System Using Substitute Fuel on Dry Distilled Gas of Wastes

The present invention relates to a combustion and incineration system in which dry distilled gas generated by continuously dry distilling wastes is used as a substitute fuel in varieties of combusting and incinerating facilities requiring a heat source, more particularly, to a combustion and incineration system comprising a dry distilled gas generator producing dry distilled gas, a dry distilled gas transferring and combusting equipment directly transferring dry distilled gas generated in the dry distilled gas generator to a combusting and incinerating facility through a transferring pipe and controlling supplying amount of dry distilled gas, a combusting and incinerating facility with the dry distilled gas transferring and combusting equipment attached in which a heat source is provided by using dry distilled gas as substitute fuel (supplementary fuel), and an automatic controller stably maintaining dry distillation velocity and pressure in a dry distilled gas generator by appropriately operating a dry distilled air supply control valve, a dry distilled gas control valve, etc. Linked with the combusted air amount variation, i.e., pressure through a gas-air mixing ejector of the transferring and combusting equipment so that recycling effects of usable wastes can be expected to be increased, and fuel cost reduction effects due to the radically reduced consumption of a supplementary fuel of an incinerator and industrial combustion facility as well as low generation effects of harmful gases such as dioxin, etc. due to the realization of low cost and high temperature combustion can be obtained using dry distilled gas as a substitute fuel (supplementary fuel).
SYSTEM USING SUBSTITUTE FUEL OF DRY DISTILLED GAS OF WASTES

BACKGROUND OF THE INVENTION

(a) Field of the Invention

The present invention relates to a combust ing and incinerating system using substitute energies of dry distilled gases of wastes, and more particularly to a combust ing and incinerating system in which dry distilled gases generated by dry distilling high quality wastes are transferred and supplied to an incinerating facility or an industrial facility which is located within a certain distance, to be used as a substitute energy source.

(b) Description of the Related Art

Existing dry distilling incinerator generally consists of a first dry distiller and a second combustor, wherein the dry distiller has an injecting door installed on a top or side area for inputting wastes, an ash outlet installed on the side or bottom area for discharging ashes, the interior wall surface structures being formed using refractory materials, etc., and a plurality of injection ports for supplying dry distilled air to be consumed in the dry distillation reaction of the input wastes are constructed on the lower wall surface. Furthermore, an outlet through which generated dry distilled gases are injected into the adjacent secondary combustor is installed in the first dry distiller.

Existing dry distilling incinerator has problems in that it is very expensive to provide the required land, and there are operating and maintenance management difficulties, for example continuous dry distilled gas production is impossible since wastes cannot be continuously input and ashes cannot be continuously discharged. This means that the existing equipment can only be operated in a batch-type method in which ashes are discharged through an ash discharge outlet when the dry distillation and incineration reaction is completed, and then a new batch of waste is input.
Two or more sets of dry distiller should be alternatively operated for the consistent production of fuel, since normal operating time is only a few hours due to the long non-operating time required for ignition and extinction during batch-type operation. In addition, fuel value is reduced due to high ignition loss and low quality of dry distilled gases, and explosion risks are high due to a wide range of changes in the production ratios of H, CO, and CH gases, and internal pressure rises of the dry distiller due to conduit hindrances of gases, etc.

Furthermore, the existing dry distilling incinerator has problems of both greatly reduced gas dry distilling efficiencies and increased maintenance and repair costs since the dry distilled air inlet installed in the lower part of the first dry distiller is installed in such a way that it faces the upper part of the dry distiller, and dry distilled air is injected in a vertical direction causing ashes to accumulate on the lower wall surface, thereby blocking dry distilled air injecting holes and resulting in difficulties in supplying uniform air injection, and a non-uniform dry distilling reaction occurs.

This equipment has further problems in that dry distilled gases cannot be supplied to isolated incinerator or combustor located more than a certain distance from the first dry distiller since pipe blocking phenomena by viscous materials such as tar present in dry distilled gases cannot be prevented, therefore the first dry distiller and the second combustor must be directly connected or adjacently located.

