

[19]	INTELLECTUAL PROPERTY PHILIPPINES		
[12]	INVENTION PUBLICATION		
[11]	Publication Number:	12017000201	Document Code: A1
[22]	Publication Date:	11/2/2019	
[21]	Application Number:	12017000201	Document Code: A
[22]	Date Filed:	11/7/2017	
[54]	Title:	MULTI-STAGE WASTE REMEDIATION SYSTEM	
[71]	Applicant(s):	DURAGO GLENN DURAGO CHARLES	
[72]	Inventor(s):	DURAGO GLENN DURAGO CHARLES	
[30]	Priority Data:	11/7/2017 PH2001120170002	
[51]	International Class 8:	F23G 5/02 20060101AFI20190220BHPH; F23G 5/027 20060101ALI20190220BHPH; F23G 5/04 20060101ALI20190220BHPH; F23G 5/08 20060101ALI20190220BHPH; F23G 5/14 20060101ALI20190220BHPH; F23G 5/16 20060101ALI20190220BHPH;	
[57]	Abstract:	The present invention relates to waste remediation processes, in particular to a self-sustained multi-stage thermal decomposition process system for waste remediation, comprising heating the waste in a first chamber to remove moisture, collecting the moisture in a first tank, transferring the moisture from the moisture tank to a waste water filtration system, delivering the heated moisture-free waste from the first chamber to a second chamber, heating the moisture-free waste in the second chamber to produce syngas, transferring the syngas to a second tank, delivering the remaining waste from the second chamber to a third chamber, and heating the remaining waste in the third chamber to produce syngas and char. The system harnesses useable producer gas and converts organic and inorganic waste into bio-char.	

where the moisture removal takes place. The burners (56) heat the first chamber (17) with temperatures between 175 – 300 °C. As the waste continuous to travel, it reaches the inter-connection drop pipe (18) where the waste goes to the second chamber (19) where the “cracking” of the waste takes place. The waste is introduced to a much higher
5 temperature, between 300 – 650 °C, to crack and harness the syngas. As the waste continuous to travel to the end of the second chamber (19) to the drop pipe (20), it transitions to the “charring stage” and the final harnessing of any residual syngas. In this stage, the waste is subjected to extremely high temperature (650 – 1200°C). The charred waste goes out of the third chamber (21) through transfer auger (23) to the sealed
10 biochar collector bin (25) where it is to be cooled down before use.

Although particular embodiments of the present invention have been illustrated and described, it will be apparent to those skilled in the art that various changes and modifications can be made without departing from the spirit of the present invention. It
15 is therefore intended to encompass within the appended claims all such changes and modifications that fall within the scope of the present invention.

MULTI-STAGE WASTE REMEDIATION SYSTEM

17 OCT -4 P3/18

TECHNICAL FIELD

5 The present invention relates to waste remediation processes, in particular to a self-sustained multi-stage thermal decomposition process system for waste remediation. The system harnesses useable producer gas (syngas) from solid wastes and converts organic and inorganic waste into bio-char.

10 BACKGROUND OF THE INVENTION

Solid wastes are usually disposed by burying them into landfills, burning in incinerators or through recycling. In highly urbanized areas, the biggest challenge is to come up with an effective and environment friendly solid waste and pollution control strategies. One
15 such strategy is pyrolysis, or the decomposition of waste through high temperatures. The current pyrolysis technology only offers two stages in their processes. To achieve an almost 100% waste free solution to the waste problem, the present invention offers a multi-stage thermal decomposition processes embedded within the system; a built-in wastewater treatment; plus, the ability to produce oxyhydrogen through HHO generator
20 system, which makes the present invention a viable, efficient, and effective solution to the waste problem.

The present invention is to be used in remediating waste problems. The reclamation of contaminated landfills back into useful land that is free of harmful contaminants, the
25 eradication of derived diseases from landfill leachates and the creation of energy and bio-char from waste are some of the advantages of this invention.

The difference of the present invention from the existing technologies are the embedded multi-stage thermal decomposition process which could set multiple temperature ranges
30 at different stages of the process simultaneously; and the inclusion of a moisture removal stage and the water treatment stage together with the oxyhydrogen production

capability, which optimizes the effectiveness and efficiency of the system in remediating almost the entire waste problem.

