May 19, 1942. L. C. KARRICK 2,283,556

VALVE

Original Filed Dec. 11, 1933

Fig. 1.

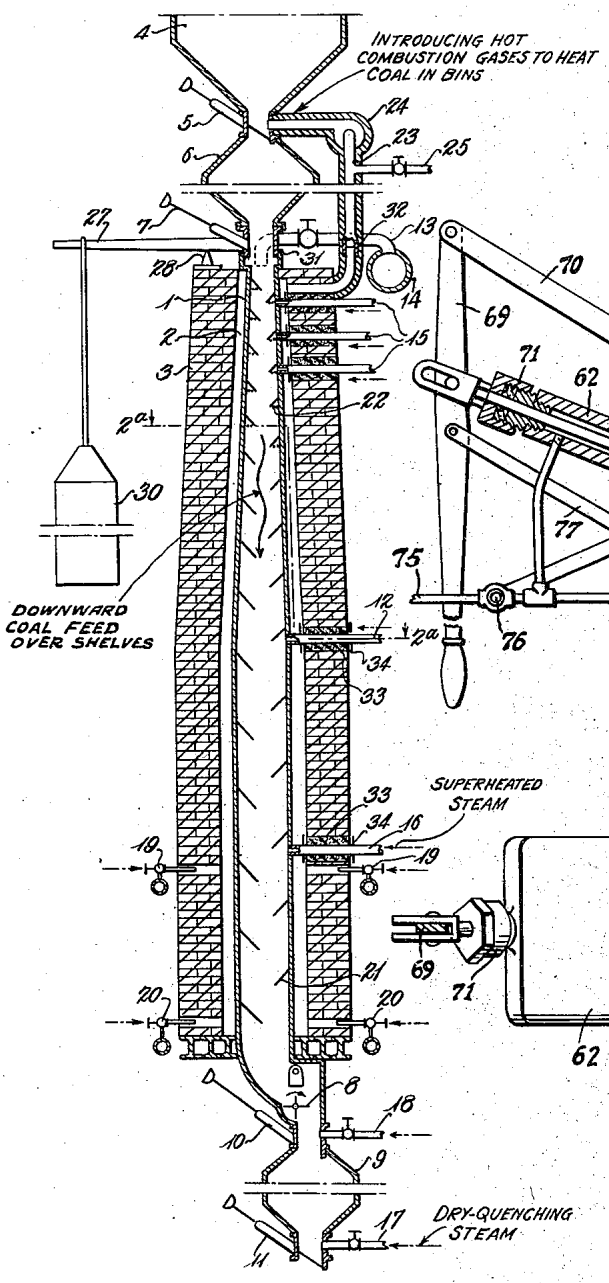


Fig. 2.

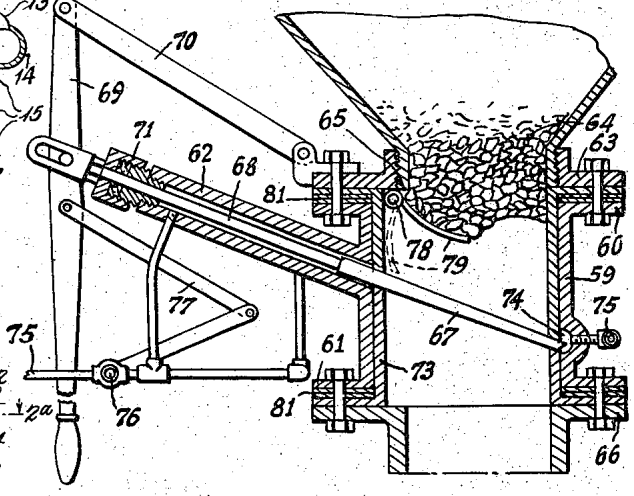
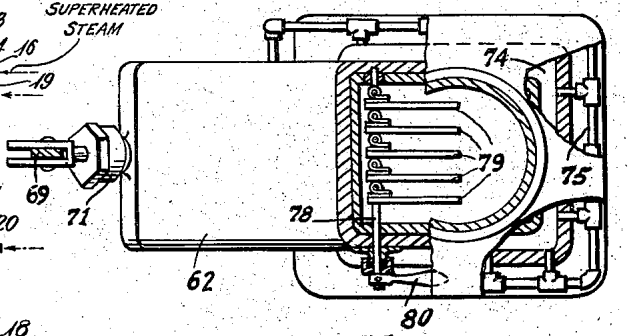


Fig. 3.



