A system for incinerating waste using Magnegas either in the primary burn process to achieve higher waste burning temperatures, in a secondary after-burn process to reduce pollutants, or in both the primary burn process and after-burn process. The use of Magnegas results in increased efficiency, reduced emissions, and additional heat. Heat produced is optionally used to generate electricity. In some embodiments, Magnegas is combined with another fuel such as oil or natural gas for desired burn characteristics or for economic reasons.

Publication Classification

Int. Cl.
F23G 5/12 (2006.01)
F23G 5/14 (2006.01)

U.S. Cl.
CPC ... F23G 5/12 (2013.01); F23G 5/14 (2013.01)

ABSTRACT

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INCINERATION USING MAGNEGAS

CROSS-REFERENCE TO RELATED APPLICATION

This application claims the benefit of U.S. provisional application no. 61/982,568 filed on Jan. 18, 2008, and European application no. 08150277.5 filed on Apr. 22, 2014, the disclosure of which are incorporated by reference.

FIELD

This invention relates to the field of waste incineration and more particularly to a method, system and apparatus for using a gas here within referred to as Magnegas in the process.

BACKGROUND

Garbage and waste incineration is a widely accepted alternative to landfill for many reasons, including the amount of space taken by a landfill, transportation to the landfill, soil and water table pollution from leaching of toxins into the soil and aquifer beneath the landfill, various aromas, wildlife attracted by a landfill (e.g., rats, birds), release of methane gas, and the overall unsightliness of a landfill. Furthermore, even well lined landfills run the risk of soil and water contamination due to earth shifting or sink holes. An incinerator is a system that burns waste material, typically including organic substances. The incinerator converts the waste material into ash, flue gas and heat and the heat is often used to generate power. Most incinerators require systems to clean the flue gas of the ash and other pollutants.

In the present embodiments, Magnegas is combined with another fuel such as oil or natural gas for the desired burn temperatures, in a secondary after-burn process to reduce pollutants, or in both the primary burn process and after-burn process. In some embodiments, Magnegas is combined with another fuel such as oil or natural gas for the desired burn characteristics or for economic reasons.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention can be best understood by those having ordinary skill in the art by reference to the following detailed description when considered in conjunction with the accompanying drawings in which:

FIG. 1 illustrates a schematic view of an exemplary system for incinerating waste.

DETAILED DESCRIPTION

Reference will now be made in detail to the presently preferred embodiments of the invention, examples of which are illustrated in the accompanying drawings. Throughout the following detailed description, the same reference numerals refer to the same elements in the figure.

Throughout this description, the apparatus is described as a system for incinerating waste, in which the term "waste" is meant to be the most generic interpretation as possible, in which the material being incinerated may include any type of materials often found in municipal waste, including, but not limited to, plastics, cardboard, unused foods, metals, wood, vegetation, baby diapers, etc.

Referring to FIG. 1, an exemplary system for the incineration of a combustible gas, herein called Magnegas, which is used herein in combustion related to incineration. This is but an example of one system for the production of Magnegas, as other such systems are also anticipated. Examples of fully operational systems for the production of Magnegas can be found in U.S. Pat. No. 7,820,924 issued Aug. 24, 2010, U.S. Pat. No. 6,183,604 issued Feb. 6, 2001, U.S. Pat. No. 6,540,966 issued Apr. 1, 2003, U.S. Pat. No. 6,972,118 issued Dec. 6, 2005, U.S. Pat. No. 6,673,522 issued Jan. 6, 2004, U.S. Pat. No. 6,663,752 issued Dec. 16, 2003, U.S. Pat. No. 6,926,872 issued Aug. 9, 2005, and U.S. Pat. No. 6,236,150 issued Aug. 7, 2012, all of which are incorporated by reference. The production of such a gas (e.g. Magnegas) is performed within the plasma 18 of a submerged electric arc.

A feedstock 22 is circulated within a tank 12 and is exposed to the plasma 18 of an electric arc between two electrodes 14/16, causing the feedstock 22 to react and release gas. The arc is powered by a source of electric power 10.

