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W. E. TRENT

PROCESS OF PRODUCING COKE

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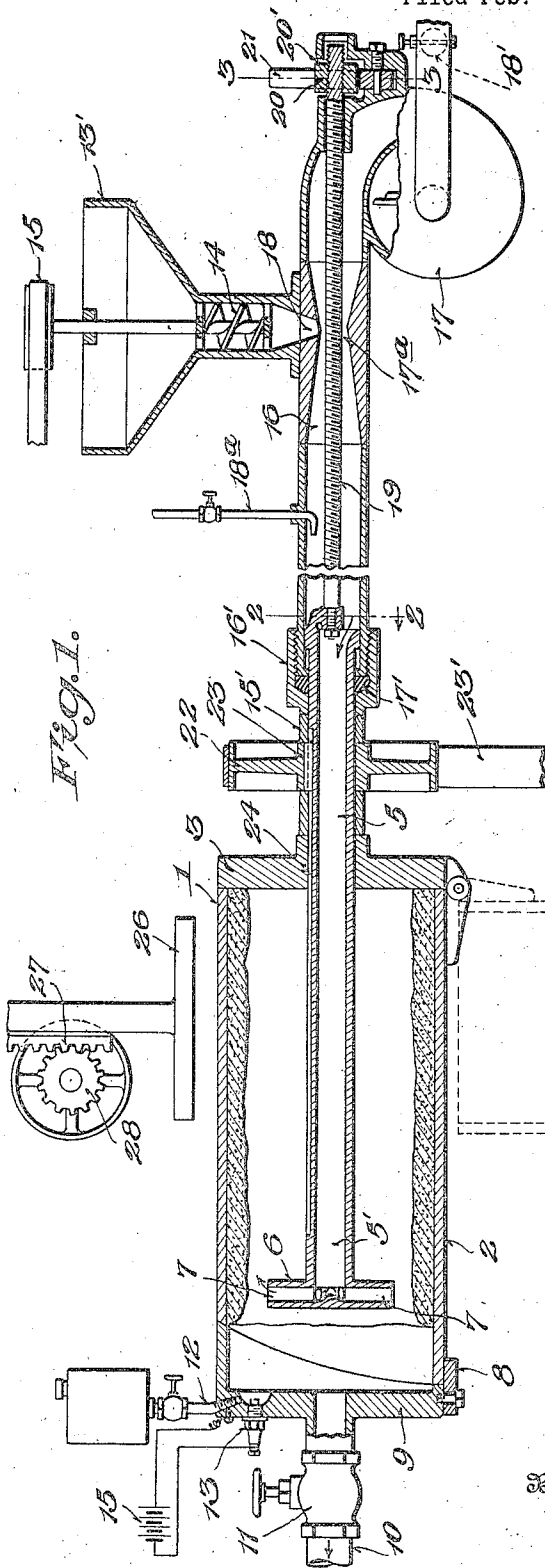


Fig. 3.

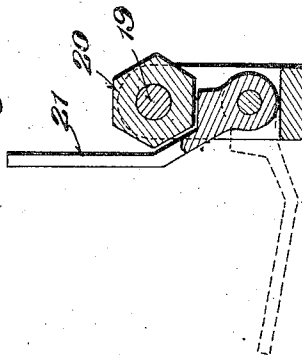
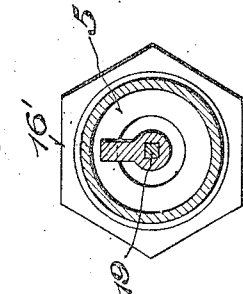


Fig. 2.



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PROCESS OF PRODUCING COKE.

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To all whom it may concern:

Be it known that I, WALTER E. TRENT, citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Processes of Producing Coke, of which the following is a specification.

This invention relates to a process of treating materials to distill the volatile content therefrom and form mass deposits of the residue.

It is an object of the invention to provide a process of producing coke from comminuted coal. While the process is primarily intended for distilling and treating comminuted coal, it is likewise applicable to other substances and contemplates the treatment of crude oils or fuel, wherein the volatile constituents are distilled and the carbon collected in a coherent mass.

It is a further object of the invention to provide a process of producing coke from divided particles of coal, by first distilling the volatile products from said particles, and then depositing the resulting non-gaseous material in a hot and viscous condition upon a collecting surface to which the particles adhere and continue to accumulate and adhere to each other producing coke.

