United States Patent [19]

Wagner

[11] **3,881,885**

[45] **May 6, 1975**

[54] **GAS GENERATOR**

[76] Inventor: **Johann Wagner**, Sandstrasse 1/V, 8500 Nurnberg, Germany

[22] Filed: **Oct. 9, 1973**

[21] Appl. No.: **404,738**

[30] **Foreign Application Priority Data**

Oct. 9, 1972 Germany 2249444

[52] **U.S. Cl.** **48/76**; 48/77; 48/82; 48/111

[51] **Int. Cl.** **C10j 3/68**

[58] **Field of Search** 48/77, 82, 83, 101, 111, 48/61, 62, 89, 100, 101, 113, 123, 76; 23/281; 110/11; 202/120, 121, 124, 125, 126

[56] **References Cited**

FOREIGN PATENTS OR APPLICATIONS

748,747	10/1938	Germany
152,573	2/1938	Austria

Primary Examiner—S. Leon Bashore
Assistant Examiner—Peter F. Kratz
Attorney, Agent, or Firm—Holman & Stern

[57] **ABSTRACT**

A gas generator for both upward and downward gasification, comprises a housing defining a combustion space, a cinder bath space below the combustion space and a space below the cinder bath space, the space below the cinder bath space being in communication with the combustion space; a main pipe leading upwards to the combustion space, the main pipe having an air inlet and a gas outlet above the air inlet, the gas outlet, when open, opening into the space below the cinder bath space; apparatus for opening and closing the air inlet and the gas outlet; and a serpentine passageway arranged around the housing and in communication with the space below the cinder bath space. In operation, the gas outlet is closed and the air during downward gasification inlet is open to allow air to be drawn by suction through the air inlet and up the main pipe into the combustion space, and gas generated in the combustion space flows into the space below the cinder bath space and thence through the serpentine passageway. During upward gasification, the gas outlet is open and the air inlet is closed and air is introduced into the combustion space and the cinder bath space, gas generated in the combustion space flowing down the main pipe and through the gas outlet into the space below the cinder bath space and thence through the serpentine passageway.

