively each oven is provided with a gas offtake 13 in communication with a standpipe 15, the top bends 16 of various standpipes leading to gas collecting mains 17 at corresponding sides of the battery. As shown each standpipe has a manually controlled valve 19 for establishing and interrupting communication with the respective mains.

As illustrated the battery at opposite sides respectively is provided with a steam main 21, branch pipes 23 leading from these mains to the upper portions of the adjacent standpipes to provide for projecting steam jets along the top bends 16 of the standpipes for creating in each standpipe an ejector action accelerating flow of gas from the respective ovens. Each pipe 23 conveniently may be provided with a controlling valve 25 for creating the ejector action when desired.

Herein the mains 17 are connected by a cross over pipe 27, and discharge into a main 29 which leads to gas coolers 31. For drawing the gases from the ovens through the coolers exhausters 33 are provided, the desired degree of pressure in the collecting mains 17 being maintained by automatic pressure controlling mechanism 35, the valve of which is indicated at 37.

As illustrated each oven at opposite ends is provided with removable doors 39 which are removed when the oven is pushed. One of the doors 39 is shown as provided with a chuck hole 41 for entrance of a "leveling bar" 43, the chuck hole having a movable closure 45 for blanking the chuck hole when the leveling bar is withdrawn. Conveniently the leveling bar is so proportioned and arranged that it just clears the top and sides of the oven chamber.

Along the top of the oven are illustrated tracks 47 supporting the wheeled larry car 49, the hopper of which is indicated at 51. As illustrated the hopper has the flared sides 53 which with the vertical baffle 55 cause the coal in the hopper to gravitate through the chute 57 uninterruptedly in a continuous stream when the quick opening valve 59 is

moved from its closed dotted line position in Fig. 7 to its open full line position by the valve operating handle 60.

I have found that by suitably preparing the coal and proportioning the parts of the apparatus the coal may be charged into each oven and distributed uniformly and evenly throughout its length without substantial mechanical leveling. As the phenomena underlying this action are not exactly known to applicant I will now describe the proportions of one apparatus and the method of operation which exemplify and will secure this result, it being understood however that I am not limited to the proportions and dimensions and particular steps described as wide deviations in these may be made without parting from the spirit of the invention.

In this particular example of apparatus referred to the oven chamber is about 40 feet long between the inner sides of the doors 39, about 13 feet high, the height being of the order of one-third of the length, and 17 inches wide at the coke side of the battery, tapering to 15 inches wide at the pusher side of the battery, the coal space of the oven occupying about 620 cubic feet and extending to within about 12 inches of the top of the oven chamber, and the walls of the oven being at about 2300 degrees Fahrenheit during charging. In this oven the charging hole is a rectangle (see Figs. 4, 5 and 6), the dimensions of which are 14 by 20 inches, the narrow side of this rectangle corresponding to the inside width of the oven at its top, while the long side lies in the direction of the length of the oven, it thus being observed that the charging opening is materially elongated in the direction of the length of the oven. The larry car has a capacity upward of about 14 gross tons and is provided with a rectangular chute the inside dimensions of which are 17 by 23 inches, being of corresponding geometric shape to the cross section of the charging hole. The coal preparatory to charging is pulverized, the degree of fineness being such that about 80% of the coal will pass through a screen having one-eighth inch square holes.

