

May 29, 1928.

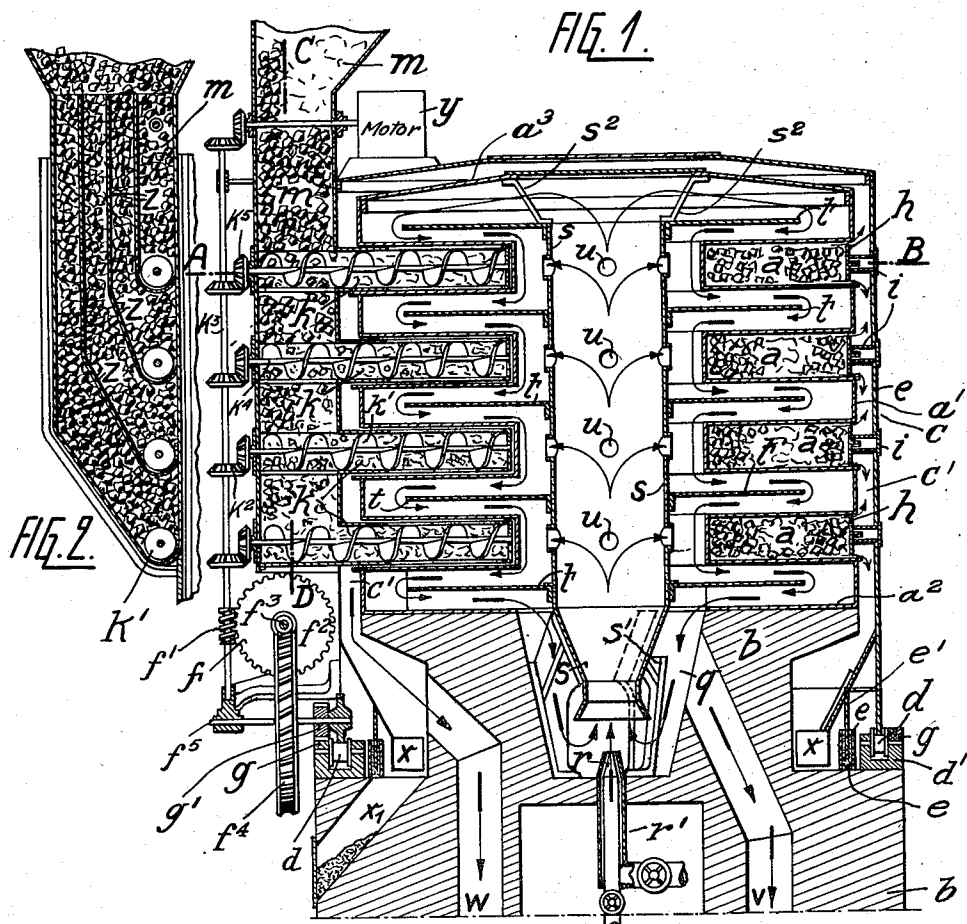
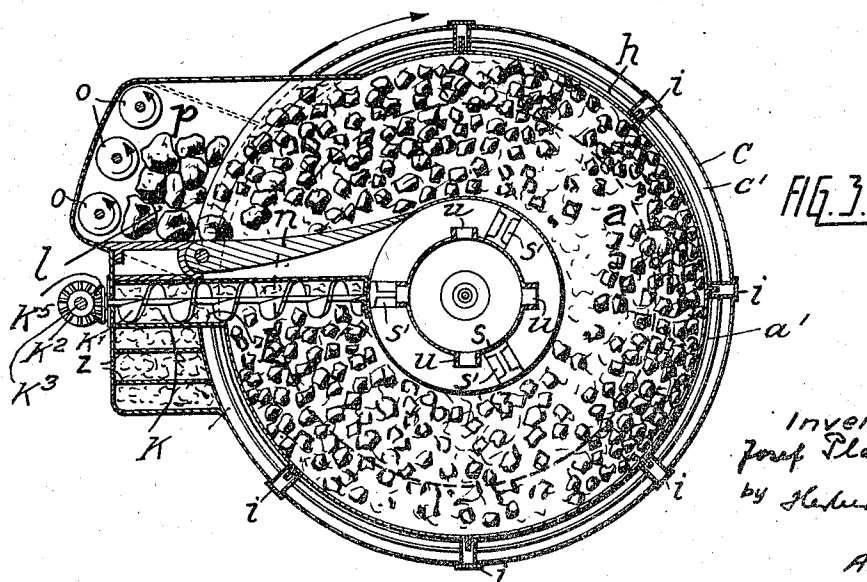
1,671,448