8 Claims, 8 Drawing Figures

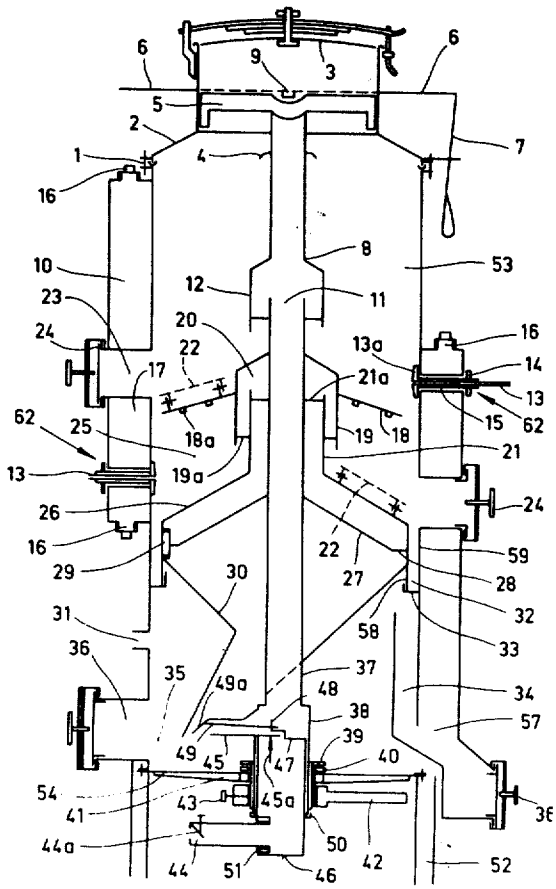
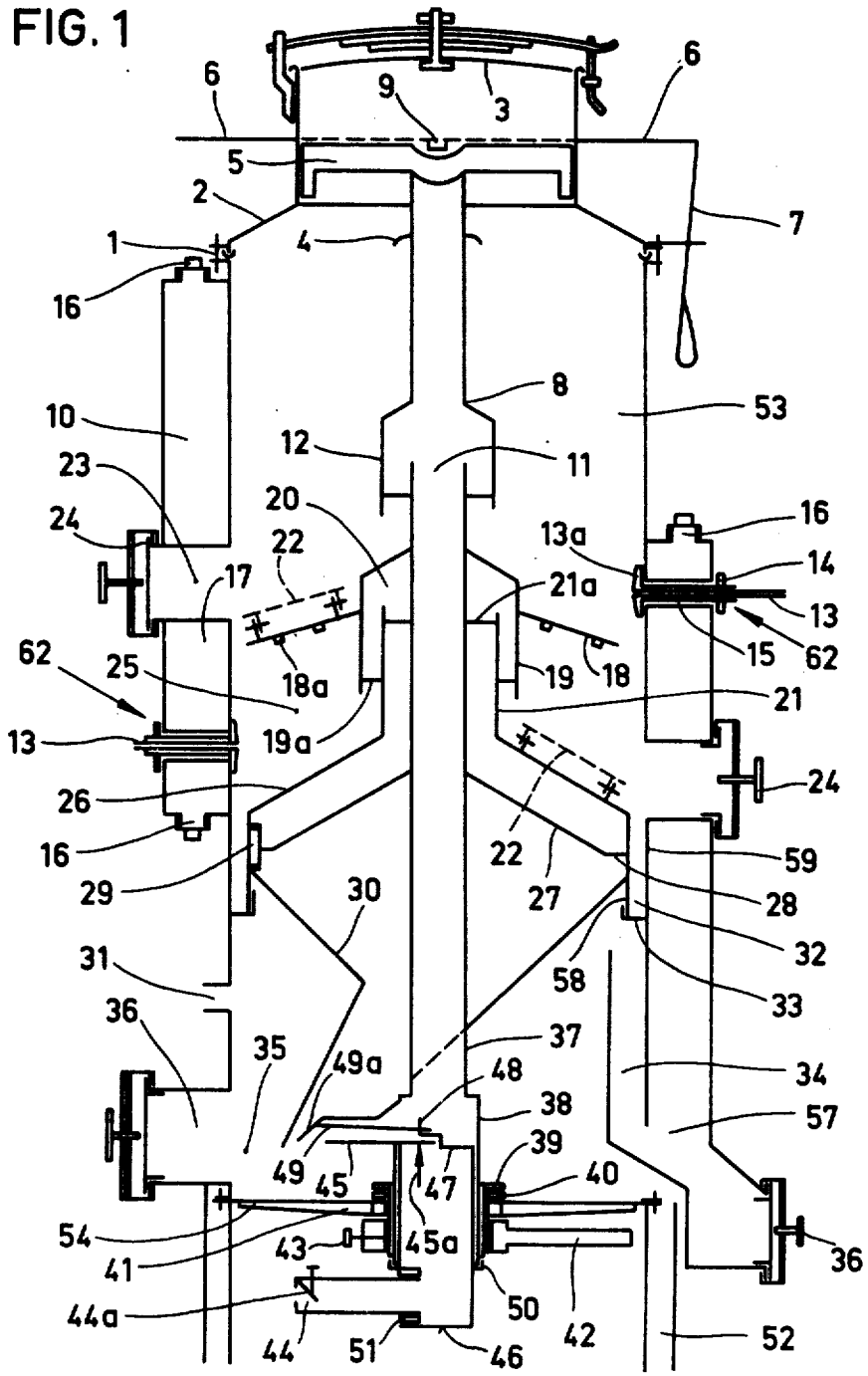


FIG. 1


6
9
3
6
5
2
7
1
4
16
8
53
10
12
11
23
20
16
24
22
13a
14
17
21a
13
62
15
25
18a
19
18
21
62
19a
13
24
26
16
22
59
29
27
28
30
32
31
58
33
36
35
49a
37
48
34
38
57
39
49
45
47
40
54
43
45a
36
41
50
44a
42
52
44
51
46