One exemplary feedstock 22 is oil, and more particularly, used vegetable or animal oil such as that from deep-fat fryers, etc. Of course, any oil is anticipated, including unused vegetable oll, oil from animal fat, used hydrocarbon-based oil, unused hydrocarbon-based oil, etc.

Any feedstock 22 is anticipated either in fluid form or fluid mixed with solids, preferably fine-grain solids such as carbon dust, etc.

In one example, the feedstock 22 is vegetable oil and the electrodes 14/16 are carbon, the oil molecules separate within the plasma 18 of the electric arc into a gas 24 referred to here-within as Magnegas 24, typically including hydrogen (H₂) and carbon monoxide (CO) atoms, which separated from the feedstock 22 for collection (e.g. extracted through a collection pipe 26. This gas 24 (e.g. Magnegas) is similar to synthetic natural gas or syngas, but the gas produced though this process behaves differently and produces a higher burn temperature. In embodiments in which at least one of the
electrodes 14/16 that form the arc 18 is made from carbon, the electrode(s) 14/16 and serves as a source of charged carbon particles (e.g., carbon nanoparticles) that become suspended within the gas 24 and are collected along with the gas 24, thereby changing the burning properties of the resulting gas 24.

[0018] In examples in which the feedstock 22 is a petroleum-based liquid, the exposure of this petroleum-based feedstock 22 to the arc (as above) results in a gas that includes polycyclic aromatic hydrocarbons which, in some embodiments, are quasi-nanoparticles that are not stable and, therefore, some of the polycyclic aromatic hydrocarbons will form/join to become nanoparticles or a liquid. Therefore, some polycyclic aromatic hydrocarbons as well as some carbon particles/nanoparticles are present in the resulting gas 24. In some embodiments, some of the carbon particles or nanoparticles are trapped or enclosed in poly cyclic bonds. Analysis of the produced gas 24 typically includes polycyclic aromatic hydrocarbons that range from C6 to C14. The presence of polycyclic aromatic hydrocarbons as well as carbon particles or nanoparticles contributes to the unique burn properties of the resulting gas 24. This leads to higher burning temperatures.

[0019] In another example, when the feedstock 22 is petroleum based (e.g., used motor oil) and at least one of the electrodes 14/16 are carbon, the petroleum molecules separate within the plasma of the electric arc 18 into a gas 24 that includes hydrogen (H2) and aromatic hydrocarbons, which percolate to the surface of the petroleum liquid 22 for collection (e.g., extracted through a collection pipe 26. In some embodiments, the gas 24 (Magnegas) produced through this process includes suspended carbon particles since at least one of the electrodes of the arc 18 is made from carbon and serves as the source for the charged carbon particles or nanoparticles that travel with the manufactured hydrogen and aromatic hydrocarbon gas 24 and are collected along with, for example, the hydrogen and aromatic hydrocarbon molecules, thereby changing the burning properties of the resulting gas 24, leading to a hotter flame. In this example, if the feedstock 22 is oil (e.g., used oil) and the fluid/gas 24 collected includes any or all of the following: hydrogen, ethylene, ethane, methane, acetylene, and other combustible gases to a lesser extent, plus suspended charged carbon particles or nanoparticles that travel with these gases.

[0020] The resulting gas is fed into either one or both burning operations as shown in FIG. 1. The gas 24 produced by the above operation, referred to as Magnegas 24, is introduced to the incineration process at any or all of three steps.

[0021] In the exemplary incineration system shown in FIG. 1, waste 132 is staged before entry into the system in, for example, a hopper 130. Some amount of the waste 132 is fed into a primary incinerator or kiln 140 through a feed mechanism 134, for example, through a feed screw 134. Within the kiln 140, a high temperature is generated in order to decompose and decontaminate the waste 132. In some embodiments, the high temperature is generated by burning of the waste 132 by injecting air from an air injection system 92. In some embodiments, the combustion is generated through burning of combination of the gas 24 and a fuel 90 such as oil or natural gas. Such combustion produces relatively high temperatures, but for some waste 132, higher temperatures are needed than those achieved using fuel oil or natural gas alone. For such, the introduction of the Magnegas 24 into the primary incineration chamber 140 through a feed line 100, either separate, or in conjunction with another fuel such as oil or natural gas, produces a significantly higher temperature, providing better decontamination of such waste 132, in particular, improved breakdown of pollutants such as dioxins. Either Magnegas 24 alone or a combination of Magnegas 24 and other fuels 90 (or ohmic heating) produces the high temperatures needed to decontaminate the waste 132. In some embodiments, an agitator 142 agitates or rotates the kiln 140 to expose more of the waste 132 to the high temperatures and effectively/throughly decontaminate all of the waste 132 within the kiln.