The present invention overcomes the environmental and health issues directly and indirectly derived from the landfills and its surrounding.

SUMMARY OF THE INVENTION

The present invention is a waste remediation system comprising heating the waste in a first chamber to remove moisture, collecting the moisture in a first tank, transferring the moisture from the moisture tank to a waste water filtration system, delivering the heated moisture-free waste from the first chamber to a second chamber, heating the moisture-free waste in the second chamber to produce syngas, transferring the syngas to a second tank, delivering the remaining waste from the second chamber to a third chamber, and heating the remaining waste in the third chamber to produce syngas and char.

The pyrolyzed organic and inorganic wastes are heated at temperatures preferably between 175-300°C in the first chamber to yield moisture, continued heating at temperatures preferably between 300-650°C in the second chamber to produce syngas, and further heating at temperatures preferably between 650-1200°C in the third chamber to produce bio-char and the final harnessing of any residual producer gas (syngas).

The waste remediation method may further comprise the step of collecting the syngas produced in the second and third tanks and separating the gas from liquid by reflux to produce fuel.

The method further may comprise the step of producing oxyhydrogen "HHO" from the moisture by electrolysis to augment syngas production. The oxyhydrogen from the moisture is piped for point of use as fuel augmentation for the system and for the electric generator. The syngas is then collected in a reflux tank for its main usage as fuel for the system and in the electric generator as well.

Preferably, the multi-stage waste remediation system of the present invention comprises: a hopper to initially hold the waste; a plurality of chambers for pyrolyzing the waste; a means by which to transport the waste from the hopper to the chambers; a
5 heating element for each chamber to heat the waste transported to the chamber; a first tank to contain gaseous substances released from the heating of waste in the first chamber; and a second tank to contain gaseous substances released from the heating of waste in the second chamber.

10 Furthermore, according to the present invention, the first tank is connected to a wastewater filtration system which is also connected to the oxyhydrogen (HHO) generator system and the second tank is connected to a reflux tank.

These and other underlying purposes and advantages of the present invention will be
15 fully understood upon a perusal of the following detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a process flow diagram of the present invention;
FIGURE 2 is the perspective view of the present invention;
20 FIGURE 3 is a sectional view showing the details of the chamber;
FIGURE 3A is a partial view of the end chamber of FIGURE 3; and
FIGURE 4 is a process flow diagram of the first, second and third chambers.

DETAILED DESCRIPTION OF THE INVENTION

25

The solid wastes are brought to the facility for segregation. In the segregation process, the organic and inorganic wastes are separated from cement, glass, and metals. The separated cement, glass and metals are brought to a recycling plant, while the organic and inorganic materials are shredded before being subjected into the system as waste.

30

In the present invention, the burners in the chambers are pre-heated to the desired temperature prior to the introduction of the waste to the system. Waste is initially contained in the hopper and the transfer auger moves the waste from the hopper to the first chamber after pre-heating. The main motor starts to turn and drive the gears
5 connected to the chamber's augers at a selected speed through a chain drive.

The auger inside the first chamber turns to push the waste along the walls of the heated chamber (175 – 300 °C) where the moisture removal stage takes place. The removed moisture goes to the moisture collection tank then to the built-in wastewater treatment
10 system before disposal for irrigation. A small percentage of the treated wastewater goes to the HHO system for hydrogen production to augment the producer gas (syngas) in powering the system and the generator.

As the waste continuous to travel, it reaches the inter-connection drop pipe where the
15 waste goes to the second chamber where the "cracking" of the waste takes place. The waste is introduced to a much higher temperature (300 – 650 °C) to crack and harness the syngas. The syngas travels through pipes and then contained in the second and third tanks where the gas is separated from the liquid by reflux and produces fuel for the system. The remaining syngas will fuel the electric generator.

20 As the waste continuous to travel to the end of the second chamber to the drop pipe, it transitions to the "charring stage" and the final harnessing of any residual syngas. In this stage, the waste is subjected to extremely high temperature (650 – 1200°C). The charred waste goes out of the third chamber through transfer auger to the sealed biochar
25 collector bin where it is to be cooled down before use.