Inventor
Lewis C. Karrick

By Stevens and Davis
Attorneys

Patented May 19, 1942 2,283,556

UNITED STATES PATENT OFFICE

2,283,556

VALVE

Lewis C. Karrick, Salt Lake City, Utah

Original application December 11, 1933, Serial No. 701,838. Divided and this application December 5, 1938, Serial No. 244,071

14 Claims. (Cl. 221—145)

This invention relates to apparatus for treating coal and other carbonaceous materials to obtain solid, liquid and gaseous products therefrom, and more particularly it has reference to a valve for controlling the feed and discharge openings of the apparatus.

This and other features of the invention will be described in connection with the accompanying drawing in which similar reference characters indicate corresponding parts in the several views, and in which:

Fig. 1 is a diagrammatic illustration of carbonizing apparatus embodying the invention;

Fig. 2 is a sectional view of a quick-acting gas-tight valve for controlling the supply of solid material; and

Fig. 3 is a plan view partly in section thereof.

Arrows are shown on the drawing with full lines to indicate the movement of the solid carbonaceous material in the chamber, and with dot-and-dash lines to indicate the flow of steam, and with dotted lines to indicate the flow of air and fuel gas or products of combustion.

In Fig. 1 the metal reaction chamber 1 is surrounded by a system of flues 2 enclosed in heat insulating walls 3. Dust-free coal of substantially uniform size is charged into bunker 4 and is then fed through valve 5 into magazine 6 from which it flows continuously by gravity through valve 7 into the reaction chamber 1 which remains full of coal at all times. At the bottom of the reaction chamber is a discharge device comprising a wheel having pockets 8 which is rotated continuously in the direction of the arrow by means of any suitable power device, not shown, which withdraws coke from the reaction chamber and drops it into receiving bin 9 through valve 10 which normally remains open. At the bottom of bin 9 is a valve 11 which remains closed while bin 9 is being filled. After the bin 9 has been filled the valve 10 is closed and valve 11 opened momentarily to permit the contents to be removed, after which valve 11 is again closed and valve 10 opened and the operations repeated.

Superheated steam, or superheated steam and water-gas, for use in distilling the coal is preferably introduced into the reaction chamber by means of insulated pipe 12. This steam rises counter-flow to the descending column of coal while giving up its superheat to the coal, and is drawn off together with the volatiles from the coal by vapor pipe 13 and thence passes into main 14 leading to suitable fractionating condensers. Leading into the top of the reaction chamber are insulated pipes 15 by which superheated steam may be directed into contact with the incoming coal. I have found that some coals soften excessively when subjected to the dissolving and disintegrating effect of heavy condensates from the tar-oils which may precipitate or condense on the coal lumps which are at lower temperature toward the top of the chamber. Steam may be admitted through the pipes 15 to remove such heavy tar-oils and prevent them from condensing on the coal in the upper zone of the chamber. Superheated steam which may contain water-gas at very high temperature may also be admitted through pipes 15 in order to quickly carbonize the outer surface of the coal and thereby produce a shell or protective layer of coke on the lumps of coal. This latter procedure is used when the coal is of a fusing or weak type. In some cases the steam introduced through pipes 15 may be drawn off either partly or entirely at pipe 12 and is then carried to condensers by means of suitable conduits, not shown.

Near the bottom of the chamber 1 is another insulated pipe 16 by which superheated steam may be introduced into the reaction chamber when it is desired to form water-gas by the reaction of the superheated steam on the coke formed in the upper distillation zone. When super-heated steam is introduced into the reaction chamber by pipe 16, the amount of superheated steam introduced through pipe 12 or pipes 15 may be reduced, or may be entirely shut off.

