

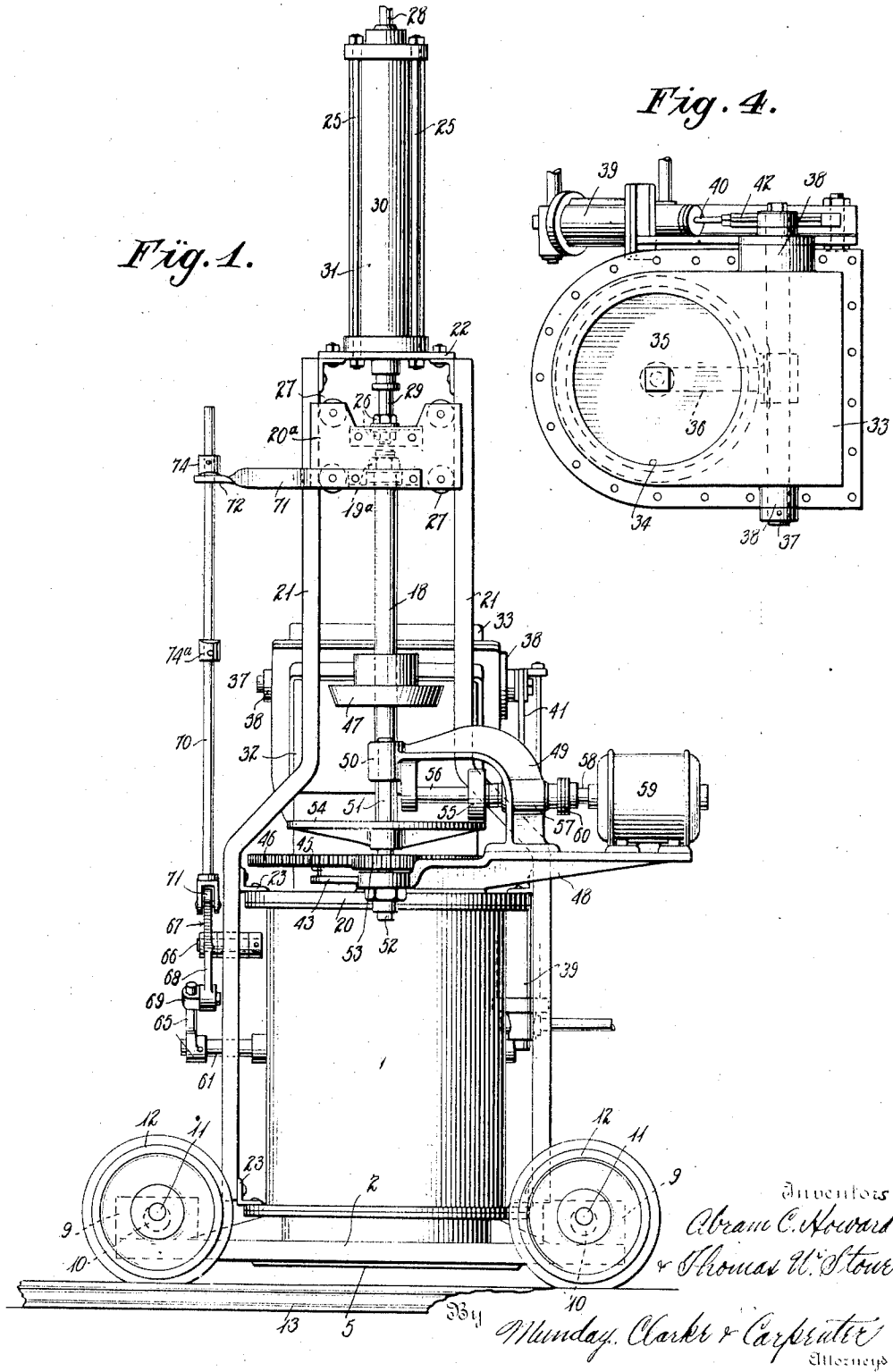
Aug. 24 , 1926.