The present invention will be more particularly described hereunder with reference to FIGURES 1 to 4.

30 FIGURE 1 is a structure diagram and FIGURE 2 is an isometric view of the multi-stage waste remediation system.

As shown in FIGURES 1 and 2, the multi-stage waste treatment system (10) comprises a supply unit hopper (13) and a transfer auger (15) for supplying the waste containing organic substance into the system (10) and thermal decomposition units for pyrolyzing the wastes. The thermal decomposition unit comprises three chambers: first (17), second (19) and third (21), for drying, cracking and charring the wastes respectively.

The first chamber (17) is connected to the supply unit (13) for removing moisture at the initial stage. The second chamber (19), where cracking takes place, is connected to the first chamber (17) and a third chamber (21), where the wastes are further decomposed to become char, is connected to the second chamber (19). The third chamber (21) is then connected to a transfer auger (23), which in turn is connected to a biochar bin (25) for collecting and storing the charred wastes.

A drive motor (51) is used for driving a gear system (53) for transferring the waste from the first chamber (17) to the second chamber (19) and to the third chamber (21) and then the charred wastes from the third chamber (21) to the transfer auger (23) and to the final biochar bin (25).

A control panel (11) connecting to the system is used for controlling the desired temperatures of each chambers. The reflux tank (35) is connected to the burners (56) through a gas pipe assembly (55) where the mixture of HHO and syngas are being used for heating the chambers.

Pipes (26) from the first chamber (17) are connected to a first tank (27) for collecting moisture. The multi-stage waste treatment system (10) has a built-in waste water filtration system (41) and a hydrogen/oxygen (HHO) system containing: an HHO water reservoir (43), an HHO generator (45), an HHO water pump (47) and an HHO cooling system (49), which are initially connected to the first tank (27). The moisture collected from the first tank (27) is treated in the water filtration system (41) before disposal and a portion of the treated wastewater goes to the HHO water reservoir (43) through a pipe (42) for producing hydrogen to supply the producer gas in powering the HHO system and generator.

Pipes (28) from the second chamber (19) and third chamber (21) are connected to the second tank (29) and further connected to the third tank (31) to produce syngas by gasification. Syngas is then collected to the second tank (29) and further condensed to
 5 separate gas from liquid in order to remove impurities. The condensed gas from the second tank (29) are transferred to the third tank (31) through a pipe (30) for further condensing. The pipe (32) on top of the third tank (31) is connected to a reflux pump (33) and into the reflux tank (35) for transferring the purified syngas.

10 A compressor (37) connecting from the reflux tank (35) through a pipe (40) is used for compressing the excess fuel. The compressed fuel is transferred to and stored in a storage tank (39) through a pipe (38) for further use or consumption.

A small amount of the oxyhydrogen produced from the HHO system is also transferred
 15 to the valves (36) through a pipe (34). The purified syngas from the storage tank (39) and oxyhydrogen from the HHO system are combined through proper mixing ratio. The mixture is used as fuel to run the electric generator (not shown) and as fuel for the burners (56) to run the entire multi-stage waste treatment system (10).

20 FIGURE 3 is a sectional view showing the structure of the chamber. An enlarged detail of the end portion of the said chamber is shown in FIGURE 3A. Inside the chamber housing (59) is a series of metal plates/auger (61) connected to the shaft (62) for pushing the waste along the walls of the chamber. A shaft sleeve (63) is connected to the chamber housing (59) to hold the auger (61) in place. A spur gear (65) is connected at the end of
 25 the shaft sleeve (63) as a locking mechanism. At the opposite side of the chamber housing (59) is a shaft sleeve (63) where the gear mechanism is located. As shown in Figure 3A, the gear mechanism contains a shaft seal (67) and a shaft bearing (69). The end of the shaft contains a bolt (73) and a pin (75) which are connected to the gear hub (71) to prevent lateral movement.