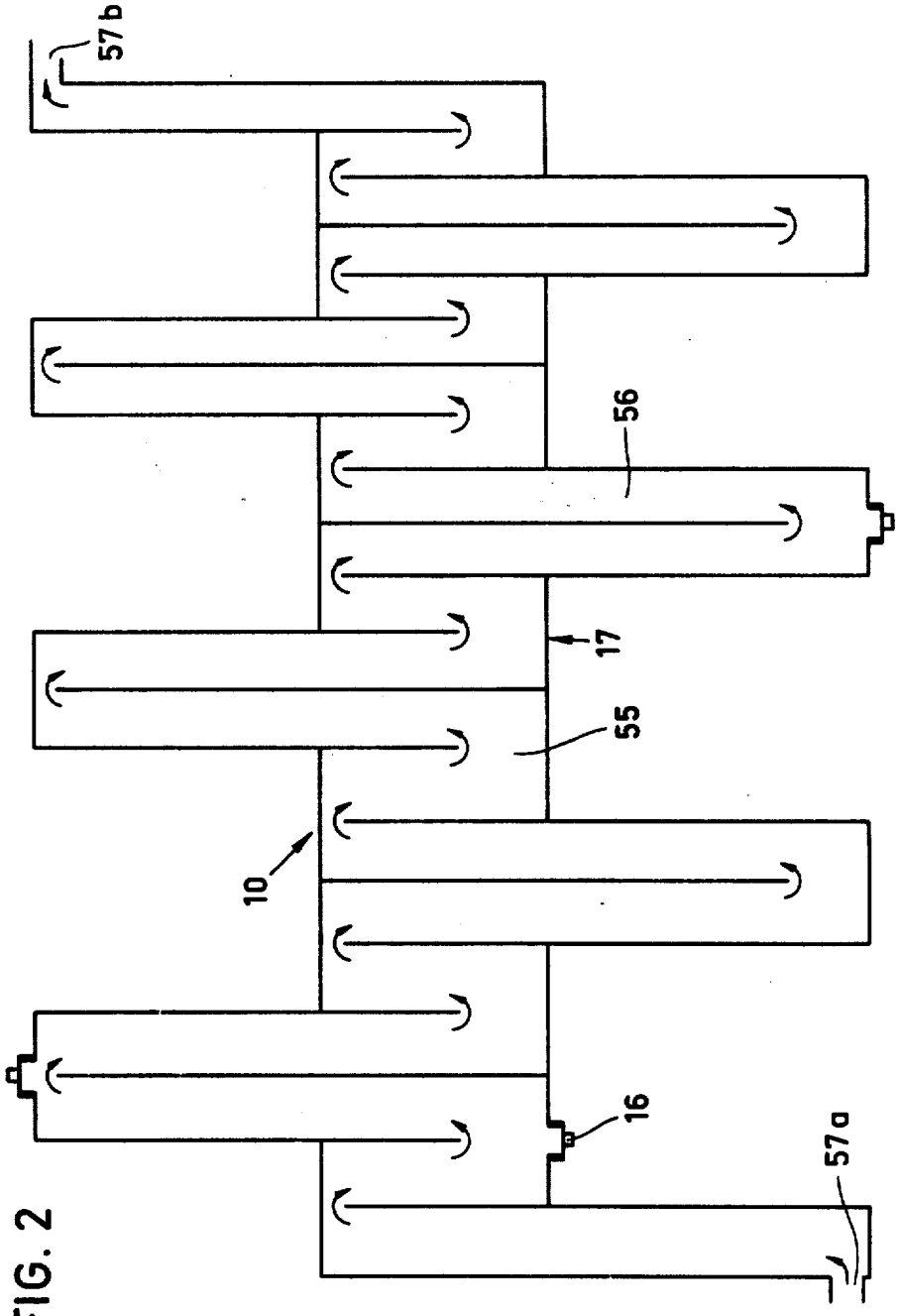


FIG. 2

FIG. 4

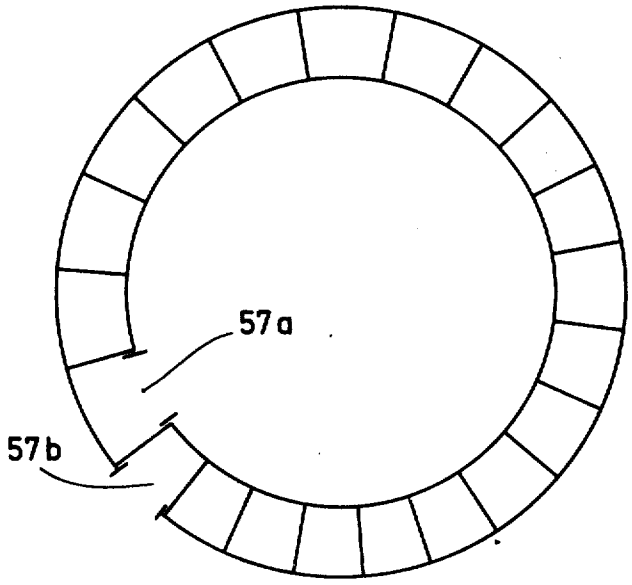


FIG. 5

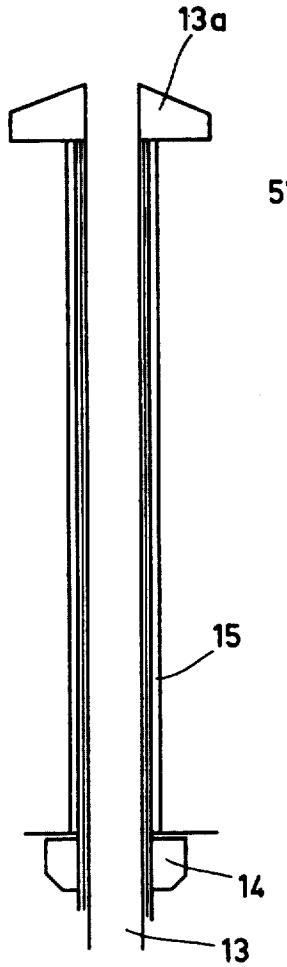


FIG. 3

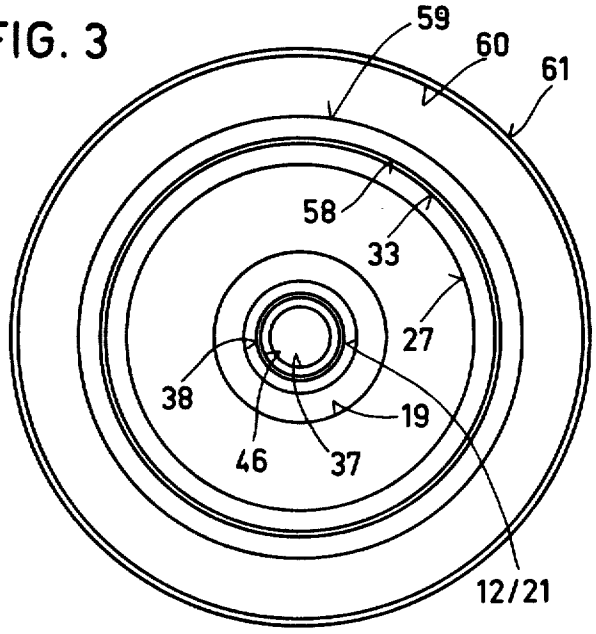


FIG. 8