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A. C. HOWARD ET AL

CHARGING APPARATUS FOR GAS GENERATORS

Original Filed Oct. 24, 1923. 4 Sheets-Sheet 1



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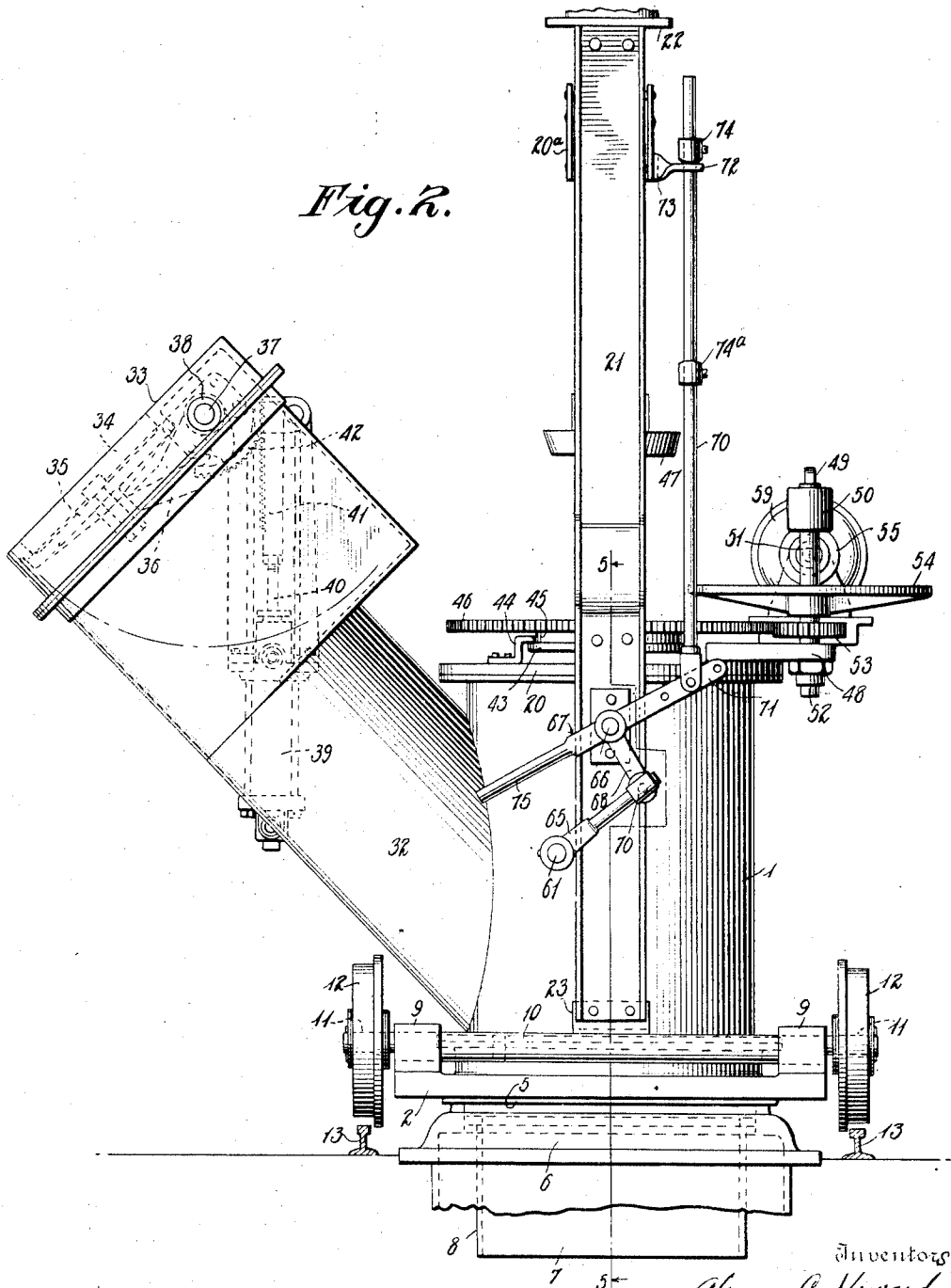
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CHARGING APPARATUS FOR GAS GENERATORS

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Fig. 2.



Inventors

Alvan C. Howard
& Thomas W. Stone

By Munday, Clarke & Carpenter

Attorneys

Aug. 24, 1926.