In order to dry-quench the coke formed by the process, and impart highly reactive properties thereto, saturated steam is introduced into the reaction chamber through pipe 17 located at the bottom of the receiving bin 9. This steam rises counter-flow to the coke and abstracts its heat, thereby becoming superheated and assisting the distillation of the coal in the upper part of the reaction chamber. When valve 10 is closed momentarily for the purpose of permitting the bin 9 to be emptied the saturated steam is introduced through supply pipe 18 while pipe 17 is shut off. The reaction chamber 1 is heated externally by burning gas in the flues 2 which surround the chamber. A plurality of gas burners 19 and 20 provides at different levels along the walls of the chambers means for regulating the amount of heat supplied to the various flues, and serves to control the temperature at different heights in the flues.

The reaction chamber 1 is provided with sloping supports 21 projecting from the side walls

and mounted in staggered relation at varying distances from top to bottom.

Near the top of the reaction chamber 1 I provide coils 22 placed under the sloping supports and carrying superheated steam. These coils serve as a means of supplying internal radiated or conducted heat to the contents of the reaction chamber and thereby prevent condensation of heavy tar-oils from the rising current of fluids.

The life and efficiency of the apparatus may be increased by constructing the lower portion of the metal reaction chamber 1 of alloys of chromium and iron, or of calorized steel, this portion being in the zone of highest temperature. The upper part of the chamber 1 may be of cast steel or calorized steel plate. The chamber is made gas-tight for operation under pressure, by welding or other suitable means. The space 2 is constructed with clearance to permit the walls of the chamber 1 to move freely in a lateral direction as they expand and contract. Means are provided for permitting the metal walls to move freely in a vertical direction, and to insure that such vertical movement will be substantially linear, thus preventing warping or buckling due to expansion in the region of greatest temperature under the weight of the super-imposed structure. This is accomplished by providing a continuous upward tension on the walls of the chamber. In the form illustrated in Fig. 1, beams 27 rest on fulcrums 28 supported by the brick walls 3. One end of each beam 27 engages a lug 29, these lugs being fastened adjacent the top on opposite sides of the walls 1. The opposite end of each beam 27 is counter-balanced by a weight 30. The weight 30 is adjusted to cause a slight tension in the metal in the hottest zone so as to prevent any tendency of the metal to warp or sag from downward pressure at any part of the metal walls. The lower end of the magazine 6 is connected to the top of the carbonizing chamber by means of a gas-tight slip-joint 31 which permits the walls of the chamber 1 to expand and contract vertically without permitting gas to leak out. A similar gas-tight slip-joint 32 is provided in the insulated pipe 23. The several supply pipes, such as 12, 15 and 16 which penetrate the brick wall 3 are provided with ample clearance around them to allow for expansion. The openings through the brick work are preferably provided with a yielding plug or bushing 33 of asbestos yarn or other similar material held in place by close-fitting metal discs or shields 34 surrounding the pipe.

Figs. 2 and 3 illustrate a gas-tight coal valve suitable for charging and discharging the magazines and receiving bins of the carbonizer. The valve comprises an outer casting 59 with top and bottom flanges 60 and 61 and an extended compartment 62. Flange coupling 63 cooperates with flange 60 and has provided an opening 64 placed off center and of such diameter that it is flush with the interior wall of the valve on one side and overhangs the interior wall of the valve by a small distance on the other side as shown at 65. Bottom flange 66 cooperates with flange 61 and is similar to top flange 63. A sliding gate 67, provided with valve stem 68 is actuated by lever 69 and link 70 to move in and out of compartment 62. Stuffing box 71 provides means for operating the valve without leakage of gas. Within the valve casting 59 are provided flanged steel linings 72 and 73 which are cut at an angle to cooperate with the respective sides of the valve gate 67. The cooperating surface of the valve gate and the linings are ground to form gas-tight contacts.

The valve casting 59 is provided with a steam channel or recess 74 on its inner surface on three sides directly opposite the contiguous edges of the valve gate. A source of high pressure steam is connected to steam channel 74 by means of pipe and fittings 75. A valve 76 which controls the flow of high pressure steam is actuated by the lever 69 and linkages 77 to deliver steam to the interior of compartment 62 and into steam channel 74 as the valve gate is forced downwardly into place. It will be noted that the scavenging effect of the steam in removing dust from the valve seat is greatest as the gate approaches its seat due to the tapered construction of the gate 67.