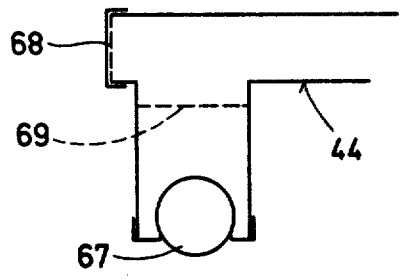


FIG. 7

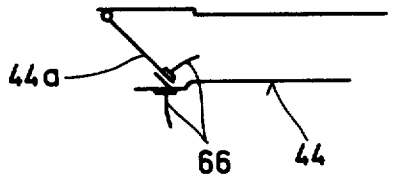
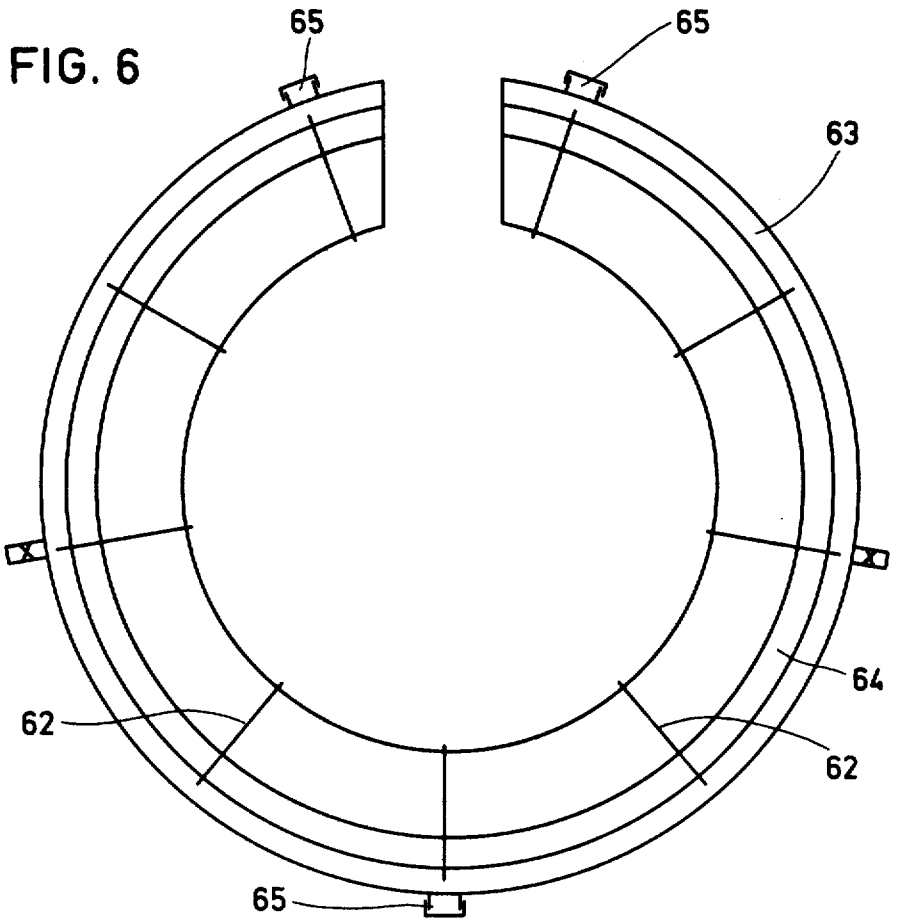


FIG. 6



GAS GENERATOR

BACKGROUND OF THE INVENTION

The present invention relates to a gas generator.

