July 14, 1942. R. DAAE 2,289,347

GAS PRODUCER

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Fig. 2.

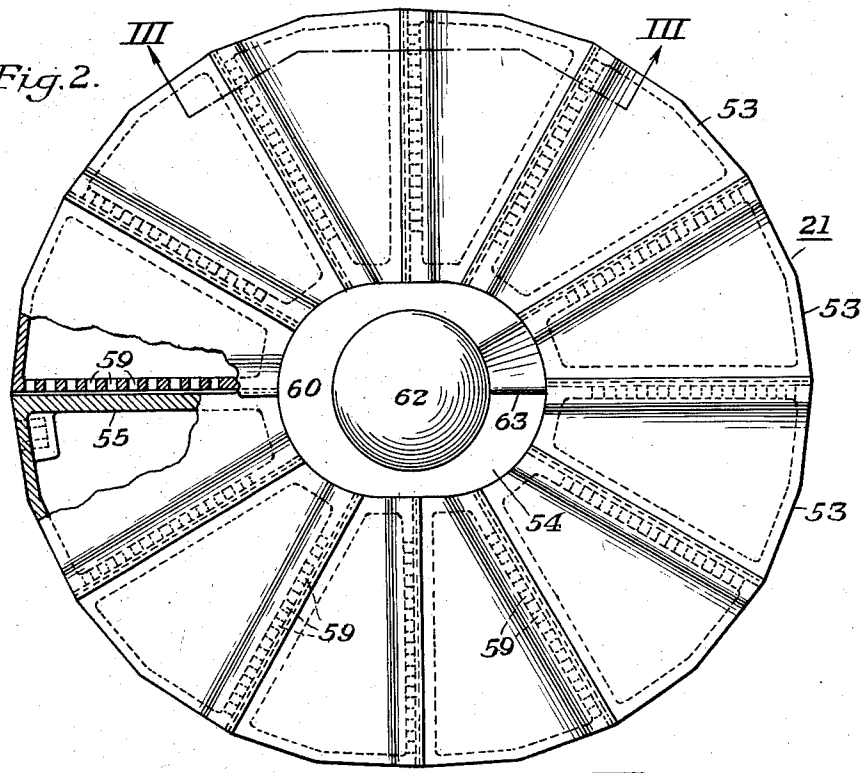


Fig. 3.

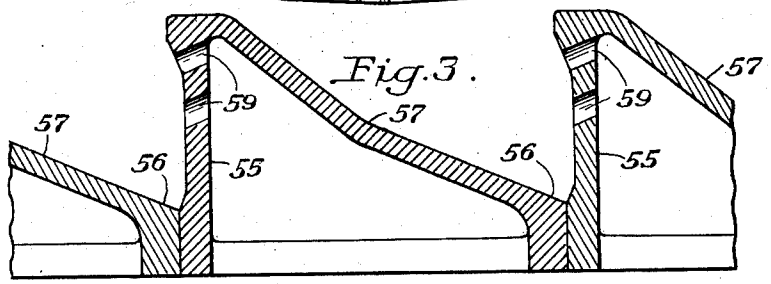


Fig. 4.

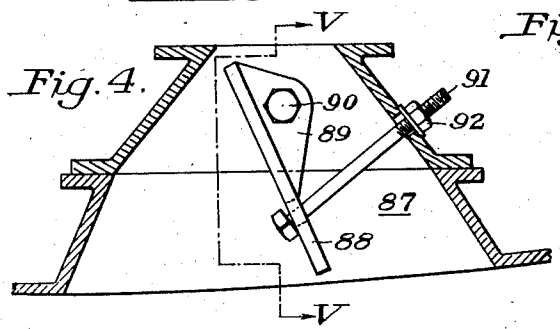
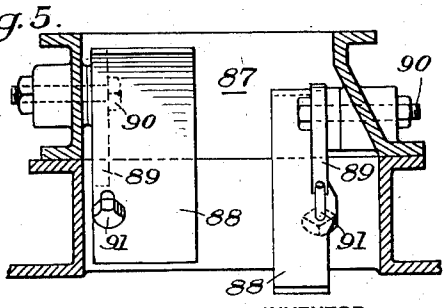


Fig. 5.