In order to arrest the flow of coal prior to closing the valve gate, a means is provided comprising a shaft 78 and a plurality of independent flexible steel fingers 79 actuated by handle 80. Prior to closing the gate 67 the handle 80 on shaft 78 is set in a horizontal position, whereupon the spring fingers 79 clearly adjust themselves within the descending column of lumps and cause it to arch well above the line of the gate 67. In a few moments the lever 69 is forced inwardly a short distance, thus opening the steam valve 76 and releasing the steam into the space 62 and 74. The further movement of lever 69 causes the gate to move into its seat. In order to provide a simple adjustment for seating the valve, I provide leaf shims 81 of any suitable material, such as metal, which may be removed as the cooperating surfaces of the valve gate 67 and linings 72 and 73 wear, to make a gas-tight fit. The gate 67 comprises a tapered plate with flat surfaces, as described above, and it is therefore easily resurfaced. Likewise, the cooperating surfaces of the linings 72 and 73 are flat plain surfaces and may be removed and ground smooth on a polishing table with little effort if adjustment becomes necessary. I have found that the gate operates with less binding if placed at an angle, either downward or upward, when cutting through a stream of lump material and I show it in this form since it may be desirable at times to quickly close the gate before the flow arresting means 79, 80 have had time to function. The valve is also suitable for use in conduits carrying highly heated steam in which case the linings 72 and 73, and the gate 67 will be of alloys such as chromium, iron and nickel. The valve will be surrounded with insulating material to prevent loss of heat.

This application is a division of my copending application Serial Number 701,838, filed December 11, 1933, which is in turn a division of my application Serial No. 285,426, filed June 14, 1928. Said applications have issued as Patents Nos. 2,165,143 and 1,938,596, respectively.

I claim:

1. A quick-acting valve comprising an upright casing having an opening for the passage of material therethrough, a groove inside said casing, a lining extending inside the upper portion of said casing, a separate lining extending inside the lower portion of said casing, the adjacent ends of said linings having a space between them registering substantially with said groove, a valve gate acting in the space between the adjacent ends of said linings, means for actuating said valve gate to close said opening, means controlled by said actuating means to admit a fluid under

pressure through said groove to dislodge particles of said material, and adjustable means intermediate said casing and said linings to permit adjustment of said space.

2. A quick acting valve comprising an upright casing having an opening of rectangular cross-section for the passage of solids therethrough by gravity into an enclosed space under super-atmospheric pressure, a reciprocating valve gate of a width substantially equal to the internal width of the casing and a length not less than the cross-sectional length of said casing having an actuating means secured to one end thereof, said gate being tapered toward the end thereof remote from said actuating means and being mounted in said casing to slope downwardly away from said actuating means, a compartment communicating with said opening formed integral with one wall of the casing extending in an upward slope from said wall at an angle which is an extension of the slope of said gate, said compartment being formed to receive said gate upon withdrawal thereof from the casing, a groove in the other three interior walls of said casing corresponding substantially with edges of said gate, an upper lining in the upper part of said casing, a lower lining in the lower part of said casing, the adjacent ends of said linings being formed to fit the respective sides of said gate when in closed position to provide a seat therefor, means controlled by said actuating means to admit a fluid under pressure to said compartment and said groove, and means interposed between said casing and said linings to permit relative adjustment thereof.

3. A quick acting valve comprising an upright casing having an opening of rectangular cross-section for the passage of solids therethrough by gravity into an enclosed space under super-atmospheric pressure, a reciprocating valve gate of a width substantially equal to the internal width of the casing and a length not less than the cross-sectional length of said casing having an actuating means secured to one end thereof, said gate being tapered toward the end thereof remote from said actuating means and being mounted in said casing to slope downwardly away from said actuating means, a compartment communicating with said opening formed integral with one wall of the casing extending in an upward slope from said wall at an angle which is an extension of the slope of said gate, said compartment being formed to receive said gate upon withdrawal thereof from the casing, a groove in the other three interior walls of said casing corresponding substantially with the edges of said gate, an upper lining in the upper part of said casing, a lower lining in the lower part of said casing, the adjacent ends of said linings being formed to fit the respective sides of said gate when in closed position to provide a seat therefor, and means controlled by said actuating means to admit a fluid under pressure to said compartment and said groove.