A known gas generator comprises a housing in which are defined a cinder bath space, a combustion space above the cinder bath space, and another space below the cinder bath space. A main pipe leads upwards to the combustion space. An air intake pipe is provided at the lower end of the main pipe. A serpentine passageway is arranged around the housing. In operation of the generator, during downward gasification, air is drawn into the air intake pipe by suction and the gas generated flows from the combustion space, through the space below the cinder bath space and into the serpentine passageway. A known gas generator of this nature German Patent specification 748,747) is suitable only for downward gasification. It is desirable however to operate with upward gasification as well in particular circumstances, because downward gasification tends to produce clogging up with different fuels because the fuels become tightly packed by suction, so that it becomes necessary to loosen these fuels and these fuels may be loosened by upward gasification.

It is known (Austrian Patent specification 152,573) to move a main pipe of a gas generator, which serves as an air feed, by means of a lever, thereby to control the metered airflow. It is also known ("Abstracts from German patent applications," 1.XI. 1949, page 358, para. 6) to arrange a gas passageway as an annular space in undulant form.

SUMMARY OF THE INVENTION

It is an object of the invention to devise a gas generator which is suitable for both downward and upward gasification.

The invention provides a gas generator of the kind defined in the foregoing, which is characterised in that nozzles lead from the wall into the combustion space and into the cinder bath space, and that for the purpose of upward gasification, the main pipe which then carries gas comprises an open discharge stub which leads into the space below the cinder bath space and is closable for downward gasification, said main pipe also being closable below the discharge stub.

The main pipe is closed off at the bottom and the discharge stub is opened, for the purpose of upward gasification. A flow of air or gas can then travel upwards from the nozzles, through the combustion space, through the main pipe and into the serpentine passageway.

Upon topping up with fuel, the air feeds are throttled down and the air inducted for downward gasification is drawn by suction through the trap opening, thereby inhibiting the upward discharge of smoke. The air feed is returned to normal again by closure by means of a lid or cover.

Only complementary inducted air passes into the combustion space through the air suction pipe and main pipe, in the case of downward gasification. If clogging by suction occurs during downward gasification and a negative pressure occurs in the incandescent section, the generator is switched over to upward gasification, thereby loosening the cinder bath and the superjacent incandescent material.

The invention also specifies that the adjacently situated gas passages are of different length in vertical direction and are so arranged that the gas passages are situated side-by-side only at the level of the incandescent section of the combustion space and of the cinder bath space, and project beyond these in upward and downward directions. The passages provide a resistance to flue dust and heavy unprocessed gas products, in such manner that upon emerging from the passages, the gas need not undergo any complementary purification nor any water separation.

In the case of a gas generator or producer, according to the invention, coal should be broken up to apple size, any grit or dust produced being processed as well. This gas generator is also suitable for all combustible wastes available. For example, it is possible to mix decaying wood, wood shavings, wood planing dust, sawdust, peat litter, coal dust, waste oil from automobile and machinery repair workshops and analogous waste refuse with fuels of higher grade. It is also possible to admix comminuted unusable tyres. The different flash points of a fuel mixture are immaterial. Combustible gas is always produced without smoke. In its existing size, the gas generator is adequate for smaller undertakings and is particularly appropriate for the wood industry. It supplies gas engines or gas turbines, generates hot water and steam, as well as bottled gas for domestic use and for vehicles.

BRIEF DESCRIPTION OF THE DRAWINGS

A gas generator embodying the invention is illustrated diagrammatically in the accompanying drawings, wherein

FIG. 1 shows a vertical cross-section through the gas generator;

FIG. 2 shows a development of the passages of the generator in FIG. 1:

FIG. 3 shows a cross-section taken at different heights through the gas generator;

FIG. 4 shows a cross-section through the passages;

FIG. 5 shows a longitudinal cross-section through an air feed nozzle;

FIG. 6 shows a cross-section through the gas generator, showing the connection of air feed nozzles to a common air feed pipe;

FIG. 7 shows a cross-section through an air suction valve;

and

FIG. 8 shows a cross-section through an alternative air suction valve.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The gas generator shown in the drawings comprise an upright cylindrical housing **59** having a top **2** and a base **54** supported on four feet **52**. The interior of the housing **59** is divided into three spaces, namely a combustion space **53** for receiving fuel, a cinder bath or gas processing space **25** below the combustion space and another space below the cinder bath space. A pipe **8** and a main pipe **37** are positioned coaxially in the housing, the main pipe leading upwards to the combustion space.