INVENTOR

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by his attys.

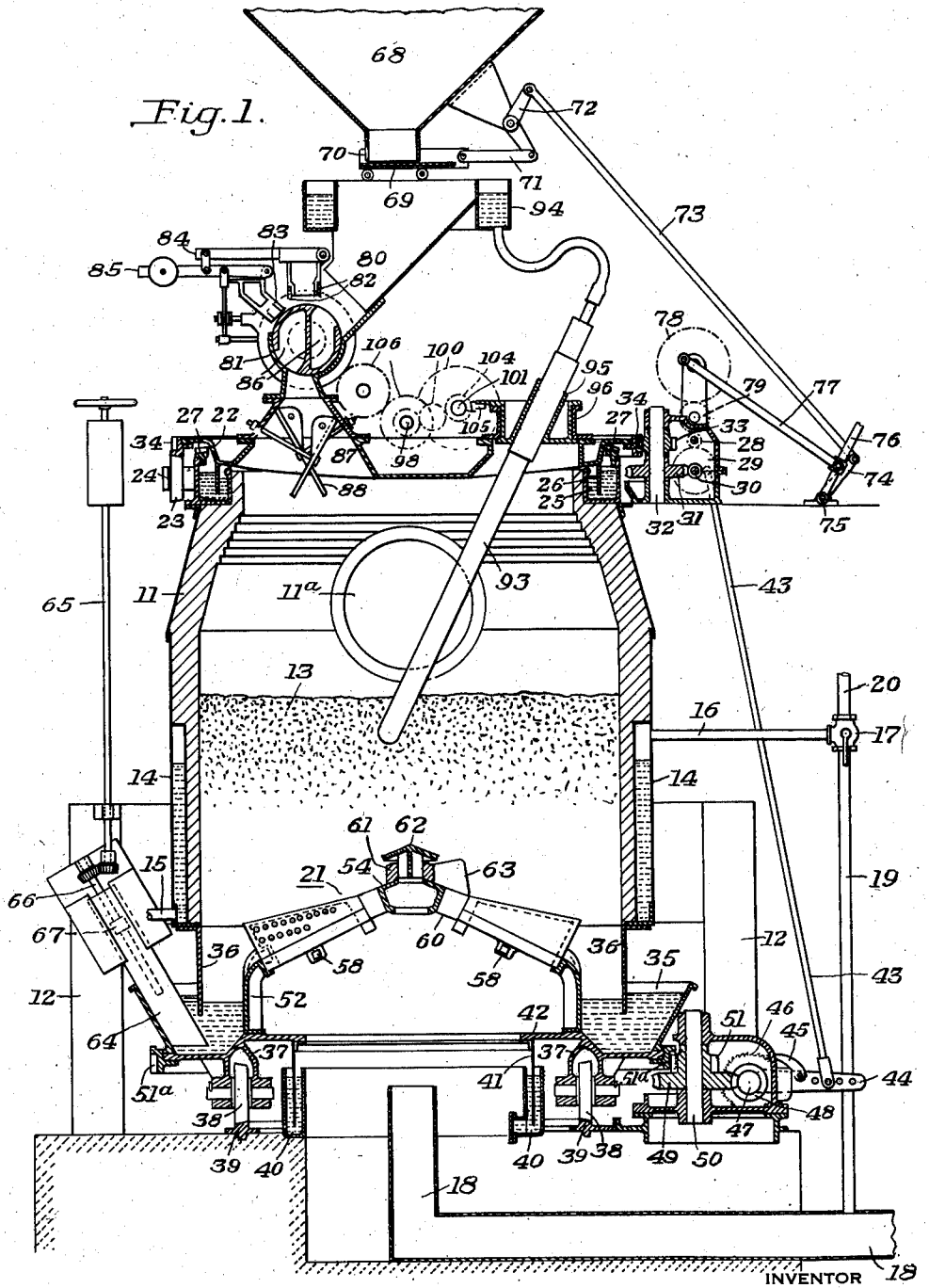
Stebbins, Blanchard & Parmelee

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Fig. 1.