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RETORT FOR CARBONIZING BITUMINOUS FUELS

Filed July 10, 1925

3 Sheets-Sheet 1



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FIG. 4.

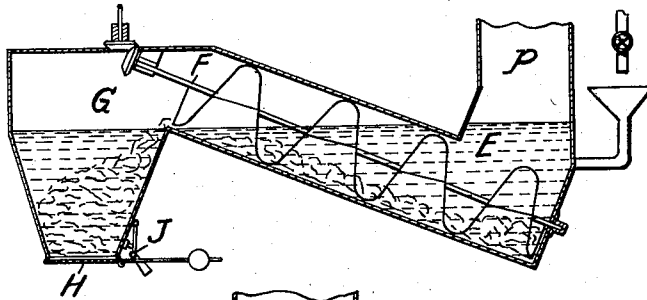


FIG. 5.

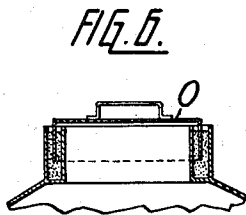
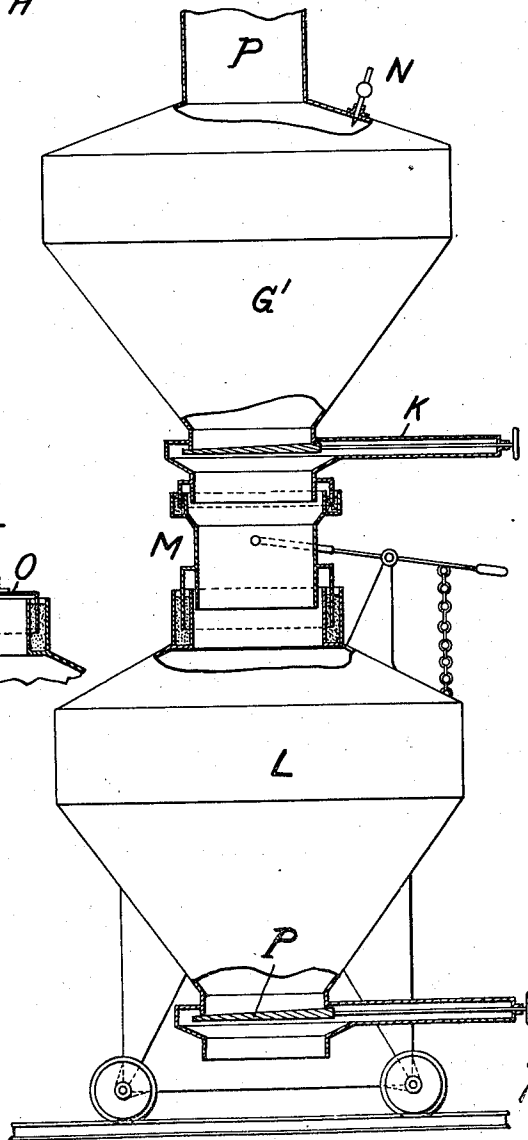


FIG. 6.



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FIG. 7.