30

Flow details of this process is also shown in FIGURE 4, wherein the auger (77) inside the first chamber (17) turns to push the waste along the walls of the heated chamber (17)

CLAIMS

What is claimed is:

- 17 OCT -4 PM:18
- 10/06/2017 12:10 00009
- 5 1. A method for treating waste comprising:
 - heating the waste in a first chamber to remove moisture;
 - collecting the moisture in a first tank;
 - transferring the moisture from the moisture tank to a waste water
10 filtration system;
 - delivering the heated moisture-free waste from the first chamber to a
second chamber;
 - heating the moisture-free waste in the second chamber to produce
syngas;
 - transferring the syngas to a second tank;
 - delivering the remaining waste from the second chamber to a third
15 chamber; and
 - heating the remaining waste in the third chamber to produce syngas and
char.
 - 20 2. The method according to claim 1, further comprising the step of collecting the
syngas produced in the second and third tanks and separating the gas from liquid
by reflux to produce fuel.
 - 25 3. The method according to claim 1 wherein the heating temperature in the first
chamber is between 175-300°C.
 4. The method according to claim 1 wherein the heating temperature in the second
chamber is between 300-650°C.
 - 30 5. The method according to claim 1 wherein the heating temperature in the third
chamber is between 650-1200°C.

6. The method according to claim 1, further comprising the step of producing oxyhydrogen "HHO" from the moisture by electrolysis to augment syngas production.
- 5 7. The method according to claim 6 wherein the oxyhydrogen and syngas are contained in a reflux tank for use as fuel
8. A multi-stage waste treatment system comprising:
- a hopper to initially hold the waste;
 - 10 - a first chamber;
 - a second chamber;
 - a third chamber;
 - means by which to transport the waste from the hopper to the chambers;
 - a heating element for each chamber to heat the waste transported to the chamber;
 - 15 - a first tank to contain gaseous substances released from the heating of waste in the first chamber; and
 - a second tank to contain gaseous substances released from the heating of waste in the second chamber.
- 20 9. The waste treatment system of claim 8, wherein the first tank is connected to a wastewater filtration system.
10. The waste treatment system of claim 8, wherein the second tank is connected to
- 25 a reflux tank.
11. The waste treatment of claim 10, wherein an oxyhydrogen (HHO) generator system is piped for point of use as fuel augmentation for the system