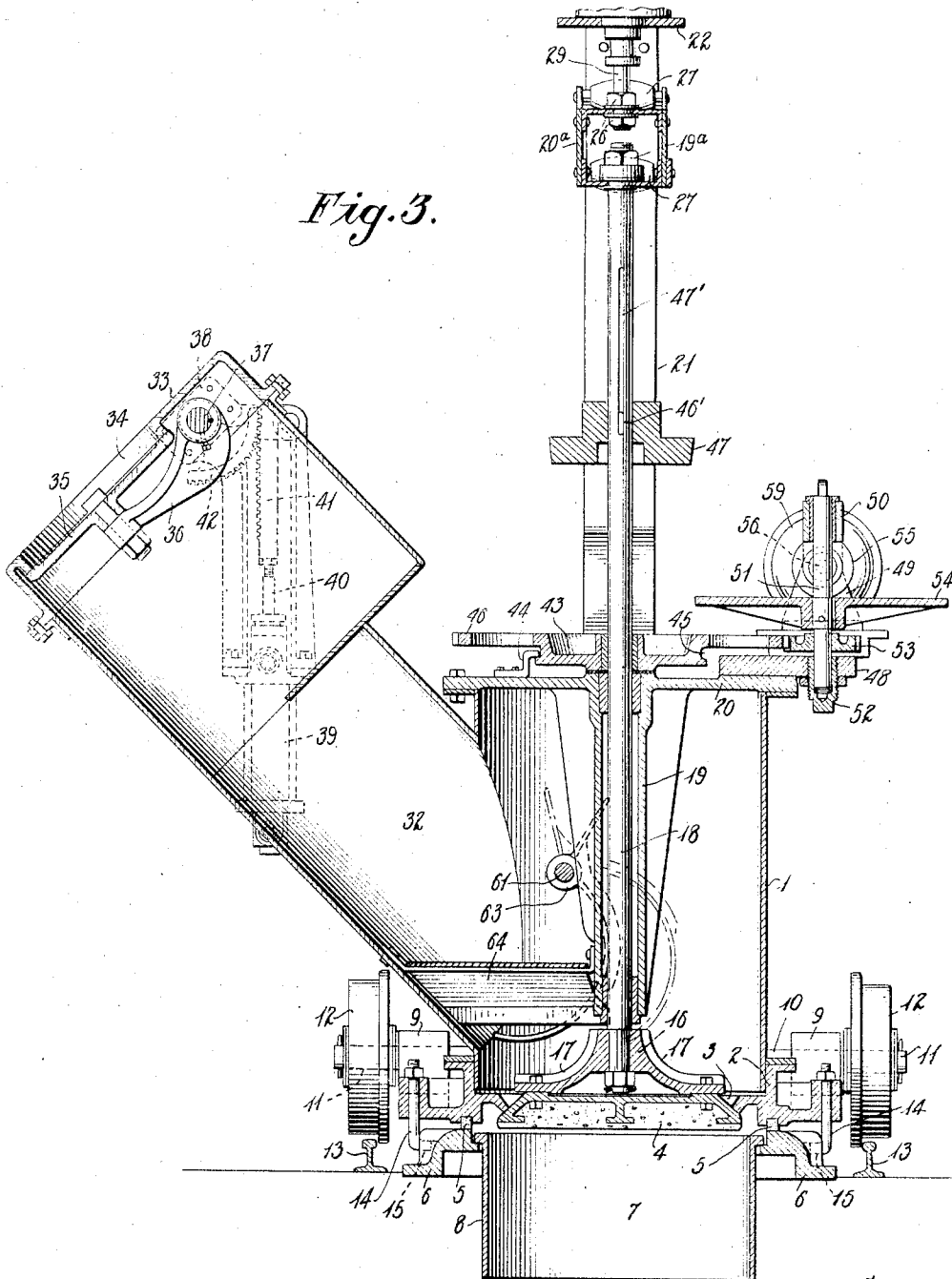
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A. C. HOWARD ET AL

CHARGING APPARATUS FOR GAS GENERATORS

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Fig. 3.



Inventors
Abram C. Howard
& Thomas W. Stone

By Munday, Clarke & Carpenter

Attorneys

Aug. 24, 1926.

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A. C. HOWARD ET AL

CHARGING APPARATUS FOR GAS GENERATORS

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Fig. 5.

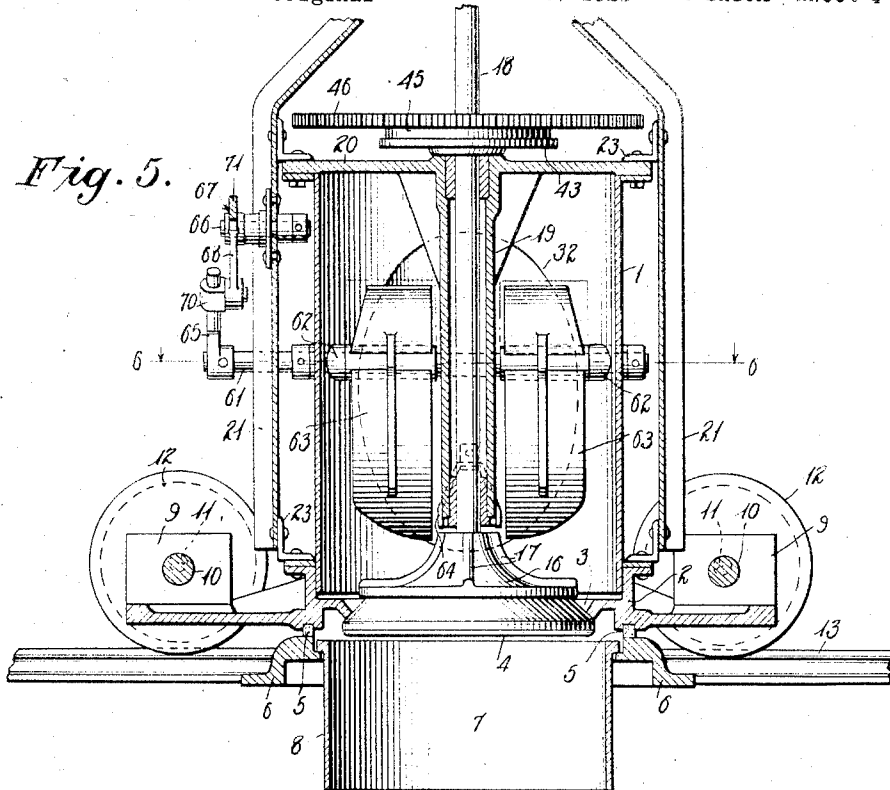


Fig. 6.