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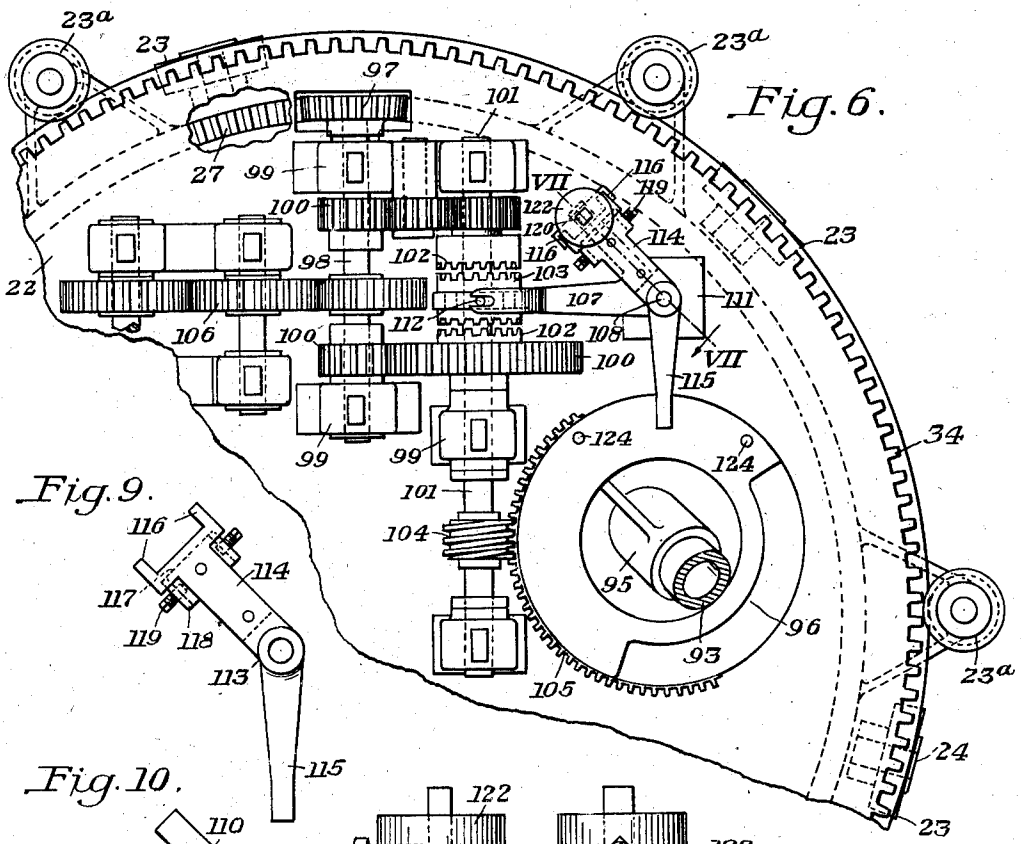


Fig. 6.

Fig. 9.

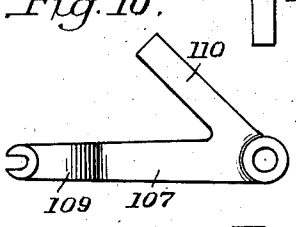


Fig. 10.

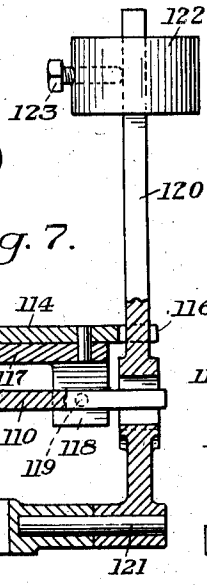


Fig. 7.