As an example of the method of operating the above described particular example of apparatus, the pressure controlling valve mechanism conveniently may be set to maintain a pressure of the order of several millimeters of water above atmospheric in the two gas collecting mains at opposite sides of the battery. When an oven is to be charged, both valves 19 associated with that oven are opened, and the steam ejectors set in operation by opening the valves 25. The charging hole cover 12 having been removed, the larry containing about 13¾ gross tons of coal is moved to place the latter over the oven with the chute of the hopper presented to the charging hole. The valve 59 is then opened, preferably quickly, to allow the coal precipitately to enter the charging hole in a continuous stream sufficient to fill the charging hole as the coal gravitates through it. I have found, under these conditions, that with coal of for example about 3 per cent moisture content, the entire charge will flow into the oven and distribute itself therein evenly, except for occasional small surface irregularities, throughout the length of the oven without mechanical leveling. After the charge of coal has gravitated out of the larry, the latter may be moved from over the oven, and the small pile of coal remaining on the oven roof about the charging opening may be swept into said opening as the coal gravitates thereinto; and, when the coal has gravitated to below the top of the charging opening, the cover may be placed in position and the opening sealed. A single stroke of the leveling bar to just past the charging hole will then suffice to insure removal of any hump in the coal, caused by sweeping in the spillage on top of the oven, that may then exist beneath the charging opening, or other small irregularities in the top of the coal that has been self-distributed as above described.

Conveniently, under some conditions of operation, the hopper on the larry car may be charged with an amount of coal greater than that which corresponds to the volumetric capacity of the coal space of the oven, and in charging the oven all the coal from the hopper, or sufficient coal, may be allowed to flow into the oven to fill the latter to above the upper level of the coal space, whereupon the leveling bar may be entered into the oven to the full length of the latter and withdrawn, which will compact the charge and pull from the oven any excess of coal above that necessary to fill the coal space, such coal pulled from the oven being received in the usual known manner by the spillage receptacle carried by the leveling machine.

My explanation of the above described phenomena is that the rapid generation of gas from the pulverized coal flowing into the oven, and possibly some entrapping of air by the rapidly entering coal, together with the withdrawal of gas from opposite ends of the oven, destroys that property of the coal which gives it its normal angle of repose, and in effect gives the coal that property of a liquid which causes it to flow into a container through an orifice and distribute itself throughout the container by gravity.

I have found that normally best results will be secured by abruptly initiating the flow of coal into the oven to the full coal conducting capacity of the charging opening, and by so proportioning the dimensions of the charging opening, relative to both the degree of fluidity of the cold coal leaving the larry, and the degree of fluidity of the coal that is distributing itself in the oven, that the coal is charged at such rate as will pre-

vent it from becoming unduly sticky in the oven due to the liberation of tar or otherwise affected to cause its flow to be retarded after it enters the oven.

Ordinarily best results will be obtained with a high chambered oven, such as that described herein, and when the charging opening is materially elongated in the direction of the length of the oven. Preferably, for a given oven and coal, the charging opening is designed to handle the coal at about its normal moisture content, it being understood that the fluidity of cold coal decreases with an increase in its moisture content. When, under normal conditions, the moisture content of the coal is very high, and the apparatus is designed for coal of normal moisture content, it may be necessary to operate the leveling bar after from about 65 to 75% of the charge has entered the oven.

The best location of the charging hole will depend to some extent upon the degree of taper of the oven, it being observed that if the charging hole is at the exact center of the oven, and the latter is tapered, a greater volume of coal must be charged toward the coke side of the oven than toward the pusher side of the oven, and that at the same time the narrowing of the oven from the charging hole toward the pusher side due to its taper acts to retard the flow of coal in that direction, while the increase in width of the oven from the charging hole toward the coke side of the oven acts to facilitate flow toward the coke side of the oven. I have found that with an oven proportioned as above described the retarding effect on the flow of coal of the taper of the oven from the charging hole toward the pusher side of the oven will be about compensated for by the lesser volume of coal charged into that side, which results in permitting the charging hole to be placed at about the center of the length of the oven.

In practicing the above method, preferably gas is withdrawn at such rate, during charging, as to prevent a material rise of pressure in the oven. To this end the oven chamber at its top is preferably maintained at about atmospheric pressure during charging, so as to prevent escape and loss of gas or intake of air through the chuck hole and other oven openings and through the coal in the charging opening. This will prevent the emission into the open air of smoke during the charging operation, and save the rich gaseous products then rapidly generated. After charging, the ejectors may be shut off, whereupon the pressures in the tops of the ovens will become and be maintained slightly above atmospheric, which will maintain the flow of gas into the collecting mains and also eliminate any draft effect which might otherwise exist tending to draw air from the regenerators through the oven floors.