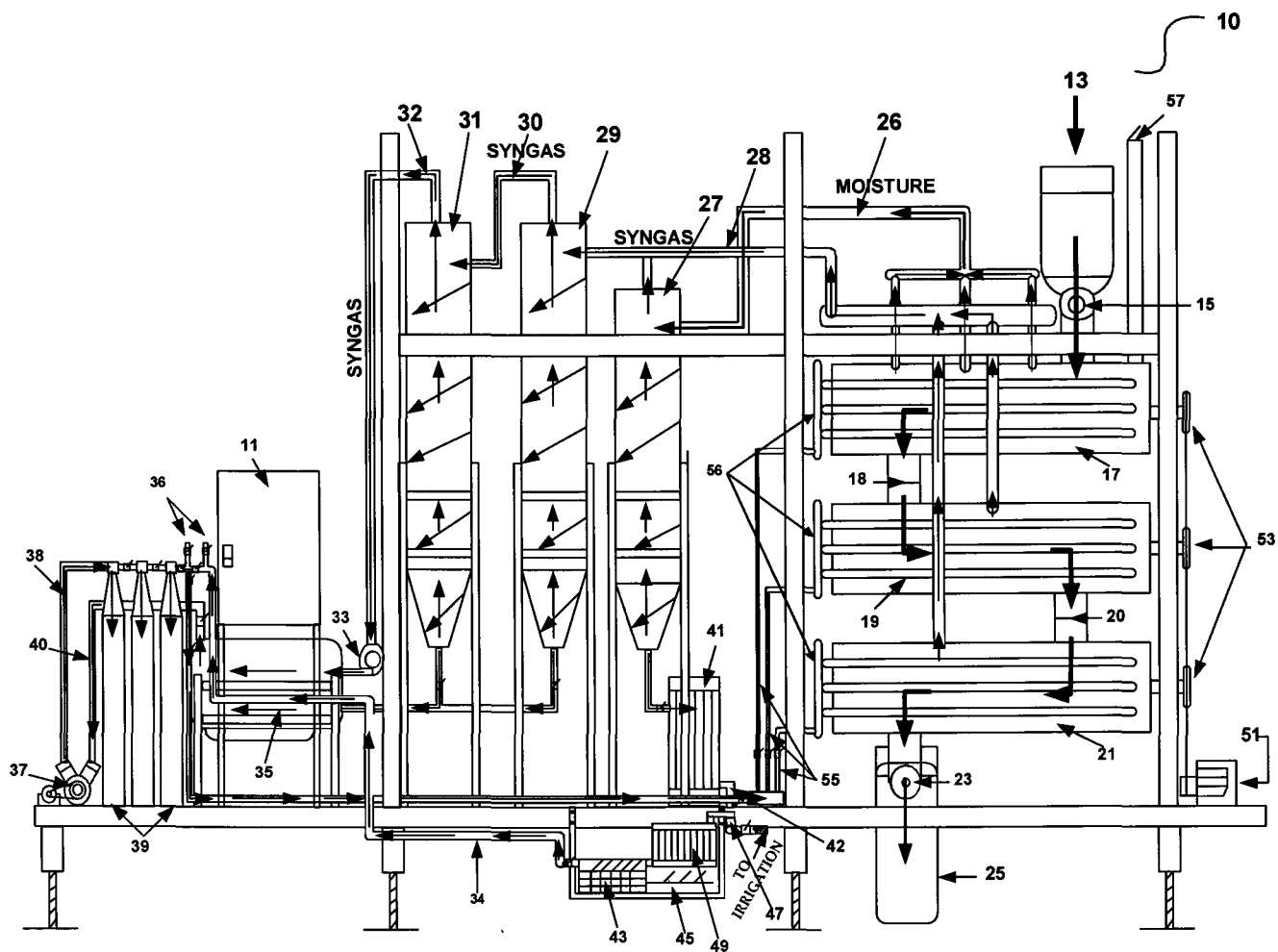


FIGURE 1

GLENN DURAGO & CHARLES DURAGO
Applicants

[Signature]
Edmund Jason Baranda
Representative of the Applicant

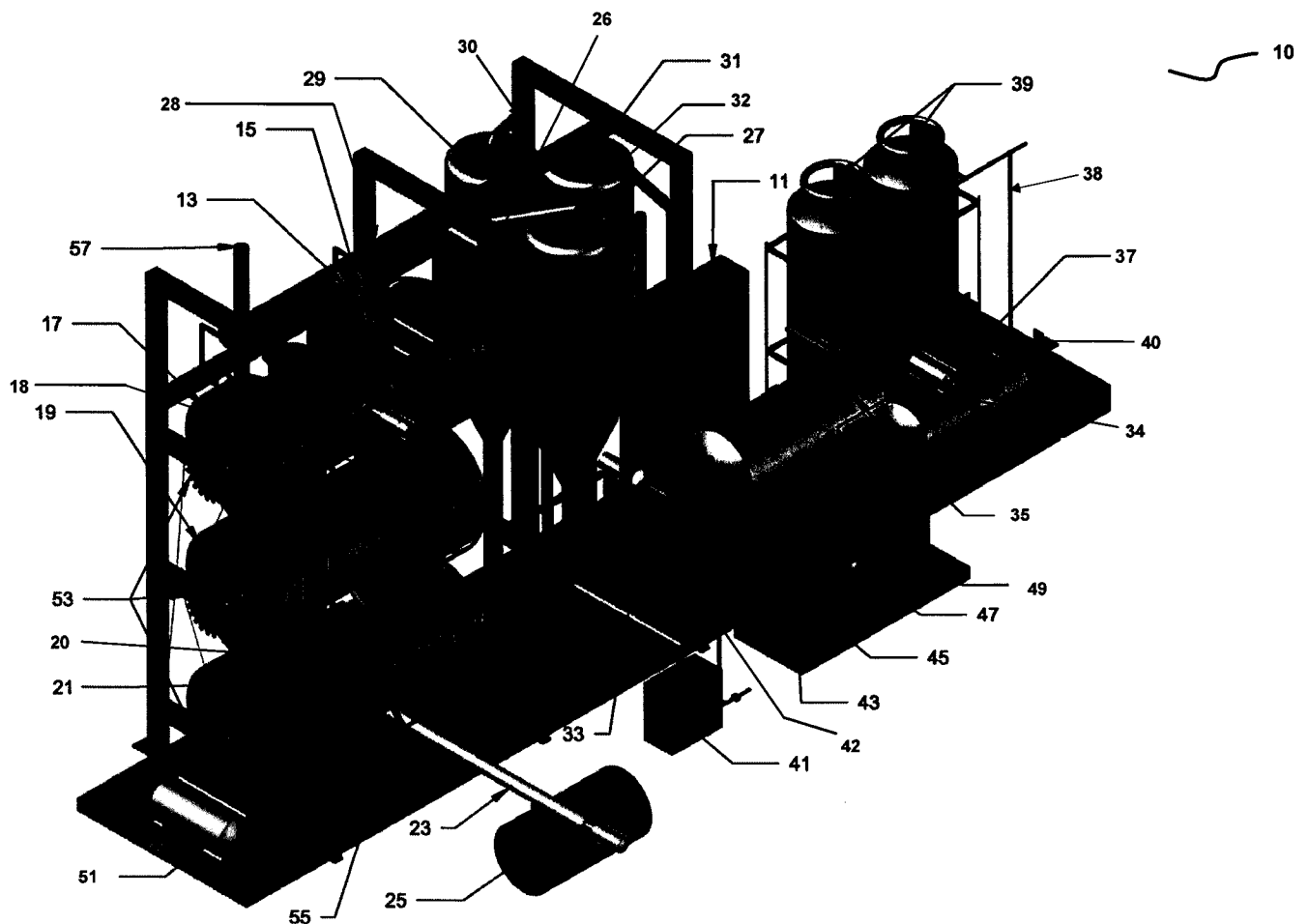


FIGURE 2

GLENN DURAGO & CHARLES DURAGO