The existing dry distilling incinerator has the problems of transferring pipe blockage, ignition and explosion in the operation and maintenance management aspects since a function controlling the dry distilled gas generation and supply amount based on combustion temperature and operational pressure variations in the first dry distiller, the second combustor, and rear preventing facility in the dry distilled gas fluidity is not employed.

**SUMMARY OF THE INVENTION**

It is an object of the present invention, as a combusting and incinerating system which is invented to solve the above problems, to stably
produce and continuously supply dry distilled gases from high quality wastes to a simple incinerating or industrial combusting facility so that the gases can be used as substitute fuels in the incinerating or industrial combusting facility, and to provide a system using substitute fuels of dry distilled gases of wastes comprising: a dry distilled gas generator producing dry distilled gases by continuously dry distilling high quality wastes; a transferring pipe with a control valve controlling the transfer amount of dry distilled gases, which directly transfers dry distilled gases produced in the dry distilled gas generator to an isolated combusting and incinerating facility; dry distilled pressurized gas transferring combustor comprising a gas-air mixing injector which combines gases from the transferring pipe with a combusted air pressure and injects the mixture of gas and combusted air into a combustor; a combusting burner for combusting the injected mixed gases; and a combusting and incinerating facility connected with the dry distilled gas combustor.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete appreciation of the invention, and many of the attendant advantages thereof, will be readily apparent as the same becomes better understood by reference to the following detailed description when considered in conjunction with the accompanying drawings, wherein:

FIG. 1 is a process drawing illustrating a system using substitute fuels of dry distilled gases of wastes according to the present invention;

FIG. 2a is a detail drawing of a continuous injector according to the present invention;

FIG. 2b, 2c, and 2d are drawings illustrating embodiments of a continuous injector according to the present invention;

FIG. 3 is a detail drawing of a nozzle pipe type dry distiller according to the present invention;

FIG. 4 is a detail drawing of a continuous ash discharger according to the present invention; and

FIG. 5 is a detail drawing of dry distilled pressurized gas transferring
combustor according to the present invention.

**DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS**

In the following detailed description, only the preferred embodiments of the invention have been shown and described, simply by way of illustration of the best mode contemplated by the inventor(s) of carrying out the invention. As will be realized, the invention is capable of modification in various obvious respects, all without departing from the invention. Accordingly, the description is to be regarded as illustrative in nature, and not restrictive.

FIG. 1, as a process drawing of a system using substitute fuels of dry distilled gases of wastes for explaining embodiments according to the present invention, illustrates a dry distilled gas generator (100) comprising a continuous injector (110), a nozzle pipe type dry distiller (120), and a continuous ash discharger (130); dry distilled pressurized gas transferring combustor (200) comprising a transferring pipe (210), a dry distilled gas control valve (220), a tar removal trap (230), heat insulating equipment (240), a gas-air mixing injector (250), and a dry distilled gas combusting burner (260); a combusting and incinerating facility (300) using dry distilled gases as substitute fuels through the dry distilled pressurized gas transferring combustor; and an automatic controller controlling a dry distilling rate, dry distilled gas amount, combusted gas amount, etc. linking with a variety of sensors (410) attached to a combustor, piping, dry distilled gas furnace, etc. of the combusting and incinerating facility, the gas-air mixing injector (250) of the pressurized transferring combustor, etc.

The continuous injector (110) which is illustrated in detail in FIG. 2a is constructed in a double gate structure with a first horizontally opened or closed slide-type device (111) and a second vertically opened or closed device (112), wherein when wastes are transferred to an input hopper from a crane, conveyor, etc., wastes are accumulated in the upper second device when the first device is open while wastes are injected into a dry distilled gas generator (100), and the second device opens immediately upon the closure
of the first device.

In this procedure, wastes are continuously injected into a dry distilled gas generator (100) while maintaining the air lock conditions by the function of the double gate structure of the continuous injector (110). The continuous injector (110) can consist of various forms according to qualities of the waste, embodiments of which are illustrated in FIGS. 2b, 2c, and 2d.

The continuous injector of the present invention can continuously inject wastes while preventing air influx into a dry distilled gas generator during the waste injection, and thereby reduce operation inefficiency caused by air influx, explosion, etc.