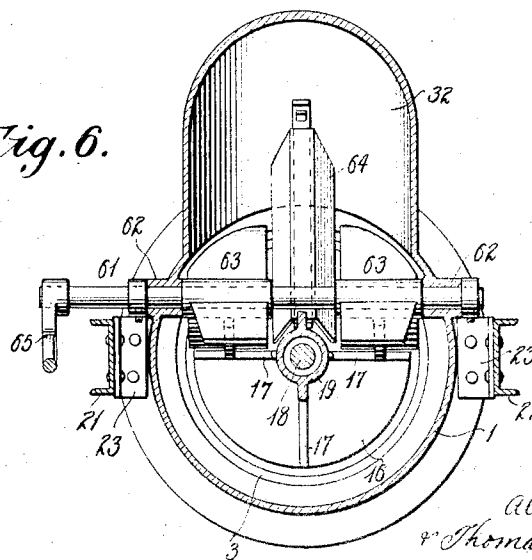
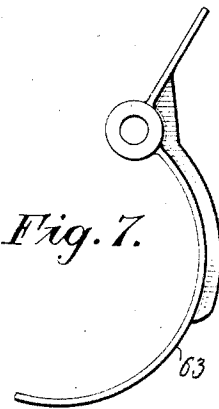


Fig. 7.



Inventors
Abram C. Howard
& Thomas W. Stout
By Munday, Clark & Carpenter
Attorneys

UNITED STATES PATENT OFFICE.

ABRAM C. HOWARD, OF SOUTH ORANGE, NEW JERSEY, AND THOMAS W. STONE, OF FORT WAYNE, INDIANA, ASSIGNORS TO THE WESTERN GAS CONSTRUCTION COMPANY, OF FORT WAYNE, INDIANA, A CORPORATION OF INDIANA.

CHARGING APPARATUS FOR GAS GENERATORS.

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The invention relates to gas generators and it has particular relation to charging devices which admit a predetermined quantity of fuel to a generator.

5 In devices heretofore employed for charging gas generators there have been several disadvantages present which impaired the efficiency of the apparatus.

10 First, in charging the generator the charging door is ordinarily removed about once every fifty minutes and sufficient fuel is admitted for seven or eight "runs" or for about fifty minutes. A very large quantity of fuel must be therefore introduced at each 15 charging period with the result that the fire in the generator is very low just prior to generating and is very high and cold just subsequent to charging. This causes great variation in the condition of the fuel bed in 20 the generator and also the loss of from five to seven minutes time each hour, during which time the generator is charged with fuel.

25 Second, in charging devices heretofore employed, there was a tendency for the fuel admitted into the generator to pile up near the center with the result that the smaller lumps packed into a central core while the larger pieces gravitated to a point adjacent 30 to the side walls. Inasmuch as the larger pieces, which laid against or near the straight wall of the generator, did not pack as closely as they did near the central portion of the fuel bed where they were intermingled with the finer particles of fuel, the 35 draft resistance through the fuel was less around the periphery of the bed and the combustion was consequently more intense in that zone than it was at the center of the fuel bed. In fact, it was not uncommon for "dead spots" to develop in the central 40 portion of the bed through inadequate draft at this point. The result was that much care was necessary in order to maintain uniform combustion throughout the entire area 45 of the fire bed.

One of the objects of the invention is to provide a device of the character described by means of which a generator may be 50 charged with fuel at any time during the operation thereof without the necessity of

temporarily discontinuing such operation and which will effectively seal the charging opening of the generator to prevent the escape of gas or fumes during the charging 55 period and to maintain the interval operating pressure of the generator during such period.

Another object of the invention is to provide a device of the character designated 60 that will automatically effect an economical and efficient distribution of fuel within the generator such as will result in a fire bed of substantially uniform height and combustion and of a constant temperature without the necessity of frequent adjustments to 65 the supply of steam and air.

A further object of the invention is to provide a device of the class designated in 70 which practically all of the principal elements are mounted upon a truck for the purpose of facilitating the transportation of the charging apparatus as an entirety from one generator to another and which 75 may be mounted in a gas tight position over a charging opening of a generator with the outlet valve of the device constituting the door of such opening.

With such objects in view, as well as other advantages, which may be incident to the 80 use of the improvements, the invention consists in the parts and combinations thereof, hereinafter set forth and claimed, with the understanding that the several elements constituting the same may be varied in proportion and arrangement without departing 85 from the nature and scope of the invention as hereinafter claimed.

In order to make the invention more clearly understood, there are shown, in the accompanying drawings, means for carrying 90 the same into practical effect, without limiting the improvements, in their useful applications to the particular constructions which, for the purpose of explanation, have been 95 made the subject of illustration.

In said drawings:

Fig. 1 is a side elevation of a charging device, constructed in accordance with the 100 invention.

Fig. 2 is a front elevation of the structure illustrated in Fig. 1.

Fig. 3 is a central vertical sectional view through the charging device and illustrating more in detail the valve element thereof.

Fig. 4 is a plan view of the cover of the chute which delivers the fuel to the charging device, and which carries the inlet valve element.