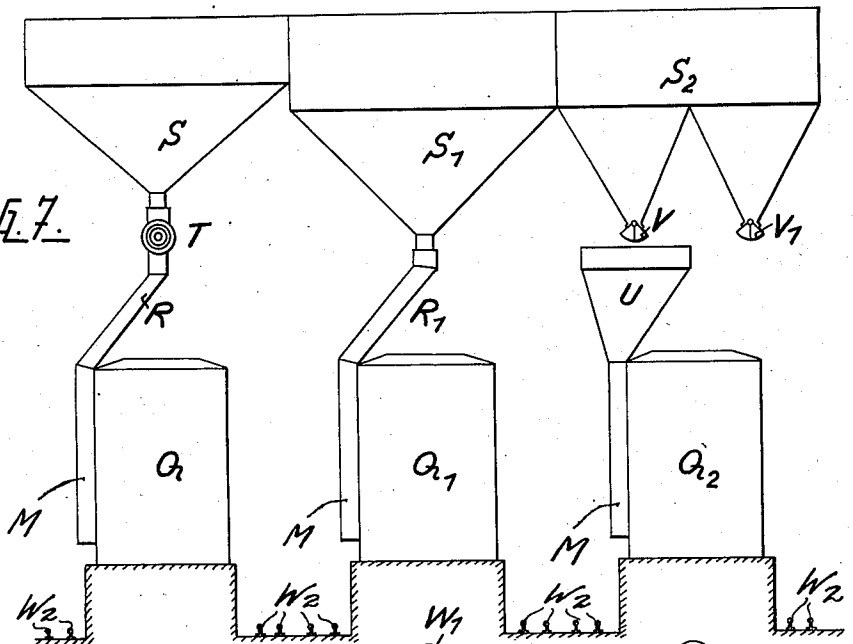
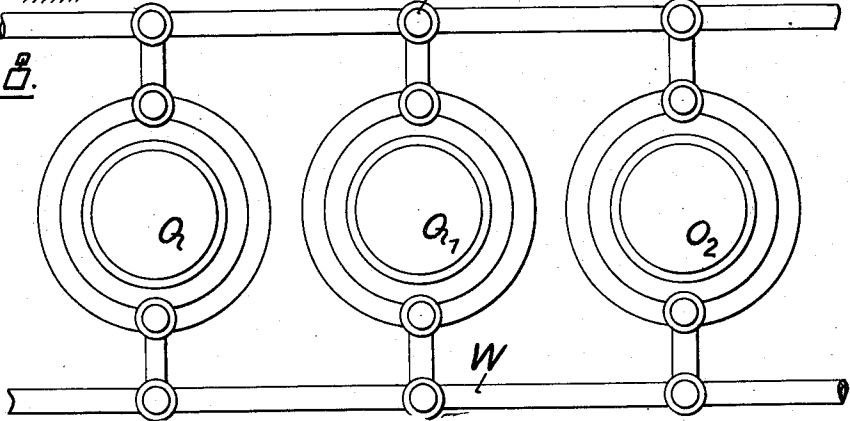


FIG. 8.



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UNITED STATES PATENT OFFICE.

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RETORT FOR CARBONIZING BITUMINOUS FUELS.

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With the known retorts for carbonizing fuels, and in which the respective fuel is supplied partly or wholly by mechanical means, either the output is insufficient or the mechanical part of the plant causes difficulties of service and renders the operation of the process uneconomical.

The retort according to the present invention does away with the disadvantages and drawbacks of the known retorts, and the gist of the invention resides in the employment of vertically spaced horizontal chambers, as carbonizing chambers of which are heated both from above and from below. The stationary superposed circular chambers are enclosed by a rotatory exterior casing to which are attached the supplying or filling means and the discharging or emptying means. The device may be designed also in the reverse way, that is to say, the casing may be stationary and the chambers rotatory. Supposed, that the casing is rotatory, then closing bands extending into the carbonizing chambers are secured to said casing and are being heated from above and from below by the directly heated chambers whereby the fuel to be carbonized is heated directly at its outer side. These closing bands pass along the outer side of the fuel to be carbonized and prevent it from falling out of the chambers.

The fuel to be carbonized is supplied to the chambers under pressure by means of a feed device whereby a dense filling of the chambers is effected and the fuel is converted into a particularly dense and solid semi-coke.

Owing to the particular manner of supplying the fuel to be carbonized and of discharging the carbonized fuel a perhaps strongly swelling fuel may swell in the direction towards the discharge end of the retort, that is to say, also a fuel of this kind may be treated in the apparatus. The carbonized fuel is generally removed from the chambers by means of a rotating scraper or the like, but also such means as discharge-conveyors or the like, may be used.