In the appended claims by "horizontal retort coke oven" and words of similar import is meant that type of coke oven with which the coke is pushed horizontally from one of the oven ends, the oven chamber having exteriorly heated side walls which are spaced a relatively short distance apart as compared with the length of the chamber. By "elongated coke oven" and words of similar import is meant a coke oven having a coking chamber the length of which is so much greater than its height that coal having a normal angle of repose charged into the chamber through an opening in the oven roof will not fill said chamber up to the normal charge level as would occur, for example, with a "vertical" type oven or a horizontal oven having a chamber with relatively short, horizontal dimensions compared to its vertical dimension.

It will be understood that I am not limited to the examples of apparatus nor to the dimensions or proportions thereof herein described, nor to the steps of the example of the method herein described, but that within the scope of the invention wide deviations may be made from these without departing from the spirit of the invention.

I claim:

1. The method of charging a horizontally elongated retort coke oven with coal which comprises delivering pulverized coal to the oven at the top thereof through coal conducting means in the oven roof while the walls of the oven are hot enough to evolve gas from the coal with such rapidity that substantially as it enters the oven the coal distributes by gravity from beneath said coal conducting means to approximately a uniform height throughout the length of the oven.

2. The method of charging a horizontally elongated retort coke oven with coal which comprises delivering pulverized coal to the oven at the top thereof through a substantially single charging opening in the oven roof while the walls of the oven are hot enough to evolve gas from the coal with such rapidity that substantially as it enters the oven the coal distributes by gravity from beneath said charging opening to approximately a uniform height throughout the length of the oven.

3. The method of charging a horizontally elongated retort coke oven with coal which comprises delivering pulverized coal to the oven at the top thereof through coal conducting means in the oven roof while withdrawing gas from the oven from above the coal, and while the walls of the oven are hot enough to evolve the gas from the coal with such rapidity that substantially as it enters the oven the coal distributes by gravity from beneath said coal conducting means to approximately a uniform height throughout the length of the oven.

4. The method of charging a narrow, elon-

gated, horizontally pushed retort coke oven which comprises delivering a charge of pulverized bituminous coal to the oven through charging opening means in the oven roof to the full coal conducting capacity of said means while the walls of the oven are hot enough rapidly to evolve gas from the coal and to initiate the coking operation, withdrawing the gas from above the coal in the oven to prevent material rise in pressure in the oven, the effective coal conducting capacity of said charging opening means being coordinated with the distilling action of the oven on the coal to cause the charge to be distributed by gravity up to approximately a uniform height throughout the length of the oven prior to the coal becoming sticky due to tar liberation therefrom.

5. In a method of operating a horizontally elongated retort coke oven having a substantially single charging opening in the oven roof, that improvement which comprises delivering pulverized coal to said oven at the top thereof through said opening, and distributing the coal therein by gravity from beneath said opening to adjacent the oven roof throughout the length of the oven by effecting, by the action of heat on the coal substantially as it enters the oven and by gas withdrawal from the oven during charging, reduction of the angle of repose of the coal to substantially zero.

6. The method of charging a horizontally elongated retort coke oven with coal which comprises delivering pulverized coal in a column by gravity to the oven at the top thereof through a substantially single charging opening near the middle point of the length of the oven while the walls defining the width of the oven are hot, during charging withdrawing gas rapidly from opposite ends of the oven from above the coal, the cross sectional area of said column and the temperature of said walls and rate of gas withdrawal being such as to cause the coal substantially as it enters the oven to be distributed by gravity from beneath said opening to approximately a uniform height throughout the length of the oven.