As shown in FIG. 1, the top **2** is seated on a U-section ring which forms a seal between the top **2** and the housing. The top **2** has a charging aperture for charging fuel into the housing. The charging aperture is as small as possible.

The charging aperture is closable by a cover **3.** The pipe **8** is rotatably attached to a guiding beam **5.** The pipe **8** rotates relative to the beam **5** during vibratory displacements. On the pipe **8** are attached two hooks **4.**

The hooks **4** are for receiving a traction cable for hoisting the under-part as a whole for general cleaning operation. Such a cleaning operation is required infrequently. To carry out such a cleaning operation, the top **2** should be taken off together with the guiding beam **5.** Below the charging aperture are mounted two metal gate panels **6** which are displaceable by means of gate levers **7** situated diametrically opposite each other. The gate panels **6** may be omitted if the gas generator is large, provided that the charging aperture is of an appropriately small size. When the generator is charged, the gate panels **6** are closed initially and are opened after the charging aperture has been closed again by the cover **3.**

The pipe **8** is closed at its upper end by a removable terminal screw **9.** The screw **9** is removed when it is desired to clean the pipe **8** throughout its length. Gas passages **10** (see FIGS. **1** and **2**), are situated around the exterior of the housing.

Three openings **11** in the form of slots, which measure approximately 10 × 4 cms, are formed in the pipe **37** adjacent its upper end.

The space **53** is for receiving fuel. The space **25** is for receiving a cinder bath and superjacent glowing material.

The lower end portion of the pipe **8** is enlarged to form a protective casing **12** which surrounds the upper end portion of the main pipe **37.** The casing **12** is prevented from being deformed by heat by means of iron rods attached to and extending between the casing and the pipe **37.** The casing **12** prevents fuel entering the pipe **37** through the openings **11.**

Upper and lower nozzles **62** lead into the space **53** and the space **25** respectively. One of the nozzles is shown in detail in FIG. **5.** Each nozzle comprises a nozzle tube **13,** a nozzle head **13***a*, a nut **14,** a sealing washer associated with the nut and another tube **15.** Screws **16** of a diameter of approximately 10 cms are incorporated at the upper and lower extremities of the gas passages **10,** so that the gas passages may be freed of flue dust and deposits.

A stabilising space **17** (see FIG. **2.**) acts as a heat accumulator and is situated adjacent the nozzles **62.** A suction stub **21** surrounds the pipe **37** and a protective case **19** is attached to the stub **21** above the stub **21.** A fuel receiver **18** is joined to the protective case **19** and reinforced by iron rings or hoops **18**a. The protective case **19** allows gas and flue dust only to pass into the suction stub. Iron rods **19***a* prevent the case **19** being deformed. A point of entry **20** into the suction stub **21** is incorporated. Iron rods **21***a* which are attached to and extend between the main pipe **37** and the suction stub. The rods **21***a* prevent the suction stub being deformed. The fuel receiver **18** may alternatively be referred to as an inclined fuel-supporting platform.

Pivotable drivers **22** which have ample play in the joints to remain movable at red-heat, are mounted on the fuel receiver **18.** The drivers **22** serve for cleaning and loosening. During vibratory displacements, a vibrating or jarring lever **42** is turned towards the right, the drivers not being swung over completely, to thereby loosen the cinder bath and the superjacent glowing material. Cinders or slag granules, depending on the fuel, may occasionally be removed through cleaning ports **23,** each closable by a closure **24.** To this end, a double ratchet is moved over to the left by means of the lever **42** and the lever **42** is turned further towards the left, thereby raising the drivers until the cleaning operation has been concluded.

The gas passes to the point of entry **20** through the space **25,** after which the gas is heated up by the cinder bath bottom **26.** A slide plate **27** is connected to the sidewall of the cinder bath bottom **26** by, for example six coupling elements **28.** Approximately three screws **29** are situated on the sidewall of the cinder bottom **26** for cleaning operations when the cinder bath bottom is extracted.

A cinder and gas discharge funnel **30** is located below the slide plate **27.** A connector **31** for a pressure switch is provided. A charging compartment **32** is filled with cinders after each fitting-up operation and thus prevents a direct downward gas draught. The charging compartment **32** is downwardly terminated by an "angled" ring **33.** The gas passes into the passages **10** through a passage **34** having, for example a cross-sectional size of 8 × 16 cms.