The discharged bulk of coke is conducted to a crushing machine operating, for instance, with crushing worms or the like, and is broken thereby into large lumps, which then are delivered into the discharge shaft.

The circular chambers are heated by means of a central heating chamber arranged pref-

erably at the lower part of the retort, and the heating gases are conducted through said circular chambers with the aid of suitably provided guide means. Said gases are caused to circulate in the carbonizing room of the retort preferably by means of a gas-air-mixture under pressure, this mixture being supplied at the central heating chamber and adding only such an amount of heat as is necessary to maintain a uniform temperature within the retort. In order to attain a uniform temperature at the walls of the carbonizing chambers, the current of heating gas conducted around said chambers is supplied with another amount of gas from a separate heating gas pipe located in the central part of the retort, said gas supply taking place just in front of every circular chamber, and the amount being such that the temperature of the respective chamber is kept on uniform height.

The heating gases and the gases developed by the carbonizing process, and the dust formed during the preliminary carbonization, are conducted downwardly in the stationary part of the retort.

The casing and the means for supplying the fuel and for discharging the coke are actuated by a motor arranged on the casing.

In order to supply uniformly all feeding devices for or of the carbonizing chambers, special guide members are provided in front of every feeding device, said members conducting the fuel uniformly to all feeding devices.

In order to produce a dry coke which is safe from igniting spontaneously at the open air, the coke discharged from the chambers is cooled down by water with the aid of a means specially provided for this purpose, as for instance with the aid of a conveying trough containing a conveying worm and a certain amount of water, this procedure being carried through in such a manner that the water adhering to the coke after the cooling is removed subsequently by evaporation. The water contained in said trough constitutes at the same time a closing means between the coking chamber and the outer air.

If the coke is to be worked further in glowing state in generators or similar devices or plants, it is discharged in such a manner that a tight closure exists between the carbonizing chamber and the open air while the discharge takes place. A device

suited for this purpose may be formed, for instance, by a portable bunker which can be closed at its lower end and can be connected air-tight at its upper end with the discharge-device of the coking retort. In order to prevent the coke from commencing to burn, in the bunker a certain small amount of water may be introduced into the bunker together with the coke, the water being at once converted into steam which then fills up the entire space of the bunker and acts on all parts of the coke. The bunker is tightly closed before it is transported away.

The apparatus is supplied with the fuel to be carbonized without interruption by means of separate bunkers located above the apparatus, every bunker being preferably arranged centrally above its appertaining retort, and a supply tube extending down from the bunker first vertically and then laterally along the side of the retort around which it can be turned. A cell-wheel may be provided between the bunker and the supply-device in order to prevent escape of gas, produced by the carbonizing operation. Or a feed hopper may be arranged between the retort and the bunker, the three parts being then superposed vertically; or a small bunker may be used instead of said hopper and may be fed automatically from a large bunker located above it. If no cell-wheel is employed, the pressure of the gas developed in the oven is maintained preferably equal to the pressure of the outer air in order to prevent said gas from escaping and the outer air from entering into the retort.

In order to increase the economy of the plant, the coke obtained by the process may be conveyed away from the rotatory discharge device into trucks or the like arriving on one side in empty state, being caused to run round the retort on a semicircular way, and leaving the retort on the other side in filled state, but instead of trucks or the like conveying bands may be employed onto which the coke is fed automatically from the retort and the coke is carried by said band to a main conveying band arranged at right angles to the several first mentioned bands. Or, the coke may fall upon a sheet-metal ring travelling continuously around the retort, together with the discharge device which may resemble a bunker, i. e. a coke-bunker, but serves chiefly for conducting the coke onto said rotatory conveying ring.