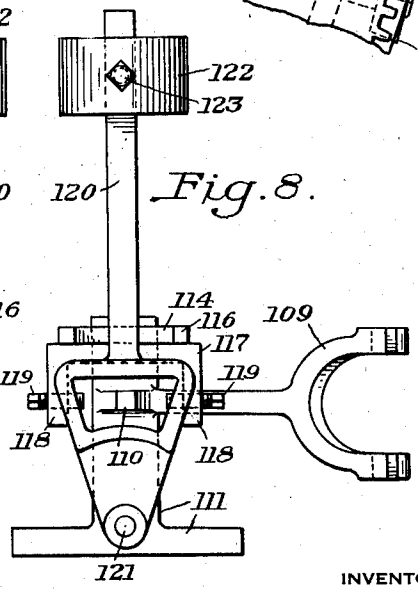
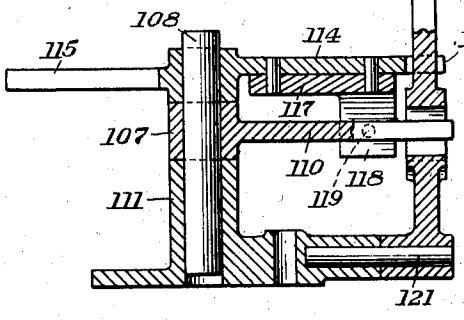


Fig. 8.



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UNITED STATES PATENT OFFICE

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GAS PRODUCER

Reinhardt Daae, Youngstown, Ohio

Application January 27, 1939, Serial No. 253,081

2 Claims. (Cl. 126—182)

This invention relates to improvements in gas producers of the type in which combustible gases are generated by the combustion of coal. In these producers, the coal is fed to the combustion chamber and the combustion process is carried out continuously and automatically. As will be hereinafter more fully described, I have developed improvements in gas producers whereby combustible gases may be generated continuously for long periods of time at a high rate of efficiency.

In the accompanying drawings I have shown certain present preferred embodiments of my invention, in which:

Figure 1 is a vertical section of my gas producer;

Figure 2 is a plan view of the grate of my producer partially broken away to show a part of the grate in section;

Figure 3 is a section along the lines III—III of Figure 2;

Figure 4 is a vertical section of the coal feeding opening in the cover of the producer;

Figure 5 is a section along the lines V—V of Figure 4;

Figure 6 is a partial plan view on an enlarged scale of the cover of my producer;

Figure 7 is a section along the lines VII—VII of Figure 6;

Figure 8 is an end view of the poker reversing mechanism shown in Figures 6, 7 and 8; and

Figures 9 and 10 are plan views of levers utilized in the poker reversing mechanism illustrated in Figures 6, 7 and 8.

As shown in Figure 1, my gas producer comprises a producer body 11 supported by standards 12 having a gas port 11*a* and containing the fuel bed 13. The lower portion of the producer body 11 is surrounded by a water jacket 14 having a cold water inlet pipe 15 and a steam outlet pipe 16. The steam outlet pipe 16 leads to a three-way valve 17 by which steam may be directed to an air pipe 18 through the pipe 19 or may be utilized for some other purpose by passing through the pipe 20. The air pipe 18 extends beneath the fuel bed 13 and supplies air necessary for combustion through a grate designated generally by the reference number 21 as will be hereinafter described. The producer body 11 is closed at the top by a rotating cover 22 which rotates on and is supported by wheels 23 which revolve about horizontal axles 24 secured to the producer body. Wheels 23*a* revolving about vertical axles engage the periphery of the cover and keep it centered over the producer body 11. The top of the producer body 11 supports a trough 25 which with a flange 26 extending downwardly from the cover 22 forms a water seal between the producer body and the rotating cover. The outer edge of the trough 25 carries a beveled ring gear 27 which is used to drive various parts of my producer as will be hereinafter described.

The cover 22 is rotated by any suitable source of power having a driving connection with a pinion 28. The pinion 28 meshes with a spur gear 29 which rotates about a horizontal axis and turns a worm 30 mounted on the same shaft. The worm 30 rotates a worm wheel 31 mounted on a short vertical shaft 32. A spur gear 33 keyed to the shaft 32 meshes with a ring gear 34 which is fastened to the periphery of the cover 22.

The bottom of my gas producer likewise rotates relatively to the producer body. As shown in Figure 1, the bottom of the producer comprises an annular trough 35 which forms an ash receptacle and also in cooperation with a flange 36 extending downwardly from the producer body a water seal for making the bottom of the producer air-tight. To enable the trough 35 to rotate, brackets 37 extend downwardly from the bottom of the trough 35 and support beveled wheels 38 which run on a track 39. A water seal around the air pipe 18 is provided by an annular trough 40 and a flange 41 extending downwardly from an extension 42 of the inner edge of the trough 35.