In carrying out the invention the comminuted coal is introduced under velocity to a treatment chamber maintained at a temperature sufficient to bring about combustion of some of the distilled gases of the coal when supplied with the required air, thereby producing the necessary heat and temperature properly to distill the volatile content from the coal particles on entering the treatment chamber. When comminuted coal is subjected to distillation, towards the end of the heat treatment, when all, or nearly all of its volatile content has been expelled, the non-gaseous residue becomes sticky and viscous for a short period rendering it capable of adhering to a surface when projected against the same in this condition. If this stage has not been reached before the particles come in contact with the collecting surface they will adhere to the viscous surface already formed and shortly thereafter become viscous themselves, the entire mass gradually becoming coke in a solid state.

The density or compactness of the solid coke depends in part upon the velocity un-

der which the particles are projected against the collecting surface, the greater the velocity, other conditions being equal, the more dense will be the mass of coke. The invention, therefore, not only contemplates making mass coke from carbonaceous particles, but making cokes of different densities according to varying requirements.

As the comminuted coal is introduced to the treatment chamber the volatile products are rapidly distilled and the carbon particles accumulate upon the surface of the chamber agglomerating or building up in layers because of the sticky condition of the particles, the distilled products being discharged and collected.

In the present process the comminuted coal or material to be coked may be fed dry, or mixed with a liquid. The coal whether fed in a dry state or suspended in oil or other liquid may be entrained and introduced to the treatment chamber with the air required to support partial combustion. During the period of coke formation, the distilled gases, vaporized oils, and products of combustion are continuously discharged from the treatment chamber and may be treated for the recovery of the distilled products.

In the accompanying drawings I have disclosed a single form of apparatus for performing the process, but it will of course be understood that many different forms of apparatus can be employed and the present construction is merely for the purpose of illustrating a convenient means of carrying into operation the process herein described.

In the drawings,

Figure 1 represents a vertical longitudinal section of one form of apparatus, and Figures 2 and 3 are detail views of parts of the apparatus.

Referring now more specifically to the drawings wherein like reference characters indicate corresponding parts, the numeral 1 designates a treatment chamber, having a shiftable intermediate portion 2 which is disclosed as being of a cylindrical formation, and may be composed of any desired material. This portion of the chamber is pivoted at the point 2' to a relatively thick end portion 3 supported in any approved manner and having a central opening 4 therein for the reception of the feeding

tube 5, of a material feeding member 5' provided at its outer end with a head 6, formed with a plurality of peripheral discharge openings 7 therein for a purpose which will hereinafter appear. The shiftable portion 2 of the treating chamber is normally maintained in a horizontal position by means of the keeper 8, movably attached to the stationary end 9 of the chamber whereby a movement of this element will permit the shiftable portion 2 of the chamber to drop to the dotted line position shown in Figure 1.

The edges of the walls of the stationary end 9 of the treatment chamber terminate in the arc of a circle as shown in the drawings. The shiftable portion 2 of the chamber normally lies between the fixed ends 3 and 9 and is fashioned at one end to present a curved edge corresponding with the curved edge of the side walls of the member 9. This construction enables the shiftable portion 1 to freely move to the dotted line position without disturbing either of the ends 3 and 9. The end 9 has therein a gas discharge outlet 10 controlled by the manually operated valve 11. This stationary end portion of the treatment chamber is also formed with a fuel feeding opening receiving a fuel feed pipe 12 leading from a source of gasoline or other fuel supply. There is also disposed adjacent the fuel opening a spark plug 13 in circuit with an electrical supply 15 for the purpose of igniting the fuel introduced to the treatment chamber when the temperature therein is to be raised to the proper degree for distilling volatile products from materials introduced thereto, and to ignite some of the distilled gases when removed from said products.

The materials introduced to the treatment chamber contain a volatile content which materials may be coal, oil, or the like, and it is an object of the process to treat the materials introduced to the treatment chamber by distilling the volatile content therefrom and in depositing the residue upon the walls of the portion 2 of the container. To accomplish this the material is preferably introduced to the container under velocity, being discharged through the peripheral orifices in the head of the feed member 5' toward the circular wall of the container portion 2, undergoing a heat treatment for the distillation of the volatile products, the heat treatment also placing the residue in a sticky or viscous condition, so that when projected against the surface of the portion 2 of the container the particles of residue adhere to the surface and to each other, building up an agglomerated mass.