Fig. 5 is a central vertical sectional view through the hopper on line 5-5 of Fig. 2.

Fig. 6 is a transverse sectional view on line 6-6 of Fig. 5.

Fig. 7 is a detail side view of one of the secondary valves or retarding members.

Referring to the drawings, a charging apparatus, constructed in accordance with the invention, is shown as including a substantially cylindrical hopper 1 which is carried by a frame 2. The frame 2 constitutes the bottom portion of the hopper 1 and is provided with an opening 3 in alignment with the axis of the hopper which is normally closed by means of a valve member 4. The lower face of the frame 2 is provided with a packing member or gasket 5 which surrounds the opening 3 and is adapted to engage an annular frame 6 of a charging door 7 of a gas generator. The frame 6 carries a depending cylindrical neck portion 8 which extends downwardly into the generator and cooperates with the valve member 4 in charging the generator, as will be hereinafter more fully explained. The frame 2 of the charging apparatus is provided with bearings 9 adjacent to each end thereof, in which axles 10 are rotatably mounted. The extremities 11 of each of the axles 10 are eccentric with respect to the major portion thereof and carry flanged wheels 12 for engagement with rails 13 of a track that is mounted upon the super-structure of the generator.

By means of this construction, the charging apparatus may be easily transported as an entirety from one generator to another, and accurately positioned over a charging door 7. The axles 10 may then be rotated by any suitable mechanism, not shown, to lower the frame 2 and the charging apparatus carried thereby, until the gasket 5 tightly engages the frame 6 of the charging door 7. If the axles 10 are rotated one half revolution, the entire weight of the charging apparatus will be transferred to and supported by the frame 6, with the wheels 12 raised from engagement with the rails 13 of the track, as shown in the drawings. The charging apparatus may then be clamped in position over the charging door by means of bolts 14, of substantially L-shape, which are carried by the frame 2 and which are adapted to engage sockets or bosses 15 formed integrally with the frame 6. When the charging apparatus is thus secured in position over a charging door, it will be practically impossible for any gas or fumes

to escape therebetween during the operation of the generator.

The valve member 4 is carried by a spider 16, the respective arms of which are provided with flanges or ribs 17 and which is secured to the lower end of a vertically extending shaft 18. The shaft 18 is mounted for rotary and vertical sliding movement in a sleeve 19, which is carried by the cover 20 of the hopper 1 and which extends downwardly into the hopper to a point adjacent to the bottom thereof.

The upper portion of the shaft 18 is threaded and is removably secured by means of a nut 19^a to a block 20^a mounted for vertical reciprocation between a pair of channel bars or frame members 21. The latter are suitably spaced and secured together at their upper ends by means of a plate or clip 22 and intermediate thereof the channel members are flared outwardly and thence extend downwardly to embrace the hopper 1, to which latter the members are rigidly secured in any desired or preferred manner, as by bolts and angle clips 23 at the top and bottom of the hopper. A hydraulic jack 30 is provided, the cylinder 31 of which is mounted on the plate or clip 22 concentrically with the shaft 18 and is removably secured between said clip and an upper clamping plate 24 by means of tie bolts 25. The plate 22 is provided with a central aperture through which the piston rod 29 of the hydraulic cylinder is adapted to reciprocate and the lower threaded portion of the piston rod is adjustably secured by the nuts 26 to the upper portion of the block 20. Vertical reciprocation of the block between the frame members 21 is facilitated by means of opposed pairs of wheels 27 having a rolling contact with the inner faces of the channel bars 21. A pipe 28 is provided to supply fluid pressure to the cylinder 31 from any desired source (not shown).

It will be apparent from the foregoing that when it is desired to charge the generator with fuel, fluid under pressure is admitted to the cylinder 31 of the hydraulic jack 30. The piston rod 29 thereof will force the block 20 and the shaft 18 downwardly to lower the valve member 4 to open position, and the valve will be maintained in open position as long as pressure is maintained within the jack 30. On the other hand, when it is desired to close the valve 4, after a sufficient charge of fuel has been introduced into the generator, the pressure in the jack 30 is reversed thereby causing the valve 4 to be elevated to its former closed position.

The hopper 1 receives its charge of fuel, such as coal or coke, through an inclined cylindrical chute 32 which is carried by the side of the hopper 1. A cover 33 is secured to the upper portion of the chute 32 and is

provided with inlet opening 34, through which fuel is introduced into the chute 33 and the hopper 1 from a source of supply, not shown. The opening 34 in the cover 33 is normally closed by means of a valve member 35 which is carried by an arm 36 fixed to a rock shaft 37. The rock shaft 37 extends through the sides of cover 33 and is mounted in bearings 38 carried thereby. The shaft 37 is rocked for the purpose of opening or closing the valve member 35 by means of a hydraulic jack 39 which is suitably secured to the side of the chute 32. The piston rod 40 of the jack 39 carries a rack element 41 which engages a segmental rack member 42 which is fixed to one extremity of the rock shaft 37.