Applicants

[Signature]
Edmund Jason Baranda
Representative of the Applicant

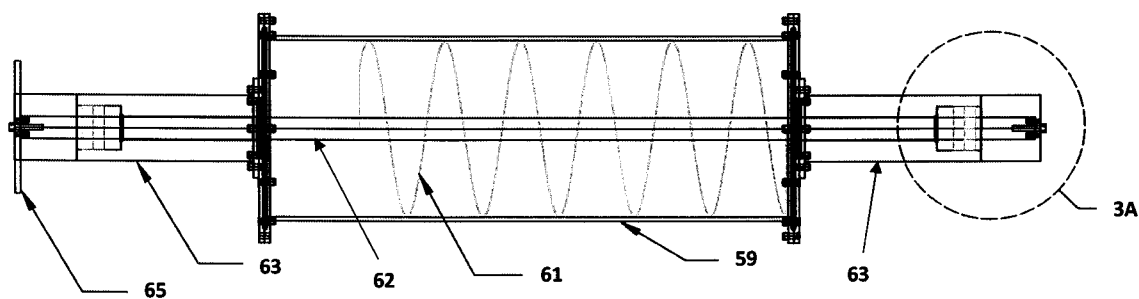


FIGURE 3

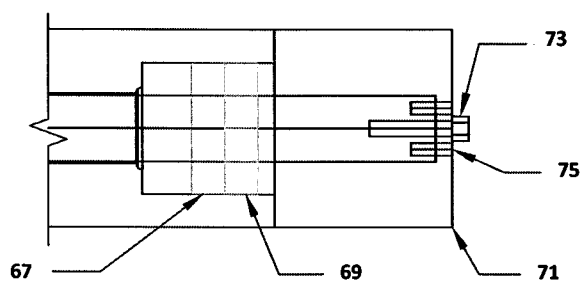
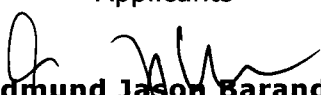