My invention is illustrated by way of example in the accompanying drawings in which Figure 1 is a vertical section through a retort devised according to the invention; Figure 3 is a horizontal section in the plane A-B of Fig. 1; Figure 2 is a vertical section in the plane C-D of Fig. 1; Figure 4 is a vertical section through one constructional form of a discharge device; Figure 5

is a vertical view partly in section of another discharge device; Figure 6 shows a detail pertaining to Fig. 5; Figure 7 shows certain means for feeding the fuel to and into the retorts; Figure 8 is a diagrammatical plan of a plant for conveying the coke away by means of trucks.

Referring to Figs. 1-3, the retort consists of superposed circular chambers *a* which are stationary and are immovably supported with their mantle *a*¹ by means of the flange *a*² by the foundation *b*. The chambers *a* are heated from three sides directly, and are enclosed by a rotatory casing *c* carried and guided by rolls *d*. The rolls *d* rest in bearings *d*¹, which are secured to the foundation *b*. There is also an inner casing which extends into a gutter filled with water and serving for separating the interior of the retort from the outer air by means of the ring *e*¹, which is secured to the casing *c* and the lower edge of which is immersed into the water. The outer casing *c* is moved by a gearing *f*¹, *f*², *f*³, *f*⁴ in such a manner that a gear wheel *g*¹, secured to the shaft *f*⁵ of the last named driving wheel *f*⁴, meshes with a circular rack *g* fastened to the base *b*.

Each circular chamber is encompassed by closing bands *h* attached to the casing *c* by means of holders *i* which thereby are caused to rotate together with the casing *c*. These bands prevent the fuel treated in the chambers from falling out at the outer circumference of said chambers, and as they serve also for transmitting heat from above and from below to the outer circumferential particles of the fuel treated, said particles are being heated indirectly also at the outer circumference of every chamber.

The rotatory casing *c* carries also the means for charging the chambers with the fuel to be converted into coke and the means for discharging the chambers. The first-mentioned of these means are formed by worms *k*¹ which convey the material from a vertical supply tube or channel *m* into the chambers, the material being thereby subjected to pressure within said chambers. The driving of the worms *k*¹ is effected by means of the bevel gear wheels *k*² which are secured to the vertical shaft *k*³ and mesh with bevel gear wheels *k*⁵ secured to the shafts *k*⁴ of the worms *k*¹. Each worm is located in a casing, and to each casing is attached a scraper *n* by which the coke is removed from the respective chamber. The coke is conducted to breaking worms *o* which crush the larger coke lumps and convey the whole to and into the discharge hopper *p*. The feeding means for the fuel to be carbonized and the discharging means of the coke may also be arranged centrally.

The heating gases, i. e. a mixture of gas and air, are or is respectively, introduced into the retort through a burner *r* and an

air tube r^1 and flow into, and upwards through, a wide tube s encompassed by annular disks t secured to said heating tube s extending between the chambers a and
 5 forming passages causing the gas to contact with the upper surface, the inner circumferential surface, and the bottom face of each chamber. Opposite each chamber the tube
 10 s is provided with apertures u through which a certain small amount of the gas is introduced directly into the before-mentioned passage in order to maintain the temperature of the gas streaming through the said passage on uniform height. The
 15 heating tube s is stationary in the same manner as the mantle a^1 and rests with its lower end on brackets s^1 supported on the wall of the heating channel q , while the upper end of said heating tube s is connected
 20 by means of brace rods s^2 to the cover a^3 of the stationary mantle a^1 . The gas leaving the space below the lowermost chamber a is divided into two currents, one flowing to and through the chamber q located below the
 25 tube s , the other passing away through the channel v .

The by-product gases developed in the course of the coking process escape laterally between the chambers a and the closing
 30 bands h into the annular-shaped space c^1 formed by the casing c and the opposite walls of the chambers, and are sucked off through the channel w . The lowermost
 35 portion of said annular-shaped space c^1 is enlarged radially inwards and serves to collect dust, and other waste which then is conveyed away by scrapers x into a discharge passage x^1 .

All movable parts of the retort are driven
 40 by a motor y arranged on the top thereof.

In order to supply the worms k uniformly with the fuel to be coked, guide walls z are provided in the channel m .