[0022] For brevity purposes, the exit for solids from the waste 132 is not shown, but it is anticipated that a dumping action or another screw device will remove residual solids (not shown) from the kiln 140, which, is later sorted and mined for metals, etc.

[0023] In some embodiments, exhaust gases from the kiln are directed into a secondary burn chamber 150 through an exhaust mechanism 145. In some embodiments, the exhaust mechanism 145 is a simple length of insulated or uninsulated pipe, transferring exhaust gases into the secondary burn chamber. In some embodiments, the exhaust mechanism 145 treats or or scrub the exhaust gases by, for example, cooling the exhaust gases or filtering the exhaust gases.

[0024] In some embodiments, the exhaust gases are optionally cooled by a chiller 143 and then mixed with the gas 24 (Magnegas) from a gas 24 feed line 182 before entering the secondary burn chamber 150 where the exhaust gases and the Magnegas 24 are combusted.

[0025] In some embodiments, the exhaust gases are mixed with Magnegas 24 from another gas feed line 184 within the secondary burn chamber 150. A secondary burn takes place in the secondary chamber 150. The secondary burn further combusts and cleans the exhaust gases to reduce pollutants, in particular, reducing dioxin by breaking down the molecular bonds of dioxin. By using Magnegas 24 in the secondary burn process, the resulting exhaust which travels out of the system through an exhaust device/chimney 152 is cleaner than if the exhausts from the initial burn we allowed into the atmosphere.

[0026] Note that, since the burning of the waste 132, along with other fuels (e.g., oil, gas, and/or Magnegas 24) generates significant heat 141/151. It is fully anticipated that, in some embodiments, the excess heat is used to generate power 192 (e.g., electrical power 192) using, for example, a steam turbine 190 or fuel cell 190.

[0027] In summary, the gas 24 produced within the arc 18 is used in any or all of the following incineration steps: the gas 24 is used in the primary burning chamber 140 to increase the temperature at which the waste 132 is burned; the gas 24 is mixed with flute gases from the primary incineration and, the mixed flute gases and Magnegas 24 is burned; and the gas 24 is used in the secondary burning chamber 50 to completely burn all exhaust fumes from the primary burning process. In all cases, it is anticipated that Magnegas is either used as a sole fuel to facilitate combustion, or Magnegas is used in conjunction with another fuel including, but not limited to, oil, propane, natural gas, synthetic natural gas, diesel, gasoline, etc., depending upon temperatures required and economic factors.

[0028] In some embodiments, the primary burn process in the primary burn chamber 140, after initiation, continues through combustion of the materials being incinerated in the primary burn chamber 140, without further injection of other
fuels. In such, in some embodiments, the gas 24 is mixed with these flue gases from the primary incineration and, the mixed flue gases and Magnegas 24 is burned; and/or the gas 24 is injected into the secondary burning chamber 50 to completely burn all exhaust fumes from the primary burning process.

[0029] Equivalent elements can be substituted for the ones set forth above such that they perform in substantially the same manner in substantially the same way for achieving substantially the same result.

[0030] It is believed that the system and method as described and many of its attendant advantages will be understood by the foregoing description. It is also believed that it will be apparent that various changes may be made in the form, construction and arrangement of the components thereof without departing from the scope and spirit of the invention or without sacrificing all of its material advantages. The form herein described being merely exemplary and explanatory embodiment thereof. It is the intention of the following claims to encompass and include such changes.