Rotation of the trough 35 is obtained by eccentrically pivoting a pitman 43 on the spur gear 29. Rotation of the gear 29 causes the pitman 43 to rise and fall which in turn raises and lowers a lever 44 to which the pitman is connected at its lower end. When the lever 44 rises, a pawl 45 pivoted on the lever 44 engages a ratchet wheel 46 keyed on a horizontal shaft 47 and rotates the ratchet wheel. A worm 48 is also keyed to the shaft 47 and upon rotation turns a worm wheel 49 mounted on a short vertical shaft 50. A spur gear 51 integral with the worm wheel 49 meshes with a ring gear 51*a* secured to the bottom of the trough 35 and thus drives the trough.

Ashes are removed from the fuel bed 13 by rotation of the grate 21 which as shown in Figure 1 of the drawings is supported by a carrier 52 which rests on the extension 42 of the inner edge of the trough 35. As shown in Figures 2 and 3, the grate comprises a plurality of truncated sectors 53 which are bolted to each other along their radial edges to the carrier 52 and to an elliptically shaped top section 54. The radial

edges of each sector have vertical faces 55 and 56, the face 55 of each sector being substantially higher than the face 56. Each sector has a sloping top surface 57 which joins the top portions of the two vertical faces 55 and 56.

The sectors 53 are bolted to each other by means of lugs 58 so that the higher vertical face 55 of one sector is next to the lower vertical face 56 of the adjacent sector. Thus, the top surfaces 57 form with the vertical edges 55 a series of radially extending troughs down which ashes may slide itno the annular trough 35. As shown in Figure 1 the ends of the sectors adjacent to the top section 54 are higher than the ends of the sectors supported by the carrier 52 so that the grate has the appearance of a cone with a plurality of radially extending ribs.

The sectors 53 are chambered so that air from the air pipe 18 may be blown through them into the fuel bed 13. The air is directed into the fuel bed by the sectors 53 through air passages 59 positioned in the top of the vertical faces 55. By placing the air passages 59 near the top of the vertical faces 55 ashes sliding down the troughs formed by the top surfaces 57 and vertical faces 55 will not clog the air passages. I have found it preferable to so rotate the complete grate that air is blown out over the top surfaces 57 in a direction opposite the direction of rotation of the grate.

To assist in the breaking up and removal of ashes from the fuel bed the top section 54 has an elliptically shaped bottom portion 60 so that the bottom edge of the grate 21 is elliptically shaped although the sectors for convenience in manufacture may all be made of the same length. Since the lower edge of the grate is elliptically shaped the distance between a point on the lower edge of the grate and a fixed point on the producer body 11 will vary upon rotation of the grate. This change in the space down which the ashes fall to the trough 35 assists in the removal of the ashes by breaking up any clinkers which may be formed. The top section 54 has a cylindrically shaped middle portion 61 and a conically shaped top portion 62. A scoop 63 is fastened to the cylindrical portion 61 of the top section and extends out over the elliptically shaped bottom portion 60. This scoop 63 further assists in the breaking up and removal of ashes from the fuel bed 13. The center section 54 is chambered to permit passage of air therethrough to the fuel bed.

The ashes are removed from the trough 35 by a plow 64 which may be raised and lowered by turning a rod 65 which is geared to a short threaded rod 66 which extends down the center of the plow 64 and cooperates with a threaded nut 67 whereby rotation of the rod 66 raises and lowers the nut 67 and consequently the plow 64.

As shown in Figure 1 coal or other fuel which is to be burned in the producer body 11 is kept in a hopper 68 mounted above the producer so that fuel may be fed into the producer body by gravity. The rate at which fuel is fed to the producer is controlled by a fuel feeding member 69 of the frictional type such as is shown for example in my Patent No. 1,034,695, granted August 6, 1912. The member 69 forms a movable bottom for the hopper and controls the amount of fuel fed into the producer by reciprocating back and forth across the bottom of the hopper. Thus when the member 69 is moved to the right, as viewed in Figure 1, a predetermined amount of fuel supported thereby is forced over its free edge while upon movement in the opposite direction it forms a support for the descending body of fuel which builds up thereon as determined by the size of the opening 70 and the angle of repose of the material.