The invention is particularly applicable to the treatment of comminuted coal to distill the volatile substances therefrom and to form coke from the carbon residue. If coal

or other comminuted material is to be introduced to the treatment chamber, a supply thereof is placed within the feed hopper 13', being fed therefrom in regulated quantities by means of the screw feed conveyor 14 operated by a belt and pulley drive 15. The fuel fed by the screw conveyor directly enters a feeding conduit 16, connected at one end with a blower or fan 17, while the opposite end of the conduit is in communication with the tube 5 of the fuel feeding member 5' entering the treatment chamber. The fuel feeding member 5' is slidably mounted relative to the feed conduit 16, and to permit of this sliding movement without disturbing the position of the conduit 16, a stationary element 15' is employed, surrounding a portion of the tube 5 and carrying a threaded member 16' threaded upon the end of the feed conduit 16 and receiving a suitable packing 17' interposed between the edge of the feed conduit and the member 16'. This manifestly enables the tube of the feed member 5' to telescope within the feed conduit 16 without the possibility of an escape of the material being introduced to the treatment chamber.

The conduit 16 is preferably provided with a venturi 17 near one end adjacent the air pump, the fuel being introduced to the conduit from the hopper 13 at the point 18 to be entrained or picked up by the air current passing from the fan 17 and carried through the feed member 5', discharging outwardly through the peripheral feed openings 7 in the head of said member toward the side walls of the treatment chamber. The material being introduced to the treatment chamber, may be conveyed thereto in the air stream in a dry comminuted form or may be introduced to the air stream while suspended in a liquid oil, water or the like, as may be found desirable. In order to control the quantity of air introduced to the chamber with fuel, regulating valve 18' is disposed within the air supply pipe of the blower.

A water or feed pipe 18^a for other substances communicates with the feed conduit 16 and is controlled by a suitable hand operated valve.

When comminuted coal or other materials having a volatile content is to be treated to distill the volatile substances therefrom and form a mass of the residue, the fan or pump 17 is placed in operation, and the material introduced to the feed conduit 16 from the feed hopper 13 in either a dry or liquid state. This material is then carried through the tube 5 of the feed member 5' and discharged with velocity through the peripheral openings in the head of the feed member, it being understood that the temperature of the treatment chamber has at this time been raised by the burning of

gasoline or the like to a point where the volatile content of the material will be distilled therefrom, and a portion of these distilled gases ignited to maintain the temperature of the treating chamber at a point sufficiently high to support combustion. The incoming material is directed toward the side walls of the treatment chamber, and undergoes a heat treatment, which treatment robs the material of its volatile content, and if powdered coal is being fed, the carbon particles are rendered, when subjected to the heat, sticky and viscous being projected upon the surface of the container 2, adhering thereto and to each other building up a mass of coke. If the carbon particles have not reached the sticky or viscous condition when the same come in contact with the collecting surface, such particles will adhere to the viscous surface previously formed, and the continued heat treatment will soon thereafter render such particles viscous themselves, the entire mass soon hardening and becoming coke in a solid state. The volatile gases distilled from the material of course continuously pass out through the discharge conduit 10 controlled by the valve 11 to a gas receiver and by-product recovery plant.

It is preferable to rotate the fuel feeding member 5 during the introduction of material to the treatment chamber, and it may also be desirable to slowly reciprocate said feed member while material is being introduced to the chamber. In the apparatus disclosed for the purpose of illustrating a convenient means of supporting this process, the end of the feed member 5' is formed with a spider, the central portion thereof receiving a threaded operating rod 19, passing through the feed conduit 16 and at its outer end cooperating with a nut 20, positioned within a nut receiving recess 20' and adapted to be engaged by a shiftable keeper 21 when it is desired to reciprocate or move the feed member 5' during the introduction of material to the treatment chamber, it being understood that the keeper 21 may be drawn to the dotted line position so as to have no effect upon the nut 2 if this is desired. To rotate the feed member 5' a drive pulley 22 is employed, the same having a lateral keyway 23 therein receiving a key 24 on the tube of the feed member so as to permit a sliding movement of the feed member relative to the pulley 22, but allow no relative rotary movement between said members. The pulley 22 is disposed between suitable bearings so as to always maintain the position disclosed in Figure 1, and it will be manifest that a rotation of this pulley causes a rotation of the feed member 5', and the threaded rod 19, so that if the keeper 21 is in engagement with the nut, the threaded connection between said nut

and rod cause a sliding movement of the feed member 5'. A suitable reversing mechanism is interposed between the driving belt 23' and the source of power, so that when the feed member 5' has been moved the full length of the treatment chamber, the direction of rotation of the pulley 22 is reversed so that said feed member then moves in an opposite direction to the other end of the treatment chamber. It will be appreciated that by rotating the feed member 5', the material being fed therethrough under velocity is subjected to centrifugal action which assists in projecting the particles toward the collecting surface 2 with such force as to cause them to adhere to said surface and to each other on the surface.