When the charging device is to be employed, the valve 35 is first opened by means of the jack 39, the valve 4 in the bottom portion of the hopper 1 being in a closed position, and the desired quantity of fuel is introduced into the chute 32. The valve 35 is then closed and the valve 4 is opened by means of the jack 30 and the predetermined quantity of fuel is permitted to gravitate into the generator through the door 7 by means to be described.

In order however that the fuel thus fed into the generator shall be properly distributed and arranged therein to effect the most efficient and satisfactory combustion the following described mechanism is provided.

A friction clutch member 43 is rotatably mounted on the shaft 18 and is supported upon the cover 20 of the hopper 1. The clutch 43 is maintained against any vertical displacement that might be occasioned through the vertical reciprocation of the shaft 18 by means of a flanged member or keeper 44 which is secured to the cover 20 of the hopper 1 and which projects into a peripheral groove 45 provided in the member 43. The clutch member 43 is further provided with a concentric gear wheel 46 which is fixed thereto and which is driven by means of mechanism hereinafter to be described.

A co-acting clutch member 47 is splined to the shaft 18 adjacent to the upper portion thereof by means of a key 46' which engages a slot 47' that is provided in the shaft 18. This clutch member is normally maintained out of co-operative engagement with the clutch member 43 as long as the shaft 18 and the valve member 4 are in raised positions to close the bottom of the hopper. The clutch member 47 is mounted on the shaft 18 at a sufficient distance from the clutch 43 so that when the shaft 18 is caused to descend to open the valve 4, the latter will have time to pass entirely through the neck 8 before the clutch member 47 engages the member 43.

A table 48 is secured to the top 20 of the

hopper 21 and carries an upwardly and horizontally extending bracket member 49, the overhanging end of which is provided with a bearing 50. A vertically extending shaft 51 is journaled adjacent to its upper end in the bearing 50 and at its lower end in a stepped bearing 52, which is carried by the table 48. A pinion 53 is keyed to the shaft 51 and meshes with the gear 46 of the lower clutch member 43. A friction disk 54 is also keyed to the shaft 51 and is driven by means of a friction pulley 55 which is splined to a horizontally extending shaft 56. The speed of the friction disk 54 and its directly associated elements may be varied in a well known manner by shifting the position of the pulley 55 in an axial direction along the shaft 56. The shaft 56 is journaled in bearings 57 provided on the bracket member 49 and is operatively connected to the shaft 58 of an electric motor 59, which is also mounted on the table 48, by means of a coupling member 60.

If the motor 59 is energized, the lower clutch member 43 will be rotated through the medium of the gear wheel 46, pinion 53, friction disk 54, pulley 55 and the shaft 56, but no rotary motion will be imparted to the shaft 18, as long as the upper clutch member 47, which rotates with the shaft 18, is maintained out of engagement with the lower clutch member 43. However, if a charge of fuel is contained in the hopper 1 and the shaft 18 is caused to descend through the medium of the hydraulic jack mechanism previously described, to deliver such charge to the generator, and as soon as the valve member 4 passes the lower edge of the neck 7, during its descent, the upper clutch member 47 engages the rotating lower clutch member 43 and causes the rotary movement thereof to be transmitted to the shaft 18 and the valve member 4. The shaft 18 will, however, continue to descend together with the rotating valve 4 until its vertical movement is arrested by the upper end of the slot 47' engaging the key 46' of the clutch member 47. It will be noted that the distance that the valve 4 may descend into the generator beyond the lower edge of the neck portion 8 of the door 7 is limited by the length of the slot 47'.

This rotary movement of the valve 4 causes the fuel supported thereby to be discharged radially into the generator by centrifugal force with the result that the small lumps and the finer particles of fuel concentrate adjacent to the walls of the generator, while the large lumps will be accumulated at a more central location therein. The ribs 17 carried by the spider 16 facilitate this centrifugal discharge of the fuel into the generator and insure that the fine particles as well as the large lumps of fuel will be subjected to such discharge.

During the operation of the apparatus it is desirable that the body of fuel admitted to the chute 32 be retained therein and out of contact with the upper surface of the valve 4 until the latter has been lowered and rotated up to full speed by the operation of the clutch and hydraulic mechanism above described. To obtain this result a secondary valve or fuel retarding mechanism is provided within the hopper 1 at the point of communication with the chute 32. A transverse rock shaft 61 is journaled in bearings 62 supported by the wall of the hopper. A pair of curved valve members or retarding plates 63 are secured to the rock shaft and arranged so that when in normal closed position the plates 63 retain the charge of fuel within the chute 32 and out of contact with the valve 4. A baffle plate 64 is mounted within the hopper and is adapted to intercept the fuel admitted to the chute and direct it equally against the plates 63 of the secondary valves. One end of the rock shaft 61 is prolonged without the hopper wall and has keyed thereto the hub portion of an arm member 65. A trunnion or stud shaft 66 is suitably bolted or secured to the outer side of one of the channel frame members 21 and centrally pivoted on the trunnion is a substantially T-shaped rocking member 67. The downwardly extending arm 68 of the T-shaped member has pivotally mounted thereon a sleeve member 69, having a sliding engagement with the upper cylindrical portion of the arm 65. A vertically reciprocating rod 70 is pivotally secured at its lower end to a second arm 71 of the T-shaped member and at its upper end the rod is slidably supported within an ear portion 72 of a horizontally extending strap or bar 73 secured at its inner end to the vertically reciprocable block 20. Adjustable stops 74, 74^a are provided at desired points on the rod 70, the upper of said stop members 74 being preferably located immediately above and resting on the ear 72 of the strap 73. An arm 75 of the T-shaped member is provided and is adapted to support a counterweight which may be provided if necessary to effectually maintain the retarding plates or secondary valve members 63 in closed position in contact with the fuel in the chute 32, and prevent access of the fuel to the valve member 4 until the latter has been lowered and imparted a high speed of rotation.