A reciprocating motion is imparted to the member 69 by a link 71 pivotally connected to a bell crank lever 72. The other arm of the bell crank 72 is connected to a pitman 73 which in turn is connected to one end of a lever 74. The lever 74 is secured to a horizontal shaft 75 which carries a second lever 76. A pitman 77 eccentrically pivoted on a gear 78 imparts a reciprocating motion to the lever 76 and to the member 69 because of the linkage above described between the link 71, the bell crank lever 72, the pitman 73 and the lever 74. The driving pinion 28 meshes with a gear 79 which in turn meshes with the gear 78.

The fuel passes from the hopper 68 down a chute 80 to a rotary feeding and sealing means 81. The construction and operation of the rotary feeding and sealing means 81 and of the scrapers 82 and 83 which are mounted on weighted levers 84 and 85 and which are designed to prevent damage to the feeding and sealing means in case large lumps of coal or foreign material are delivered to the pockets 86 of the rotary feeding and sealing means 81 are described in my Patent No. 1,819,836 granted August 18, 1931, and form no part of the present invention.

The rotary feeding and sealing means 81 is not perfectly gas-tight. Occasionally, therefore, combustible gas generated in the producer body 11 will escape through the sealing means and go up the chute 80 where it may ignite. I locate the hopper 68 above the chute 80 so that there is an opening to the left of the bottom of the hopper, viewing Figure 1, which will by-pass the open flame to the atmosphere and prevent ignition of the fuel in the hopper 68. However, the hopper should be so located that the member 69 does not extend at the end of its movement to the right beyond the edge of the chute 80 so that coal dust falling off the right-hand edge of the member 69 will fall down the chute.

The fuel is discharged from the pockets 86 into a fuel feeding opening 87 in the cover 22 of the producer. Upon leaving the pockets 86 the fuel falls on chutes 88 which are pivotally mounted in and extend across the fuel feeding opening. Figures 4 and 5 show the construction of the chutes 88. The chutes have flanges 89 which pivot about bolts 90 extending through the sides of the fuel feeding opening 87. Additional bolts 91 extend through the other sides of the fuel feeding opening and the lower ends of the chutes 88 and hold the chutes in position. By turning nuts 92 on the bolts 91 the slope of the chutes may be adjusted as desired for proper distribution of the fuel onto the fuel bed 13. As is shown in Figure 5 the chutes 88 do not extend completely across the fuel feeding opening 87 but leave a space between them through which fuel may fall from the fuel feeding and sealing means 81 directly onto the fuel bed 13.

To stir the fuel bed and to distribute it evenly through the producer body 11, I provide a hollow poker 93 which extends down through the cover 22 and which is connected to a water tank 94 supported by the sides of the chute 80. The poker is held in proper position by a cylindrical holder 95 which rotates in a circular flange 96 seated on the cover 22. I provide for rotation of the poker 93 so that all portions of the fuel

bed may be reached thus insuring better stirring and distribution of the fuel in the fuel bed 13. The drive for rotating the poker consists in a bevel gear 97 (Figure 6) which extends through a hole in the cover 22 and meshes with the ring gear 27 secured to the outer edge of the trough 25. Rotation of the cover 22, therefore, causes rotation of the gear 97. The gear 97 is keyed to a shaft 98 mounted in bearings 99 on the cover 22. Rotation of the shaft 98 drives two oppositely rotating gear trains 100. The end gears of the gear trains 100 rotate freely on a shaft 101 and are made integral with square-toothed gears 102 which likewise run freely on the shaft 101. A double-faced gear 103 with teeth cut to mesh with the gears 102 is splined to the shaft 101 so that by sliding the gear 103 into mesh with first one and then the other of the two gears 102, the direction of rotation of the shaft 101 may be changed. The mechanism for shifting the gear 103 will be hereinafter described. The shaft 101 carries a worm 104 which meshes with a toothed sector 105 secured to the periphery of the holder 95. The shaft 98 also drives a gear train 106 which drives the rotary feeding and sealing means 81 as described in my Patent No. 1,819,836, granted August 18, 1931.