7. The method of charging a horizontally elongated, high-chambered, retort coke oven with coal which comprises delivering pulverized coal precipitately by gravity to the oven at the top thereof through a substantially single charging opening near the middle point of the length of the oven to the full coal conducting capacity of said opening while the walls defining the width of the oven are hot, during charging withdrawing gas rapidly from opposite ends of the oven from above the coal, the coal conducting capacity of said opening and the temperature of said walls and rate of gas withdrawal being such as to cause the coal substantially as it enters the oven to be distributed by gravity from beneath said opening to approximately a uniform height throughout the length of the oven.

8. In a method of producing gas and coke from bituminous coal utilizing a horizontally elongated coke oven the height of which is in the order of a third of its length and the walls of which defining its width are exteriorly heated, that improvement which comprises charging the oven with pulverized coal by delivering it by gravity to the oven at the top thereof through a substantially single charging opening in the oven roof near the middle point of its length, said walls of the oven during charging being hot enough rapidily to evolve gas from the coal, during charging withdrawing the gas from opposite ends of the oven at points above the coal, and allowing the major portion of the charge of coal to gravitate into the oven through said opening and substantially as it enters the oven to be distributed by gravity from beneath said opening to approximately a uniform height throughout the length of the oven.

9. In a method of producing coke and gas from bituminous coal utilizing a horizontal coke oven the height of which is in the order of a third of its length and the walls of which defining its width are exteriorly heated, said oven being arranged with a substantially single charging opening in its roof near the middle point of its length and with gas offtakes above the coal space thereof near each end of the oven, that improvement which comprises delivering the coal in a pulverized state by gravity to said oven at the top thereof through said opening to its full coal conducting capacity from a container communicating with said opening while said walls are hot enough to cause gas to be evolved rapidly from the mass of coal when it enters the oven, during charging withdrawing gas through said offtakes with sufficient rapidity to prevent material rise in pressure in the oven, and allowing the major portion of the charge to gravitate into the oven and substantially as it enters the oven to be distributed by gravity from beneath said opening to approximately a uniform height throughout the length of the oven.

10. The method of charging a horizontally elongated, narrow, high-chambered, retort coke oven with coal, which comprises delivering the coal in a pulverized state to the oven at the top thereof through a substantially single charging opening in the oven roof while the walls of the oven are at a high temperature, said opening being situated between the oven ends, and the coal being delivered thereto by gravity, the effective size of said opening being coordinated with the relative fluidity of the coal delivered thereto and the fluidity of the coal in the oven during charging to cause the major portion of the charge of coal to flow into the oven and sub-

stantially as it enters the oven to be distributed therein by gravity throughout the length of the oven to approximately a uniform height.

11. The method of charging a horizontally elongated, high-chambered, retort coke oven having exteriorly heated walls, which comprises delivering pulverized coal in a column to the oven at the top thereof through a substantially single charging opening in the oven roof while the walls of the oven are at a high temperature, such opening being situated between the oven ends and the cross sectional area of said column being such that the coal will flow into the oven and substantially as it enters the oven be distributed therein by gravity to adjacent the oven roof throughout the length of the oven.

12. A method of charging a horizontally elongated retort coke oven which comprises delivering pulverized coal in a column to the oven at the top thereof through its roof by use of a single charging opening while the oven is hot, the degree of fineness and moisture content of the coal and the temperature of the oven being so coordinated with the height and length of the oven and the cross sectional area of said column that the coal will flow substantially rapidly into the oven and substantially as it enters the oven be distributed therein by gravity to adjacent the oven roof throughout the length of the oven.

In testimony whereof, I have signed my name to this specification.

ROBERT M. FOLSOM.

CERTIFICATE OF CORRECTION.

Patent No. 1,886,948. November 8, 1932.

ROBERT M. FOLSOM.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, line 15, for "normal" read "abnormal"; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 3rd day of January, A. D. 1933.

M. J. Moore,
Acting Commissioner of Patents.

(Seal)