A cinder repository **35** is situated at the bottom of the housing, which is accessible through a cleaning port **36** having a closure. The gas flow should be interrupted during the de-ashing operation, if a gate or lock arrangement is not incorporated. The pipe **37** has an enlarged extension **38** at its lower end. The extension **38** receives a rotatable pipe insert **46.**

A pipe reinforcement **39** comprising a supporting extension is mounted on the enlarged extension **38.** A bearing ring **40** whereon the pipe reinforcement **39** rotates is connected to a base **54** which is prevented from sagging by means of four intersecting base reinforcements **41** with a ring at the middle. The lever **42** serves the purpose of operating the clockwise and anticlockwise ratchet (double ratchet) and is secured by means of an anchoring screw **43.** An unscrewable air suction pipe **44** which has a flap closure **44***a* adjustable by means of a screw, is arranged at the bottom of the extension **38.** The flap closure may be omitted if an electromagnetic closure is incorporated, as described below with reference to FIG. **7.**

A discharge stub, or stationary closure member, **45** on the extension **38** for the gas and flue dust appearing in the cinder repository **35** during upward gasification covers half of the enlarged extension **38** as indicated by arrow **45***a*. The pipe insert **46** is also half-covered at the top by a cover **47.** The pipe insert **46** is equipped with a crank **48** receiving a guiding rod **49** which is connected to a flap **49***a*.

FIG. **1** shows the gas generator in the condition it is in when upward gasification is being carried out. If the air suction pipe **44** is turned towards the right, the crank **48** acting through the guiding rod **49** closes the flap **49***a* and the half-cover **47** passes under the other half-cover as indicated by arrow **45***a*. This opens an upward airpath for downward gasification. The switching operation may occur automatically by means of a pressure switch.

A box nut **50,** associated with a sealing washer if appropriate, holds the pipe insert **46** and should be taken off upon dismantling the principal element. The pipe insert **46** comprises a threaded reinforcement **51.** The gas generator is supported on the four feet **52.**

FIG. 2 shows the arrangement of the gas passages **10**. Although the individual gas passages **10** are straight, together the gas passages constitute a serpentine gas passageway. Charging chambers **55** act as heat accumulators against temperature drop in the passages. Each charging chamber **55** is followed by a respective post-processing chamber **56**. Only a part of the screws **16** is illustrated. The charging chambers **55** are situated at the level of the nozzles **13** for constant heating purposes. Excessive temperatures as well as inadequate temperatures may result in unfavourable gas conversion. In this case, a temperature regulator may act on the air suction valves as shown in FIG. **7**, either by throttling or by switching off some of the valves. A gas inlet **57***a* is situated at the beginning of the passages **10** and a gas outlet **57***b* is situated at the end of the passages. The diameter of the passages diminishes from the left towards the right. The diameter amounts to **16** cms e.g. for the first three passages, and to **15, 14, 13,** 12, 11 and **10** cms for the three passages which follow on next in each case.

As shown in FIG. **3**, the gas generator comprises the following parts, (listed from the inside to the outside): The pipe **37**, the pipe insert **46**, the extension **38**, the protective casing **12** and the suction stub **21**, the protective case **19**, the chute plate **27**, the ring **33**, the cage rim **58** which forms the charging space **32** together with the housing **59**, the outer side **60** of the passages and a heat-protection device **61**.

The air feed nozzle, one of which is shown actual size in FIG. **5**, each comprise the nozzle tube **13** with a threaded reinforcement, the nozzle head **13***a* of material resistant to high temperature, e.g. steatite, the box nut **14** with a sealing washer and the pipe **15** for the nozzle seat, which is welded at both extremities to other parts of the gas generator. To prevent interference, and even at the cost of uneven distribution, the nozzles should be installed on the passage walls.

As shown in FIG. **6**, the nozzles **62** which terminate in the spaces **25** and **53** at one extremity and in a common air feed pipe **63** at the other extremity, are circularly arranged around the housing. The air feed pipe encircles the housing and is radially spaced at a distance **64** from the latter. An air feed pipe **63** is incorporated for the upper nozzles opening into the space **53** as well as for the lower nozzles opening into the space **25**. FIG. **6** also shows cleaning ports **65** with inspection windows which allow of a check on the inside of the nozzles.

As shown in FIG. **7**, the air suction pipe **44** is equipped with a flap closure **44***a* (check valve). Magnetic poles **66** with connecting leads are incorporated to hold the flap closure **44***a* closed. The air suction valve shown in FIG. **8** is appropriate for special cases. The suction pipe **44** is equipped with two screw-threads. One of these has screwed on to it a cap nut with a plastic ball valve **67**. The other thread has screwed on to it a cap nut comprising an inspection window **68**. A separating wire mesh **69** serves to retain the ball valve **67**.