The operation of the secondary fuel-controlling valve mechanism described will be apparent. The valve 4 is lowered by the hydraulic cylinder 31 to establish communication between the hopper 1 and the generator chamber, the charge of fuel being retained in the chute 32 by the retarding valve plates 63 which are in normal closed position as illustrated in the drawings. The

clutch members 43 and 47 are thus caused to engage until the valve 4 attains a high speed of rotation at a time preferably just prior to the engagement of the downwardly moving strap 73 with the lower stop 74 which has been adjusted to its proper position on the rod 70. The continued downward movement of the piston rod then causes the rod 70 to be moved downwardly rocking the T-shaped member on the trunnion 66. The sliding and pivotal engagement of the arm 68 with the arm 65 causes the latter to swing inwardly to rotate the rock shaft 61 and open the retarding valve plates 63, thus permitting the fuel to enter the hopper and gravitate upon the valve 4 which at this time has acquired the necessary speed of rotation to receive the fuel and properly distribute it by centrifugal force within the fuel chamber of the generator. On the upward stroke of the piston rod 29 the valve plates 63 will gradually return to their normal closed position retaining the fuel in the chute 32 and the valves are prevented from being opened by pressure of the fuel by reason of the engagement of the strap 73 with the upper stop member 74. A balance weight may be employed if desired on the arm 75 to assist in returning the valves 63 to closed position cutting off the fuel from the hopper 1 on the upward stroke of the piston rod 29. Baffle plates 76 are preferably provided on the valves 63 to assist preventing communication between the generator and the upper portion of the chute when the valves are in open position during the charging operation.

From the foregoing it will be apparent that by means of the present invention the generator may be charged without opening the same to the atmosphere or to lower the internal pressure thereof. The operation of the generator may be maintained continuously without loss of time during the charging period. A charge may be admitted to the generator at any time during its operation and consequently such charge may be introduced, if desired, at a period of "down run", when the dome of the generator is occupied by steam, with the result that only steam will be admitted to the hopper when the communicating valve 4 is open and no nuisance or difficulty is experienced at a later period when the valve 35 is opened. The generator may be charged more frequently (once each run if desired) thereby maintaining the fuel bed uniformly high and approximately the same throughout the entire operating period. The supply of steam and air may consequently be maintained more constant and nearer a maximum for a most efficient condition of the fire and a maximum gas-making rate may therefore be obtained throughout an entire day. The distribution accomplished by the centrifugal action of

the rotating charger will overcome the tendency for open spaces to occur adjacent to the side walls of the generator and will effect a more thorough draft through the center of the fire bed, as the large lumps and finer particles will be more uniformly distributed throughout the entire bed. As a result, a more uniform heat condition will be obtained across the fire area and proportionately increase the gas-making capacity of the machine.

The invention is hereinabove set forth as embodied in one particular form of construction, but we do not limit it thereto or to less than all the possible forms in which the said invention as hereinafter claimed may be embodied and distinguished from prior devices.

What is claimed is:

1. A charging device for gas generators comprising a hopper adapted to be positioned over the charging opening of a gas generator, and a rotatable valve element carried by said hopper for closing said charging opening.

2. A charging device for gas generators comprising a movable hopper adapted to be secured in position over the charging opening of a generator, and a vertically slidable valve element carried by said hopper and constituting the door for said charging opening.

3. A charging device for gas generators comprising a movable hopper adapted to be secured in position over the charging opening of a generator, and a vertically movable and rotatable valve element carried by said hopper and constituting the door for said charging opening.

4. A charging device for gas generators comprising a hopper adapted to be moved as an entirety and secured in position over the charging opening of a generator, an inlet valve for admitting a charge of fuel to said hopper and a vertically slidable outlet valve carried by said hopper and constituting the door for said charging opening for delivering said fuel to said generator.

5. The combination with a gas generator having a charging opening surrounded by a frame, of a hopper adapted to be moved laterally into position over said charging opening, means for lowering said hopper into gas tight engagement with said frame, means for clamping said hopper in position, and a valve carried by said hopper and constituting the door for said charging opening.