The nozzle pipe type dry distiller (120) having both an internal pipe (121) and an external pipe (122) is illustrated in detail in FIG. 3, wherein the internal pipe is connected with a dry distilling nozzle (123) so dry distilled air is supplied through the internal pipe, passing a dry distilled air supply control valve (124) and injected into a dry distilled gas generator (100) through the dry distilling nozzle (123). The dry distilling nozzle (123) of the present invention has a characteristic form in which dry distilled air is injected in a vertical direction toward the lower face of the dry distilled gas generator (100), so the air injecting hole blocking phenomena of existing dry distilling incinerator does not occur, so dry distilled air can be injected uniformly and thereby maximizing dry distilled gas generation efficiencies from wastes.

The external pipe (122) is supplied with cooling air or cooling water in order to reduce the reaction heat generated during the dry distilling reaction, so the dry distilling nozzle can be used semi-permanently.

The nozzle pipe type dry distiller (120) is installed at the lower part of the dry distilled gas generator (100), and wastes injected from the continuous injector (110) are stacked on the upper part of the nozzle pipe type dry distiller thereby incurring a thermal decomposition reaction during the ignition, and along with dry distilling air ejected from the dry distilling nozzle, this results in a formation of dry distilled gases.

Because problems of existing dry distilling incinerator such as the injecting hole blocking phenomenon do not occur due to the horizontal
ejection of dry distilled gases in accordance with the characteristics of the dry distilling nozzle, and because a uniform and desired amount of dry distilled air is smoothly injected, and thermally decomposed waste ashes naturally fall into the lower part of the nozzle through gaps between the pipes so continuous ash discharging is easily done, dry distilled gas generating efficiencies can be maximized and thus dry distilled gases having high calorific values can be produced.

Furthermore, specification standardization of dry distilling nozzles and piping can be made such that fabrication, installation, maintenance, and repairing of equipment according to waste quality and required dry distilled gas amount can be promptly and efficiently made.

FIG. 4 illustrates the continuous ash discharger (130) comprising an ash accumulation part (131) which is located in the lower area of the nozzle pipe type dry distiller (120) and in which the resultant ashes pile up after the dry distilling reaction in a nozzle pipe type dry distiller, an ash discharging scraper (132) discharging ashes from the lower part of the ash accumulation part while operated by a driving motor, an ash discharging hole (133), and a chute (134).

The materials remaining after the wastes lose cohesion and become ashes after the dry distilling reaction are automatically crushed at the gap between the pipes formed in a nozzle pipe type dry distiller, they fall to an ash accumulation part located at the bottom, and the accumulated ashes are continuously pushed to the discharging hole by the revolving ash discharging scraper (132), and they are finally discharged to the outside of the dry distilled gas generator through the opening and closing chute located on the discharging pipes connected to the discharging hole.

At this time, external air does not enter the dry distilled gas generator because it is blocked by ashes piled up at the ash accumulation part, the chute, the water vat, etc.

The continuous ash discharger, which existing dry distilling incinerator have not implemented can be made easily and can facilitate the continuous operation of the dry distilled gas generator of the present
invention.

The dry distilled pressurized gas transferring combustor (200), which is connected with the dry distilled gas discharging hole (101) of the dry distilled gas generator, comprising the dry distilled gas transferring pipe (210), the dry distilled gas control valve (220), the tar removal trap (230), the heat insulating equipment (240), the gas-air mixing injector (250), the dry distilled gas combusting burner (260), etc., is illustrated in detail in FIG. 5. Dry distilled gases influxed from the dry distilled gas discharging hole of the dry distilled gas generator are transferred to a combusting and incinerating facility through the transferring pipe for combustion, wherein heat insulating equipment minimizes the amount of tar sticking to the inner surface of the pipe by minimizing the dry distilled gas temperature drop inside the transferring pipe, and liquefied tar inside the transferring pipe is removed by a tar removal trap, thereby preventing the blocking phenomena of the transferring pipe, and the supplying amount of dry distilled gases required in a combusting and incinerating facility can be controlled by a dry distilled air control valve.