4. A quick acting valve comprising an upright casing having an opening of rectangular cross-section for the passage of solids therethrough by gravity into an enclosed space under super-atmospheric pressure, a reciprocating valve gate of a width substantially equal to the internal width of the casing and a length not less than the cross-sectional length of said casing having an actuating means secured to one end thereof, said gate being tapered toward the end thereof remote from said actuating means and being mounted in said casing at an angle to the axis of said opening, a compartment formed integral with one wall of the casing extending outwardly from said wall at an angle which is an extension of the said angle of said gate, said compartment being formed to receive said gate upon withdrawal thereof from the casing, a groove in the other three interior walls of said casing corresponding substantially with the edges of said gate, an upper lining in the upper part of said casing, a lower lining in the lower part of said casing, the adjacent ends of said linings being formed to fit the respective sides of said gate when in closed position to provide a seat therefor, and means controlled by said actuating means to admit a fluid under pressure to said compartment and said groove.

5. A quick acting valve comprising an upright casing having an opening of rectangular cross-section for the passage of solids therethrough by gravity into an enclosed space under super-atmospheric pressure, a reciprocating valve gate of a width substantially equal to the internal width of the casing and a length not less than the cross-sectional length of said casing having an actuating means secured to one end thereof, said gate being tapered toward the end thereof remote from said actuating means and being mounted in said casing at an angle to the axis of said opening, a groove in at least three of the interior walls of said casing corresponding substantially with the edges of said gate, an upper lining in the upper part of said casing, a lower lining in the lower part of said casing, the adjacent ends of said linings being formed to fit the respective sides of said gate when in closed position to provide a seat therefor, and means controlled by said actuating means to admit a fluid under pressure to said groove.

6. A quick acting valve comprising an upright casing having an opening of rectangular cross-section for the passage of solids therethrough by gravity into an enclosed space under super-atmospheric pressure, a reciprocating valve gate of a width substantially equal to the internal width of the casing and a length not less than the cross-sectional length of said casing having an actuating means secured to one end thereof, said gate being tapered toward the end thereof remote from said actuating means and being mounted in said casing at an angle to the axis of said opening, a compartment formed integral with one wall of the casing extending outwardly from said wall at an angle which is an extension of the said angle of said gate, said compartment being formed to receive said gate upon withdrawal thereof from the casing, a groove in the other three interior walls of said casing corresponding substantially with the edges of said gate, an upper lining in the upper part of said casing, a lower lining in the lower part of said casing, the adjacent ends of said linings being formed to fit the respective sides of said gate when in closed position to provide a seat therefor, and means controlled by said actuating means to admit a fluid under pressure to said compartment and said groove.

7. A quick acting valve comprising an upright casing having an opening for the passage of solids therethrough by gravity into an enclosed space under super-atmospheric pressure, a valve gate having an actuating means secured to one end thereof, said gate being tapered toward the end thereof remote from said actuating means and being mounted in said casing to slope down-

wardly away from said actuating means, a compartment formed to receive said gate upon withdrawal thereof from the casing, a groove in the other three interior walls of said casing corresponding substantially with the edges of said gate, an upper lining in the upper part of said casing, a lower lining in the lower part of said casing, the adjacent ends of said linings being formed to fit the respective sides of said gate when in closed position to provide a seat therefor, and means controlled by said actuating means to admit a fluid under pressure to said groove.

8. In a valve for controlling the downward flow by gravity of solid material through a substantially vertical conduit; a reciprocating gate having an actuating means connected to one end thereof, said gate being tapered toward the end thereof remote from said actuating means and mounted in said conduit to slope upwardly from the smaller end thereof, a compartment formed in that wall of the conduit adjacent the end of the gate to which said actuating means is connected to receive said gate in withdrawn position, an opening in the other three walls of the conduit formed to contact the sides of said gate along respective edges thereof when the gate is in closed position, a channel in the walls of said conduit adjacent and in open communication with said opening, and means controlled by said actuating means to admit fluid under pressure to said compartment and said channel.