Referring now to Fig. 4 in which a coke
 45 discharge device is shown, the coke falls through the lower end of the passage P (Figs. 3 and 4) into an inclined basin E which is filled with water and encloses a conveying worm F . The passage P is connected with
 50 the lower end of said basin, whereas the upper end of the latter is connected with a collecting chamber G closed at its lower end by a flap H which can be closed or released at will by a lever J . The glowing or at
 55 least hot coke is cooled in the basin E by the water contained therein, and the water still adhering to the coke after it has left the basin E is removed automatically by evaporation.

If the coke is to be worked further immediately in glowing state, the device shown in
 60 Figs. 5 and 6 is used instead of that of Fig. 4. The glowing coke falls through the passage P into the vessel G^1 which is closed at its
 65 lower end by a slide K . The coke is col-

lected in the vessel G^1 which, therefore, forms a kind of bunker, and is removed from said vessel from time to time by means of a truck L resembling the vessel or bunker
 70 G^1 . The upper part of the truck vessel L is provided with a water seal and with a vertically movable neck M dipping into the water of said seal; said neck M is carrying
 75 a second water-seal forming an annular vessel which may be moved upwards towards and against an annular closing member that dips into the water of said upper
 80 water seal when the neck M has been lifted by a lever or the like, there being then established an airtight connection between the
 85 two vessels. N denotes a nozzle through which water may be injected into the vessel G^1 onto the glowing or hot coke therein contained. When the coke has been conveyed from the vessel G^1 into the vessel L , the slide
 90 K is closed, the neck M lowered, and a cap-shaped cover O , Fig. 6, is placed upon said neck, or into the water of said seal.

Fig. 7 shows means for feeding the retorts with the fuel to be carbonized. There is
 95 shown in this figure a set of three retorts Q Q^1 Q^2 , and each retort is provided laterally with a charging tube M which is an equivalent for the charging tube m of Fig. 1. S S^1 S^2 denote the bunkers from which the
 100 tubes M are supplied with the fuel to be carbonized. Fig. 7 shows three constructional forms, as regards the means for conveying the fuel into the tubes M . Concerning the bunkers S and the retort Q a cell-
 105 wheel T is inserted between the bunker and the conveying tube R . Concerning the bunkers S^1 and the retort Q^1 , the conveying tube R^1 and the bunker S^1 are connected with each other quite directly, without any
 110 intermediate means. And as regards the bunker S^2 and the retort Q^2 , the tube M carries on its top a hopper U which revolves together with the tube M (it being understood that this tube is attached to the casing of the retort, as in the other constructional forms just described, and that the casing is rotated constantly in order to feed the several chambers, as already described in an earlier part of this specification). The bunker S^2 is subdivided in its
 115 lower part, in two hoppers, as shown, or in three or more. There is a closing valve V (V^1) or a similar closing means at the end of every hopper, and that valve is opened when, and as long as, the hopper U is passing by below the respective hopper.

Figure 8 shows diagrammatically how the coke can be carried away with the aid of trucks or the like. There are parallel tracks
 120 W furnished with turn-tables W^1 . Each retort is surrounded by a circular track W_2 which is connected with two longitudinal parallel tracks W . The trucks arrive on one of the straight tracks in empty state,
 125 130

are caused to travel around the retorts on a semicircular way on one or the other side or both sides of the retort concerned, are being filled during this time, and are then hauled
5 away on the other straight track in filled state.

The fuel treated in the circular chamber retort, that is to say, carbonized therein may also be dried in the retort or only be
10 dried therein.

The thickness of the layers which the fuel forms in the retort may be different, and there may be left a space above the fuel in every chamber so that the surface of the
15 layer is heated indirectly by radiation from the upper wall of the chamber. The thickness of the layers depends upon the degree of dryness of the fuel, also upon other conditions, as well as upon the length of time re-
20 quired to heat the layers thoroughly, and finally, also upon the question whether the fuel is to be merely carbonized or merely dried or dried and carbonized. Also the manner in which the heating is effected is of
25 importance.