FIGURE 3A

GLENN DURAGO & CHARLES DURAGO
Applicants


Edmund Jason Baranda
Representative of the Applicant

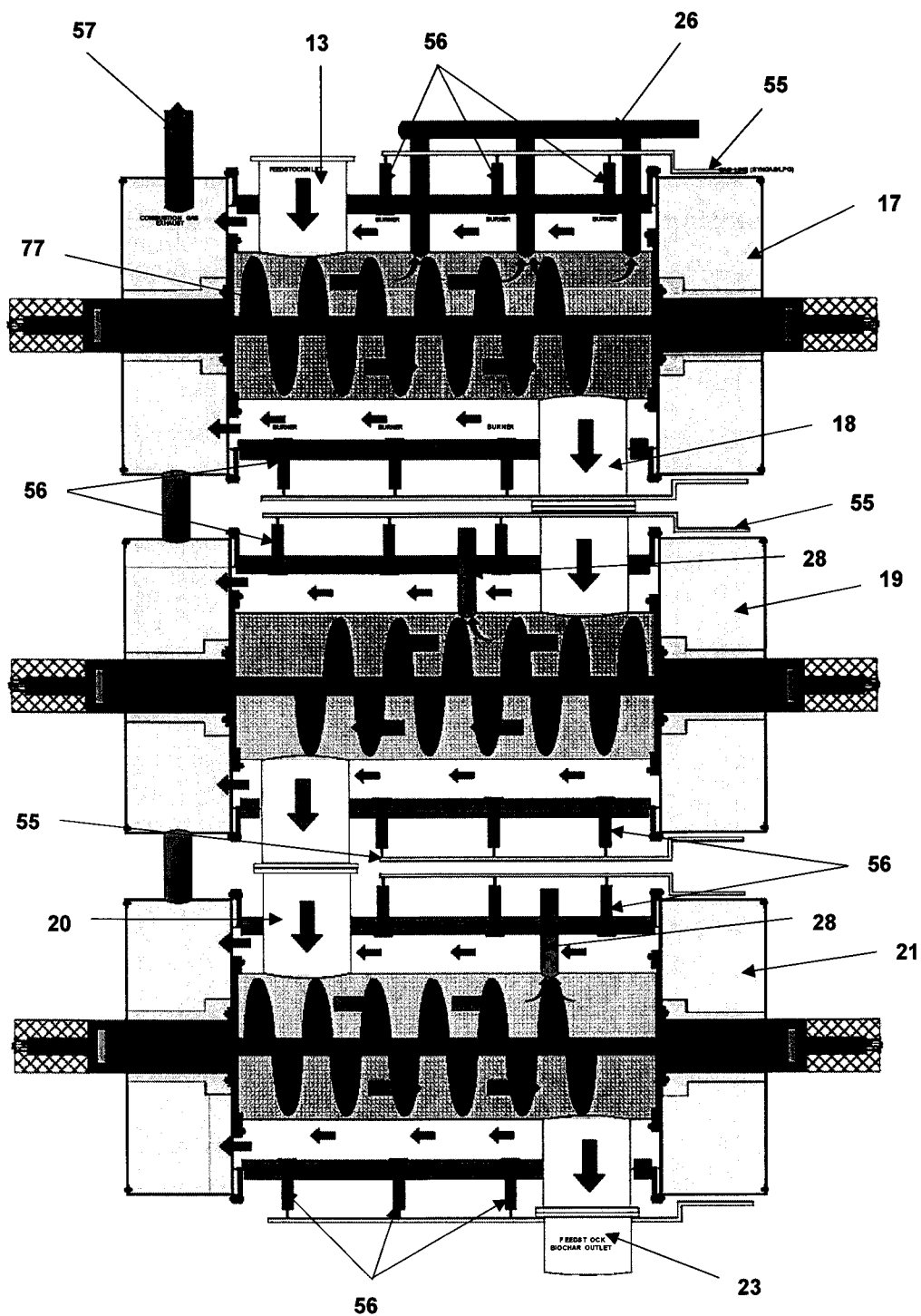


FIGURE 4

GLENN DURAGO & CHARLES DURAGO
Applicants

Edmund Jason Baranda
Edmund Jason Baranda
Representative of the Applicant