The air suction valve shown in FIG. **7** is the most appropriate. The nozzle combination shown in FIG. **6** may be eschewed if each nozzle is equipped with this valve. A check on incandescence is performed by pushing the flap back with one hand by means of a rod, and by holding a mirror obliquely up to the opening with the other hand. If the inner nozzle extremity is plugged, the slag deposit is pushed through by means of an iron bar. This occurs infrequently however.

In operation of the generator, during downward gasification, the inlet stub **45** is closed by means of the flap **49***a* and the air suction pipe **44** is opened by means of the flap closure **44***a*. The cover **47** is pushed aside to clear the airpath. Air flows through the air suction pipe **44**, the pipe **37** and the aperture **11** into the space **53**. Air also flows into the space **53** through the upper nozzles **62**. The gas being produced in the space **53** passes into the space **25**. Air may also be fed into the space **25** through the lower nozzles **62**. The gas passes from the space **25**, through the point of entry **20** and into the space below the chute plate **27**. From the latter, the gas flows through the passage **34** into the passages **10**.

In operation of the generator, during upward gasification, the discharge stub **45** is open and the air suction pipe **44** is closed. Air enters only through the upper nozzles and lower nozzles **62**. The cover **47** is closed. The gas present in the space **53** flows through the apertures **11**, the main pipe **37** and the discharge stub **45** into the cinder repository chamber **35**, and from the latter into the passage **34**. The gas present in the space **25** is partially impelled into the space **53** and the rest passes through the point of entry **20** into the space below the chute plate **27** and from the latter into the passage **34**.

As a modification of the design of the passages **10** shown in FIG. **2**, the charging chambers **55** which form a stabilising space may also be so devised that a serpentine horizontal passage is incorporated between each two adjacent post-processing chambers **56**. The gas then flows through a post-processing chamber in the vertical direction and from the latter passes into one of the serpentine horizontal passages, through which it flows, to return to a post-processing chamber again. In the case of downward gasification, it is essential that a heating action on the gas should occur in the area of the incandescent section and of the cinder bath space.

I claim:

1. A gas generator for both upward and downward gasification, comprising: a housing defining a combustion space, a cinder bath space below the combustion space, and a zone formed by a space in the housing below the cinder bath space, the space below the cinder bath space being arranged in communication with the combustion space; nozzles arranged for feeding air into the combustion space and the cinder bath space; a vertical main pipe in communication with the combustion space, the main pipe having an air inlet and a gas outlet above the air inlet, the gas outlet, when open, opening into the space below the cinder bath space; means for opening and closing the air inlet; means for opening and closing the gas outlet, and means defining a serpentine passageway arranged around the housing and in communication with the space below the cinder bath space; the above gas generator permitting downward and upward gasification, the gas outlet being closed and the air inlet open during downward gasification to allow air to be drawn by suction through the air inlet and up the main pipe into the combustion space and gas generated in the combustion space flowing into the space below the cinder bath space and thence through the serpentine passageway, and the gas outlet being open and the air inlet closed during upward gasification and air introduced into the combustion space and the cinder bath space, gas generated in the com-

bustion space flowing down the main pipe and through the gas outlet into the space below the cinder bath space and thence through the serpentine passageway.

2. A gas generator as claimed in claim 1, wherein means for rotating the vertical pipe is provided and the means for opening and closing the air inlet comprises a closure member carried by the lower end of the main pipe, which closure member cooperates with a stationary closure member, so that in one angular position of the main pipe the air inlet is open and in another angular position of the main pipe the air inlet is closed.

3. A gas generator as claimed in claim 1, wherein the means for opening and closing the air inlet is operatively connected to the means for opening and closing the gas outlet so that when the gas outlet is open the air inlet is closed and when the gas inlet is closed the air inlet is open.

4. A gas generator as claimed in claim 1, wherein the means for opening and closing the air inlet comprises a half-cover and an electromagnetically controlled flap.

5. A gas generator as claimed in claim 1, wherein some of the nozzles open into the combustion space above and adjacent a fuel-supporting platform and the other nozzles open into the cinder bath space below the platform.

6. A gas generator as claimed in claim 1, wherein the nozzles pass through gas passages constituting said serpentine passageway.

7. A gas generator as claimed in claim 1, wherein pivotable members are mounted on a fuel supporting platform forming the bottom of the combustion space and rigidly connected to the main pipe, the main pipe being rotatable.

8. A gas generator as claimed in claim 1, wherein the gas passageway is constituted by the serpentine passages some of which extend upwardly from a region surrounding the lower portion of the combustion space and the upper portion of the cinder bath space and some of which project downwardly from that region, the passages projecting upwardly having a different vertical extent to those projecting downwardly.

* * * * *