I claim:

1. A carbonizing retort comprising in combination a set of alternately superposed annular carbonizing chambers and heating
30 chambers, the former being closed at their inner circumference and being wholly independent of each other, the heating chambers being closed at their outer circumference and open at their inner, said set of alter-
35 nately superposed annular chambers forming a structural unit, a casing surrounding said superposed chambers and forming a second structural unit, and means for rotating one of the structural units.

2. A carbonizing retort comprising in combination a set of alternately superposed annular carbonizing chambers and heating
45 chambers, the former being closed at their inner circumference and being wholly independent of each other, the heating chambers being closed at their outer circumference and open at their inner, said set of alternately
50 superposed annular chambers forming a structural unit, a casing surrounding said superposed chambers and forming a second structural unit, and means for rotating said casing.

3. A carbonizing retort comprising in combination a set of alternately superposed annular carbonizing chambers and heating
55 chambers, the former being closed at their inner circumference and being wholly independent of each other, the heating chambers being closed at their outer circumference and open at their inner, said set of alter-
60 nately superposed annular chambers forming a structural unit, a casing surrounding said superposed chambers and forming a second structural unit, closing bands encom-
65 passing loosely the carbonizing chambers

at their outer circumference, means connecting said bands with said casing, said bands being so devised that they prevent the contents of the carbonizing chambers from fall-
70 ing out thereof, but permit escape of the gases developed and means for rotating one of the structural units of the retort.

4. A carbonizing retort comprising in combination a set of alternately superposed annular carbonizing chambers and heating
75 chambers, the former being closed at their inner circumference and being wholly independent of each other, the heating chambers being closed at their outer circumference and open at their inner, said set of alter-
80 nately superposed annular chambers forming a structural unit, a casing surrounding said superposed chambers and forming a second structural unit, and means for rotat-
85 ing one of the structural units, and a feeding device carried by said casing and adapted to charge material to be treated into the carbonizing chambers.

5. A carbonizing retort comprising in combination a set of alternately superposed
90 annular carbonizing chambers and heating chambers, the former being closed at their inner circumference and being wholly independent of each other, the heating chambers being closed at their outer circumference
95 and open at their inner, said set of alternately superposed annular chambers forming a structural unit, a casing surrounding said superposed chambers and forming a
100 second structural unit, and means for rotating one of the structural units, and conveying screws carried by said casing and adapted to charge material to be treated into the carbonizing chambers.

6. A carbonizing retort comprising in
105 combination a set of alternately superposed annular carbonizing chambers and heating chambers, the former being closed at their inner circumference and being wholly independent of each other, the heating chambers
110 being closed at their outer circumference and open at their inner, said set of alternately superposed annular chambers forming a structural unit, a casing enclosing said
115 superposed chambers and forming a second structural unit, means for rotating one of the structural units, and means for breaking material leaving the carbonizing chambers.

7. A carbonizing retort comprising in
120 combination a set of alternately superposed annular carbonizing chambers and heating chambers, the former being closed at their inner circumference and being wholly independent of each other, the heating chambers
125 being closed at their outer circumference and open at their inner, said set of alternately superposed annular chambers forming a structural unit, a casing surrounding
130 ing said superposed chambers and forming

a second structural unit, means for rotating one of the structural units, and a crushing worm located at the point of discharge for the material and being adapted to reduce
5 the larger lumps.

8. A carbonizing retort comprising in combination a set of alternately superposed annular carbonizing chambers and heating chambers, the former being closed at their
10 inner circumference and being wholly independent of each other, the heating chambers being closed at their outer circumference and open at their inner, said set of alternately superposed annular chambers
15 forming a structural unit, a casing surrounding said superposed chambers and forming a second structural unit, means for rotating one of the structural units, and centrally located heating means for the heating
20 chambers.

9. A carbonizing retort comprising in combination a set of alternately superposed annular carbonizing chambers and heating chambers, the former being closed at their
25 inner circumference and being wholly independent of each other, the heating chambers being closed at their outer circumference and open at their inner, said set of alternately superposed annular chambers forming
30 a structural unit, a casing surrounding said superposed chambers and forming a second structural unit, means for rotating one of the structural units, a centrally located heating tube spaced from the inner
35 circumference of the chambers and gas directing annular plates attached to said tube and extending into the heating chambers.