What is claimed is:
1. A system for incinerating waste, the system comprising:
   a primary combustion chamber;
   means for feeding an amount of waste into the primary combustion chamber;
   means for burning the waste within the primary combustion chamber fueled by a fluid comprising a gas that was produced by exposing a feedstock to an electric arc; and
   an exhaust interfaced to the primary combustion chamber.
   the exhaust extracting fumes from the primary combustion chamber.

2. The system for incinerating waste of claim 1, wherein the fluid further comprises a material selected from the group consisting of natural gas, propane, acetylene, oil and syngas.

3. The system for incinerating waste of claim 1, wherein the primary combustion chamber is agitated to expose the waste to the means for burning.

4. The system for incinerating waste of claim 1, wherein air is injected into the primary combustion chamber to improve combustion and increase flue temperatures.

5. The system for incinerating waste of claim 1, further comprising a secondary combustion chamber interfaced to the exhaust, whereby a second fluid comprising the gas is combined with the fumes from the primary combustion chamber and burned, reducing pollutants before the exhaust is released to the atmosphere.

6. The system for incinerating waste of claim 1, wherein the fluid comprises Magnegas.

7. The system for incinerating waste of claim 5, further comprising a generator coupled to the primary combustion chamber and/or coupled to the secondary combustion chamber, the generator using heat from the primary combustion chamber and/or coupled to the secondary combustion chamber to produce usable power.

8. The system for incinerating waste of claim 7, wherein the usable power is electricity.

9. A system for incinerating waste, the system comprising:
   a primary combustion chamber having means for feeding an amount of waste into the primary combustion chamber, and
   having an exhaust for venting exhaust gases;
   a burner within the primary combustion chamber, the burner fueled by a fluid comprising a gas that was produced by exposing a feedstock to an electric arc;
   a secondary combustion chamber; the exhaust of the primary combustion chamber fluidly interfaced to the secondary combustion chamber, thereby transferring exhaust gases from the primary combustion chamber to the secondary combustion chamber; and
   whereas, the gas is combined with the exhaust gases from the primary combustion chamber and the combination of the gas and the exhaust gases are burned in the secondary combustion chamber before being released from the secondary combustion chamber.

10. The system for incinerating waste of claim 9, wherein the fluid further comprises a material selected from the group consisting of natural gas, propane, acetylene, oil and syngas.

11. The system for incinerating waste of claim 9, wherein the feedstock comprises a material selected from the group consisting of oil, unused vegetable oil, oil from animal fat, used hydrocarbon-based oil, and unused hydrocarbon-based oil.

12. The system for incinerating waste of claim 9, wherein the primary combustion chamber is agitated to expose the waste to the means for burning.

13. The system for incinerating waste of claim 9, wherein air is injected into the primary combustion chamber to improve combustion and increase flue temperatures.

14. The system for incinerating waste of claim 9, wherein the gas is combined with the exhaust gases from the primary combustion chamber before the exhaust gases enters the secondary combustion chamber.

15. The system for incinerating waste of claim 9, wherein the gas is combined with the exhaust gases from the primary combustion chamber within the secondary combustion chamber.

16. A method for incinerating waste, the method comprising:
   producing a gas by exposing a feedstock to an electric arc;
   feeding waste into a primary combustion chamber;
   burning the waste within the primary combustion chamber using a fluid comprising the gas; and
   transferring exhaust gases produced by the burning out of the primary combustion chamber.

17. The method for incinerating waste of claim 16, further comprising:
   mixing the exhaust cases from the primary combustion with the gas into a mixed gas;
   combusting the mixed gas within a secondary combustion chamber; and
   releasing an exhaust from the secondary combustion chamber.

18. The method for incinerating waste of claim 16, wherein the fluid further comprises a material selected from the group consisting of natural gas, propane, acetylene, oil and syngas.

19. The method for incinerating waste of claim 16, wherein the feedstock comprises a material selected from the group consisting of oil, unused vegetable oil, oil from animal fat, used hydrocarbon-based oil, and unused hydrocarbon-based oil.

20. The method for incinerating waste of claim 16, further comprising generating of power from heat produced by the step of burning and/or the step of combusting.

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