6. The combination with a gas generator having a charging opening surrounded by a frame, of a charging device comprising a wheeled truck adapted to be moved into position over the charging opening of a generator, means for lowering said truck into engagement with said frame, means for securing said truck thereto, a hopper carried by

said truck, and a valve element disposed in the bottom portion of said hopper and constituting the door for said charging opening.

7. A charging device for gas generators comprising a hopper adapted to be positioned over the charging opening of a generator, a valve disposed in said hopper, means for opening said valve to deliver a charge of fuel to said generator and means for rotating said valve to cause said fuel to be discharged against the side walls of the generator under centrifugal action.

8. The combination with a gas generator having a charging opening provided with a depending neck portion, of a hopper adapted to be positioned over said opening, a valve in said hopper adapted to lower a charge of fuel through said opening and means for causing the rotation of said valve when the same has passed through said neck to discharge said fuel against the side walls of the generator by centrifugal action.

9. A charging device for gas generators comprising a hopper adapted to be positioned over the charging opening of a generator, a valve disposed in said hopper, means for opening said valve to deliver a charge of fuel to said generator, means for rotating said valve to cause said fuel to be discharged against the side walls of the generator under centrifugal action and a plurality of radially extending web members carried by said valve to augment such centrifugal discharge of the fuel.

10. A charging device for gas generators comprising a hopper adapted to be positioned over the charging opening of a generator, an inlet valve for admitting a charge of fuel to said hopper, an outlet valve adapted to support the fuel in the hopper, means for lowering said outlet valve through the said charging opening and means for causing the rotation of said valve during its descent to discharge said fuel into said generator under centrifugal action.

11. A charging device for gas generators comprising a hopper adapted to be positioned over the charging opening of a generator, an inlet valve for admitting fuel to said hopper, an outlet valve for delivering said fuel to said generator, means for lowering said outlet valve through said charging opening, and means for subsequently causing the rotation thereof to discharge the fuel into said generator under centrifugal action.

12. A charging device for gas generators comprising a hopper adapted to be positioned over the charging opening of a generator, a fuel inlet valve for said hopper, a vertically extending shaft mounted for rotary and sliding movement in said hopper, an outlet valve carried by said shaft, means for reciprocating said shaft to open and close said charging opening, a clutch member ro-

tatably mounted on said shaft, means for rotating said clutch member, a second clutch member fixed to said shaft and disposed out of operative engagement with said loosely mounted clutch member when said shaft is raised to close said charging opening and adapted to descend into engagement therewith when said shaft is lowered to open said valve to cause the rotation of said shaft and valve.

13. A charging device for gas generators comprising a hopper adapted to be positioned over the charging opening of a generator, a valve disposed in said hopper, a pressure cylinder operatively connected with said valve to open and close the same whereby fuel is periodically delivered to said generator, and means for rotating said valve, whereby said fuel is distributed by centrifugal force within said generator.

14. A charging device for gas generators comprising a hopper adapted to be positioned over the charging opening of a generator, a rotatable valve disposed in said hopper, a pressure cylinder mounted above said hopper and operatively connected with said valve to periodically deliver fuel charges to said generator, and clutch mechanism for rotating said valve, whereby said fuel charges are distributed by centrifugal force within said generator, said clutch mechanism cooperating with and adapted to be actuated by said pressure cylinder.

15. A charging device for gas generators comprising in combination: a movable hopper adapted to be positioned over the charging opening of a generator, a chute communicating with said hopper and adapted to be charged with fuel, a valve mounted in said hopper and constituting the door of said charging opening, means for actuating said valve to open and close said charging opening to deliver fuel from said hopper to said generator, means for rotating said valve to distribute said fuel by centrifugal force against the side walls of said generator, means for retarding the passage of

said fuel from said chute to said hopper, and means for actuating said fuel retarding means.

16. A charging device for gas generators comprising in combination: a movable hopper adapted to be positioned over the charging opening of a generator, a chute communicating with said hopper and adapted to be charged with fuel, a valve mounted in said hopper and constituting the door of said charging opening, means for actuating said valve to open and close said charging opening to deliver fuel from said hopper to said generator, means for rotating said valve to distribute said fuel by centrifugal force against the side walls of said generator, a secondary valve mounted in said hopper and adapted when in closed position to retard the passage of fuel from said chute to said hopper, and means actuated by said valve actuating means for automatically operating said secondary valve to permit the passage of said fuel from said chute to said hopper.

17. A charging device for gas generators comprising in combination: a hopper adapted to be positioned over the charging opening of a generator, a chute communicating with said hopper and adapted to be charged with fuel, a rotatable valve mounted in said hopper, means for opening and closing said valve to deliver fuel from said hopper to said generator, means for rotating said valve, a pair of secondary valves mounted in said hopper and adapted to retard the passage of fuel from said chute to said hopper, a baffle plate mounted within said hopper and adapted to direct the fuel in said chute against each of said secondary valves, and means actuated by said rotatable valve opening means for automatically operating said secondary valves to permit the passage of fuel from said chute to said hopper and said generator after the opening and during the rotation of said rotary valve.

ABRAM C. HOWARD.
THOMAS W. STONE.