In practicing the invention, materials are introduced through the fuel feeding member 5' when the temperature of the treatment chamber has been raised to a point sufficient to bring about combustion, the volatile constituents of the materials being distilled therefrom, and passing out through the feed pipe 10 while the carbon residue adheres and builds up in mass form, as disclosed in Figure 1 of the drawing upon the inner surface of the portion 2 of the treatment chamber, becoming solid and forming mass coke. The introduction of material is continued until a mass of sufficient thickness has been formed upon the collecting surface of the treatment chamber, whereupon the supply of material to the chamber is discontinued, and the feeding member 5' is moved to a position adjacent to the end 3. To discharge the mass of coke, the keeper 8 is turned to allow the shiftable portion 2 of the treatment chamber to occupy the position shown in dotted lines. A suitable gear operated ram 26 is then reciprocated by means of the gear and rack operating devices 27 and 28, the ram engaging the mass of coke and forcing the same from the container portion 2. After a mass has been thus removed the ram is raised and the portion 2 of the container is elevated to, and locked in its normal position and the operation hereinbefore described repeated.

Having thus described the invention, what I claim is:

1. A process of producing coke from comminuted coal, which consists in subjecting fine particles of coal while in motion to a heat treatment sufficient to remove volatiles therefrom and place said particles in an adhesive condition, and in collecting the particles as an agglomerated mass upon a surface against which they are projected while in an adhesive state.

2. The process of producing coke from comminuted coal, consisting in subjecting moving particles of coal to a heat treatment to distil the volatile constituents therefrom and to place said particles in an adhesive

condition, and in collecting said particles on a surface as a coherent mass of coke against which surface said particles are projected while in an adhesive state.

5 3. The process of producing coke, consisting in subjecting projected comminuted coal particles to a heat treatment to distill the volatile products therefrom, and to place the carbonaceous particles in a viscous condition
10 and in collecting said particles in the form of a coherent mass on a surface against which they are projected when in a viscous condition.

4. The process of producing coke which
15 consists in forcing comminuted particles of coal through a heating zone, in distilling in such zone the volatile products from the comminuted particles and to place the same in an adhesive condition, and collecting said
20 particles as an agglomerated mass upon the surface against which said particles are projected.

5. The process of producing coke from comminuted particles of coal which consists
25 in introducing to a treating chamber coal particles in a fine state of division, in subjecting said particles to a heat treatment while in the chamber to distill the volatile products therefrom, and in collecting the
30 resulting carbonaceous residue in an adhesive condition upon the surface of said heating chamber against which the particles are projected with sufficient force to adhere to the surface and to each other forming a coherent mass of coke.
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6. The process of producing coke, consisting in projecting carbonaceous particles in a treatment chamber, in subjecting said particles while moving to the action of heat to
40 distill the volatile products therefrom, said particles being collected on a surface against which they are projected with sufficient velocity to cause the heated particles to unite

with one another and with the walls of said surface to form a coherent mass of coke. 45

7. The process of producing coke consisting in introducing comminuted particles of coal to a treatment chamber to be carried
50 therethrough in fluid suspension, in subjecting the particles while suspended in the current to a heat treatment to distill the volatile products therefrom, and in collecting said particles on a surface as a mass of coke where they are projected when in a viscous
55 condition.

8. The process of producing coke, consisting in introducing to a treatment chamber rapid moving comminuted particles of coal, in subjecting the particles to a heat treatment to distill the volatile contents therefrom, and
60 in collecting said particles on a collecting surface where said particles are projected when in a viscous condition with sufficient force to unite to one another and form a coherent mass of coke. 65

9. The process of producing coke, consisting in subjecting moving particles of comminuted coal to a heat treatment to distill the volatile products therefrom, and to place
70 such particles in a viscous condition, and in then collecting said particles on a surface where said particles are projected while in a viscous condition with sufficient velocity to form a coherent mass of coke.

10. The process of producing coke, consisting in subjecting moving particles of
75 new coal to a heat treatment to distill the volatiles therefrom and to place the residue of said particles in a viscous condition, and in then depositing the particles upon a collecting surface against which said particles
80 are projected with sufficient force to cause them to adhere to one another and form a coherent mass of coke.

In testimony whereof I affix my signature. 85
WALTER E. TRENT.