10. A carbonizing retort comprising in combination a set of alternately superposed
40 annular carbonizing chambers and heating chambers, the former being closed at their inner circumference and being wholly independent of each other, the heating chambers being closed at their outer circumference
45 and open at their inner, said set of alternately superposed annular chambers forming a structural unit, a casing enclosing said superposed chambers and forming a second
50 structural unit, means for rotating one of the structural units, a centrally located heating tube spaced from the inner circumference of the chambers and having lateral gas outlet openings, and gas directing annular
55 plates attached to said tube between said openings and extending into the heating chambers so as to form gas passages which are approximately zig-zag-shaped in vertical section.

11. A carbonizing retort comprising in
60 combination a set of alternately superposed annular carbonizing chambers and heating chambers, the former being closed at their inner circumference and being wholly independent of each other, the heating chambers
65 being closed at their outer circumference

and open at their inner, said set of alternately superposed annular chambers forming a structural unit, a casing surrounding said superposed chambers and forming a
70 second structural unit, and forming an annular space together with the first named constructional unit, a centrally located heating tube spaced from the inner circumference of the chambers and means for conducting the heating gas along the top surface
75 and the bottom surface of the carbonizing chambers, a foundation carrying the chambers-forming structural unit and the casing and having discharge channels for the escaping heating gas and for the gases
80 developed during the carbonizing operation and escaping into said tubular space and having also a collecting groove for the dust carried by the last mentioned gases.

12. A carbonizing retort comprising in
85 combination a set of alternately superposed annular carbonizing chambers and heating chambers, the former being closed at their inner circumference and being wholly independent of each other, the heating chambers
90 being closed at their outer circumference and open at their inner, said set of alternately superposed annular chambers forming a structural unit, a casing surrounding said superposed chambers and forming a second
95 structural unit, means for rotating one of the structural units, means for supplying the carbonizing chambers with materials to be carbonized, means for conducting away the produced coke and a common driving mechanism
100 for all said movable parts.

13. A carbonizing retort comprising in combination a set of alternately superposed
105 annular carbonizing chambers and heating chambers, the former being closed at their inner circumference and being wholly independent of each other, the heating chambers being closed at their outer circumference and open at their inner, said set of alternately
110 superposed annular chambers forming a structural unit, a casing surrounding said superposed chambers and forming a second structural unit, means for rotating one of the structural units, a supply channel for conducting the material to be carbonized into
115 the respective chambers, and vertical distributing walls in said channel.

14. A carbonizing retort comprising in
120 combination a set of alternately superposed annular carbonizing chambers and heating chambers, the former being closed at their inner circumference and being wholly independent of each other, the heating chambers being closed at their outer circumference and open at their inner, said set of alternately
125 superposed annular chambers forming a structural unit, a casing enclosing said superposed chambers and forming a second structural unit, means for rotating one of those constructional units, and a coke dis-
130

charging device adapted to receive the coke in glowing state and to prevent it from coming in contact with the outer air.

15. A carbonizing retort comprising in combination a set of alternately superposed annular carbonizing chambers and heating chambers, the former being closed at their inner circumference and being wholly independent of each other, the heating chambers being closed at their outer circumference and open at their inner, said set of alternately superposed annular chambers forming a structural unit, a casing surrounding said superposed chambers and forming a second structural unit, means for rotating one of the structural units and a bunker adapted to receive the material to be carbonized and to convey it continuously to the carbonizing chambers.

16. A carbonizing retort comprising in combination a set of alternately superposed annular carbonizing chambers and heating chambers, the former being closed at their inner circumference and being wholly independent of each other, the heating chambers being closed at their outer circumference and open at their inner, said set of alternately superposed annular chambers forming a structural unit, a casing surrounding said superposed chambers and forming a second structural unit, means for rotating one of the structural units, means for supplying the carbonizing chambers with material to be carbonized, and means for conducting away the produced coke.

In testimony whereof I affix my signature.

JOSEF PLASSMANN.