Furthermore, dry distilled gases are influxed into the gas-air mixing injector (250) through a transferring pipe and thoroughly mixed with combusted air, wherein the formed high quality dry distilled gases having a uniform concentration are injected into the dry distilled gas combusting burner (260), and injected dry distilled gases directly supply the required heat sources and calorific values into a combusting and incinerating facility by the ignition of the dry distilled gas combusting burner.

The dry distilled pressurized gas transferring combustor (200) of the present invention not only solves the difficulties of existing dry distilling incinerator in the supply of dry distilled gases to a remotely located combusting facility due to the problem of pipe blocking phenomena caused by tar, etc., but it also makes long distance transference and supply of dry distilled gases possible due to the pressurized injection of combusted air by a gas-air mixing injector and the dry distilled gas inducement linked with it. Furthermore, dry distilled gas transferring combustor (200) of the present
invention not only has the merits of easy operation and maintenance management through automatic control of dry distilled gas production, transference and supply, linked with a nozzle pipe type dry distiller and a combusting and incinerating facility located below thereof, but it also solves the problems that existing dry distilling incinerator only indirectly uses waste heat generated by combusting dry distilled gases in the second combustor and they cannot use dry distilled gases by supplying them into other combusting and incinerating facilities, but rather the dry distilled gases must be directly used in a combusting and incinerating facility in order to be used as substitute fuels.

A variety of facilities using heat energy such as incinerating facilities including the generally widely known rotary kilns, fluidized beds, stokers, etc., and industrial combusting facilities including drying furnaces, heating furnaces, melting furnaces, etc. can use the fuel supplied by the combusting and incinerating facility (300). These combusting and incinerating facilities which are applied to the present invention use dry distilled gases as supplementary fuels having high calorific values, so higher combustion temperatures can be maintained thereby greatly reducing the discharge of a variety of harmful gases because of the efficient combustion reaction.

Furthermore, they have the merits of substantially reducing fuel costs, the greatest maintenance and management expense of a combusting and incinerating facility.

The automatic controller is composed of electrical and instrumental components so that the dry distilled air supply control valve (124) and the dry distilled gas control valve (220) are interlocked according to the variation of the amount of combusted air which is supplied through the gas-air mixing injector (250) in order to properly supply the right amount of dry distilled gas required in a combusting and incinerating facility, wherein the dry distilled gas supplying amount is automatically adjusted by automatically operating a control valve of each component according to the combusting temperature when proper combusting temperatures cannot be maintained.

This automatic controller of the present invention can not only
automatically maintain stable operating conditions by promptly reacting to combustion temperature variations according to the quality changes of object materials which are injected into the combusting and incinerating facility, but it also solves operational problems such as ignition, explosion, etc. which existing dry distilling incinerator suffer from, so appropriate dry distilling rate adjustments and a stable dry distilling pressure can be automatically and efficiently maintained resulting in an easy operation of all facilities.

As described above, the present invention increases recycling effects of wastes by producing dry distilled gases for fuels using wastes, that is, by producing large amounts of high quality dry distilled gases with only small scale facilities through the continuous operation of a dry distilled gas generator, and it can substantially reduce fuel costs by transferring and supplying the produced dry distilled gases to an incinerating or industrial combusting facility located a long distance away. When used as substitute fuels, these gasses can increase combustion efficiencies of incinerating or industrial combusting facilities since high temperature combustion can be possible due to the low expense. They also greatly improve atmospheric pollution problems by reducing harmful emissions such as dioxins, etc. which are generated during combustion, they reduce the scale of atmospheric pollution prevention apparatus needed and fabrication expenses thereof, and they can automatically control combustion conditions in an incinerating or industrial combusting facility by automatically controlling the dry distilled air control valve of a dry distilled gas generator and the control valve of the transferring and supplying equipment according to the required calorific values of the incinerating or industrial combusting facility, thus automatically controlling the thermal decomposition rate of the dry distilled gas generator so that proper operating conditions can be maintained resulting in easy operation. Furthermore, the present invention maximizes dry distilling efficiencies due to specification standardization of the main equipment, i.e., the nozzle pipe type dry distiller, and it eases difficulties of fabrication, installation, maintenance and repair of the equipment.