9. In a valve for controlling the downward flow by gravity of solid material through a substantially vertical conduit; a reciprocating gate having an actuating means connected to one end thereof, said gate being tapered toward the end thereof remote from said actuating means and mounted in said conduit at an angle to the axis thereof, a compartment formed in that wall of the conduit adjacent the end of the gate to which said actuating means is connected to receive said gate in withdrawn position, an opening in the other three walls of the conduit formed to contact the sides of said gate along respective edges thereof when the gate is in closed position, a channel in the walls of said conduit adjacent and in open communication with said opening, and means controlled by said actuating means to admit fluid under pressure to said compartment and said channel.

10. In a valve for controlling the downward flow by gravity of solid material through a substantially vertical conduit; a reciprocating gate having an actuating means connected to one end thereof, said gate being tapered toward the end thereof remote from said actuating means and mounted in said conduit to slope upwardly from the smaller end thereof, an opening in the walls of the conduit formed to contact the sides of said gate along respective edges thereof when the gate is in closed position, a channel in the walls of said conduit adjacent and in open communication with said opening, and means controlled by said actuating means to admit fluid under pressure to said channel.

11. In a valve for controlling the downward flow by gravity of solid material through a conduit disposed at an angle to the horizontal; a gate having an actuating means connected thereto, said gate being tapered in a direction away from the point of attachment of said actuating means and mounted in said conduit at an acute angle to the axis thereof and a seat for said gate comprising an opening in the wall of the conduit closed on the exterior of the conduit with respect to the atmosphere, said opening being formed to closely contact the opposite sides of the gate adjacent the edges thereof throughout the entire length of the intersection of said gate with the conduit wall, and means to admit a fluid under pressure to said opening along its full extent to dislodge said material from the seat and facilitate closing of the valve.

12. In a valve for controlling the downward flow by gravity of solid material through a conduit disposed at an angle to the horizontal; a gate having an actuating means connected thereto, said gate being mounted in said conduit at an acute angle to the axis thereof and a seat for said gate comprising an opening in the wall of the conduit closed on the exterior of the conduit with respect to the atmosphere, said opening being formed to closely contact the opposite sides of the gate adjacent the edges thereof throughout the full extent of the intersection of said gate with the conduit wall, and means to admit a fluid under pressure to said opening throughout the full extent thereof to dislodge said material from the seat and facilitate closing of the valve.

13. A quick acting valve comprising an upright casing having an opening for the passage of material therethrough, a groove inside said casing, a lining extending inside the upper portion of said casing, a separate lining extending inside the lower portion of said casing, the adjacent ends of said lining having a space between them registering substantially with said groove, a valve gate acting in the space between the adjacent ends of said lining, means for actuating said valve gate to close said opening, and means to admit a fluid under pressure to said groove to dislodge particles of material from the edge of said lining in said lower portion adjacent said space.

14. A quick acting valve comprising an upright casing having an opening of rectangular cross-section for the passage of solids therethrough by gravity to an enclosed space under super atmospheric pressure, a reciprocating valve gate of a width substantially equal to the internal width of the casing and a length not less than the cross-sectional length of said casing having an actuating means secured to one end thereof, said gate being tapered toward the end thereof remote from said actuating means and being mounted in said casing to slope downwardly away from said actuating means, a compartment communicating with said opening defined by means formed integral with one wall of the casing extending in an upward slope from said wall at an angle which is an extension of the slope of said gate, said compartment being formed to receive said gate upon withdrawal thereof from the casing, a groove in the other three interior walls of said casing corresponding substantially with edges of said gate, an upper lining in the upper part of said casing, a lower lining in the lower part of said casing, the adjacent ends of said lining being formed to fit the respective sides of said gate when in closed position to provide a seat therefor, means controlled by said actuating means to admit a fluid under pressure to said compartment and said groove, and means interposed between said casing and said lining to permit relative adjustment thereof.

LEWIS C. KARRICK.