Figures 6, 7, 8, 9 and 10 show the mechanism for shifting the gear 103. A lever 107 pivoted about a vertical shaft 108 and having two arms 109 and 110 is used to shift the gear 103 in and out of mesh with the gears 102. The vertical shaft 108 is mounted in a base 111 which is secured to the top of the cover 22. The arm 109 of the lever 107 is forked and the prongs of the fork are slotted to grip small studs 112 which extend from a ring around the gear 103. A second lever 113 having two arms 114 and 115 is mounted on and rotates about the shaft 108 above the lever 107. The arm 114 of the lever 113 is forked to provide two horizontally spaced prongs 116 and carries a U-shaped member 117 having flanges 118 which extend down beyond each side of the arm 110 of the lever 107. The flanges 118 carry adjusting screws 119 by which movement of the lever 107 by movement of the lever 113 can be adjusted. A vertically extending lever 120 is pivoted about a horizontal shaft 121 mounted in the base 111. The lower end of the lever 120 is shaped in the form of a spade with the upper portion of the spade cut out. The arm 110 of the lever 107 extends through the cut-out portion of the spade. The upper end of the lever 120 carries a weight 122 which may be set in various positions along the lever 120 by means of the set screw 123.

The operation of the reversing mechanism is as follows. The poker holder 95 has two vertically extending pegs 124 near its periphery. Upon rotation of the poker the pegs 124 strike the arm 115 of the lever 113 and cause the lever to rotate about the vertical shaft 108. When the lever 113 rotates about the shaft 108 one of the adjusting screws 119 strikes the arm 110 of the lever 107 and causes the lever 107 to rotate. The arm 109 of the lever 107 will thus move the gear 103 partially out of mesh with one or the other of the gears 102. Upon further movement of the lever 113 one of the prongs 116 of the lever 113 strikes the lever 120. Continued movement of the lever 113 will cause the lever 120 to move past a vertical position and thus the weight 122 will overbalance. Under the action of gravity the overbalanced weight will move in a vertical arc until one edge of the spade-shaped end of the lever 120 strikes the arm 110 of the lever 107. The momentum of the falling weight is transmitted to the arm 109 of the lever 107 and snaps the gear 103 completely out of mesh with one and into mesh with the other of the gears 102. The direction of rotation of the carrier 95 will thus be changed and the poker will revolve in this direction until the lever 115 is struck by another one of the pegs 124 in which case the levers 107 and 113 will be moved in an opposite direction and the weight 122 will be swung to the opposite end of its arc of movement and the gear 103 will again be shifted from one to the other of the gears 102.

Because of the improvements above described, the coal is automatically fed in the right quantities to the combustion chamber and is evenly distributed therein. The revolving grate effectively removes the coal ashes and prevents them from clogging the air passages by which air necessary for combustion is supplied to the chamber. Reversing mechanism which controls the gears which drive the poker insures positive change of direction of rotation of the poker which in turn insures a thorough stirring and even distribution of the fuel throughout the fuel bed. By reason of these improvements my gas producer will operate automatically at a high rate of efficiency and for long periods of time.

While I have shown certain present preferred embodiments of my invention, it is to be distinctly understood that they may be otherwise embodied within the scope of the following claims.

I claim:

1. In a gas producer, a rotary grate of generally conical shape comprising a plurality of sectors having vertical faces along their radial edges, one vertical face being substantially higher than the other, a top surface sloping from one vertical edge to the other, air outlets adjacent the top of the higher vertical face of each sector, the sectors being joined together along their radial edges so that the high vertical face of one sector is adjacent the low vertical face of the next sector thereby forming a passage down which ashes may pass for removal from the producer, the difference in height between the vertical faces being such that during operation of the producer the ashes may move down the passages below the air outlets.

2. In a gas producer, a rotary grate of general conical shape having a plurality of radially extending ribs, each of said ribs having a substantially vertical face and a sloping face extending from a point adjacent the top of the vertical face of the rib to a point adjacent the bottom of the vertical face of the succeeding rib, and a plurality of air passages positioned adjacent the top of the vertical face, thereby forming a series of troughs down which ashes may slide beneath the air passages for removal from the producer.

REINHARDT DAAE.