While the present invention has been described in detail with
reference to the preferred embodiments, those skilled in the art will appreciate that various modifications and substitutions can be made thereto without departing from the spirit and scope of the present invention as set forth in the appended claims.
WHAT IS CLAIMED IS:

1. A system using a substitute fuel of dry distilled gases of wastes comprising:

    a) a dry distilled gas generator producing dry distilled gases by continuously dry distilling high quality wastes;

    b) dry distilled pressurized gas transferring and combusting equipment comprising:

       i) a transferring pipe which directly transfers dry distilled gases produced at the dry distilled gas generator to isolated combusting incinerator and to which a control valve controlling a dry distilled gas transferring amount is attached;

       ii) a gas-air mixing injector which is directly connected with the transferring pipe, which combines gases from the transferring pipe with combusted air, and injects a mixture of gas and combusted air into a combustor in a pressurized state; and

       iii) a combusting burner for combusting the injected mixed gases;

    and

    c) a combusting and incinerating facility connected with the dry distilled gas combustor.

2. A system using a substitute fuel of dry distilled gases of wastes in accordance with claim 1, wherein the dry distilled gas generator comprises:

    a) a continuous injector with which wastes are continuously injected into the dry distilled gas generator while maintaining airtight conditions;

    b) a nozzle pipe type dry distiller in which dry distilled gases are produced through thermal decomposition by stacking up wastes injected from the continuous injector at an upper part thereof; and

    c) a continuous ash discharger in which ashes that lose
cohesive forces and fall into the spaces between the nozzles
after dry distilled gases are generated by thermal
decomposition at the nozzle part in the nozzle pipe type dry
distiller are continuously discharged without exterior air influx.

3. A system using the substitute fuel of dry distilled gases of wastes
in accordance with claim 1, wherein the pressurized transferring combustor
further comprises:

a) a tar removal trap which removes tar generated inside a dry
distilled gas furnace, attached to the transferring pipe and which
possibly discharges tar in a liquid phase fuel form with viscosities
lowered by a heater mounted therein; and

b) heat insulating equipment minimizing the temperature drop of dry
distilled gases inside the transferring pipe.

4. A system using a substitute fuel of dry distilled gases of wastes in
accordance with claim 1 further comprising:

a) a detector which is located at a gas-air mixing injector
outlet of the pressurized transferring combustor and which
detects a combustion air volume supplied through the
gas-air mixing injector from the pressurized transferring
combustor;

b) a dry distilled air control valve which controls an induced
amount of dry distilled gases according to a dry distilled
gas influx variation, which is controlled by the detector and
which is attached to the dry distilled gas generator; and

c) an automatic control device to which the dry distilled gas
control valve of the pressurized transferring combustor is
interlocked so that a dry distillation rate is automatically
controlled, and a stable pressure inside a dry distillation
furnace can be automatically maintained.

5. A system using a substitute fuel of dry distilled gases of wastes in
accordance with claim 1, wherein the combusting and incinerating facility is
an incinerating facility selected from the group consisting of a rotary kiln
incinerator, a fluidized bed incinerator, and a stoker, or an industrial combusting facility selected from the group consisting of a drying furnace, a heating furnace, and a melting furnace.
A. CLASSIFICATION OF SUBJECT MATTER

IPC7 F23G 5/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC F23G 5/00, F23G 7/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean Patents and applications for inventions since 1975
Korean Utility models and applications for Utility models since 1975
Japanese Utility models and applications for Utility models since 1975

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
NPS, PAJ, PATROM

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<tbody>
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<td>US 4,417,528 A (MANSFIELD CARBON PRODUCTS INC, PEABODY DEV COMPANY) 29 NOV.1983, see entire document</td>
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<td>JP 6-26632 A (YAMATO SANKO SEISAKUSHO KK) 04 FEB 1994, see entire document</td>
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☐ Further documents are listed in the continuation of Box C.  ☐ See patent family annex.

* Special categories of cited documents:
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Name and mailing address of the ISA/KR
Korean Industrial Property Office
Government Complex-Taejon, Dunsan-dong, So-ku, Taejon Metropolitan City 302-701, Republic of Korea

Authorized officer
SEO, Jae Ycop

Telephone No. 82-42-481-5487

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