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• **Shved, Roman Petrovych**
Kiev 01054 (UA)

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(72) Inventors:
• **Stryzhak, Sergiy Yuriyovych**
Kiev 03039 (UA)
• **Shved, Roman Petrovych**
Kiev 01054 (UA)

(71) Applicants:
• **Stryzhak, Sergiy Yuriyovych**
Kiev 03039 (UA)

(74) Representative: **Rezac, Petr**
Jihozápadní-III 1145/4
141 00 Praha 4 (CZ)

(54) **METHOD FOR PROCESSING INDUSTRIAL AND DOMESTIC WASTES**

(57) The invention relates to chemical technology and equipment, in particular, to methods and apparatuses for pyrolysis (gasification) in molten salts and/or alkalis of organic household and industrial waste. The task of the invention is to increase quality and quantity of obtainable pyrolysis gas.

Set task is achieved by formation of gas-tight plug from compressed waste in the supply channel. From outside of loading channel a layer of products of low-temperature waste processing is formed, at that along the loading channel temperature regime in the range from 20 to 550 °C is formed. Temperature regulation in the loading channel is carried out by dosed supply of water vapor and/or carbon dioxide into product layer of low-temperature processing waste.

Metals, oxides, salts or oxide hydrates thereof are added to waste as processing catalysts. Water vapor and/or carbon dioxide are supplied into the area of high-temperature processing.

Silicon dioxide is added to waste for melt regeneration.

The pipe of the waste loading device in the apparatus is equipped with the cooler for method implementation. The reactor pipe, damper chamber and shell of operating area are located coaxially with the pipe of loading device in the apparatus. The blades, providing melt twisting and dispersion of gaseous products in melts, are installed in the operating area of the device. The heating tubes are located in the area between the operating area shell and

vessel. The apparatus is equipped with the displacing device for slug discharge.

Proposed method and device allow to obtain optimal gas composition for its further use in production of electric power of for synthesis of, for example, alternative engine oil. At that oxygen or air are not used and harmful and atmospheric emission are practically absent.

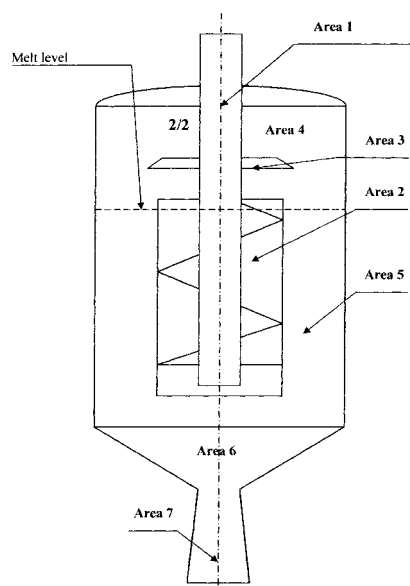


Fig. 2

Description

[0001] The invention relates to chemical technology and equipment, in particular, to methods and apparatuses for processing (pyrolysis and gasification) in volume in molten salts and/or alkalis of household and industrial waste containing organic substances.

[0002] US Patent No. 6799595 IPC F16K 13/00, F16K 13/10 describes the method for waste processing, which comprises waste supply into molten salts or alkalis and the apparatus for implementation thereof, wherein the waste is fed into the melt in air stream. At that flameless oxidation of waste occurs.

[0003] The closest technical solution for inventive method is the method for industrial and household waste processing, comprising waste supply through loading channel into the melt of salt or alkali mix, known from RU Patent No. 228021, IPC F23G 5/00. The method for waste processing in melt is carried out at the absence of oxygen. Depending on morphological structure of waste calculated quantity of mineral additives are added to them in order to minimize the amount of gas which is obtained during waste processing.

[0004] UA patent No. 75555 IPC C10B 49/00, F23G 7/00 describes the apparatus for waste processing, which comprises the vessel with conical bottom, device for waste loading with vertical loading pipe, shell coaxial with the vessel and loading pipe, screw surfaces inside of the shell and displacing device connected with the conical bottom.

[0005] However, the disadvantage of said solutions is that the volume minimization is connected with degradation of both thermal power of obtained gas and its chemical composition. It impedes the use of obtained gas both in power generation cycle and for synthesis of, e.g., petrol.

[0006] The object of the invention is to increase the cost-effectiveness by acceleration of processing, to increase quality and quantity of gas obtained at processing for its further use and to improve slag discharge conditions.

[0007] Set tasks are solved by inventive method for organic industrial and household waste processing, comprising the supply of waste into the apparatus - reactor through the vertical loading channel into molten salt and/or alkali mix to area of high-temperature processing within the temperature range from 850 to 950°C. Wastes are supplied into the reactor through the pipe of loading device and movable gas-tight plug is formed by compression of waste using a piston. An area of low-temperature waste processing is formed in operating volume of vertical loading pipe, for this purpose temperature regime within the range from 20 to 550 °C is set along it, at that case temperature regulation is carried out by dosed supply of water vapor and/or carbon dioxide into the layer of products of low-temperature processing, formed in loading channel.

[0008] Additionally, metals, and oxides, salts or oxide hydrates thereof can be added to melt as catalysts. Also water vapor and/or carbon dioxide can be supplied to the area of high-temperature processing, and for melt regeneration silicon dioxide is added to waste.

[0009] The proposed apparatus for implementation of the method for industrial and household waste processing supports solving the set tasks. Said apparatus comprises the vessel with conical bottom, device for waste loading with vertical loading channel, shell, which is located concentrically relative to the vessel with screw surfaces inside, heating tubes, cutter, located over the shell, displacing device, connected through the mouth with conical bottom of the vessel, loading channel chamber, where the reactor pipe is placed coaxially with the waste loading pipe, at that case lower opened end of loading device pipe is located at the level of upper end of reactor pipe. The pipe of loading device is equipped with the cooler in the area of gas-tight plug formation, and reactor pipe has longitudinal slits, widening downwards, damper chamber is located outside reactor pipe, and the pipe for supply of water vapor and/or carbon dioxide is introduced into said pipe. Screw surfaces inside the shell can be made as blades, and lower blades are made with elevation from the center to peripheral part in radial direction, and blades located above are made horizontal in radial direction, and blades of the upper layer are equipped with aprons used to direct liquid-gas flow to the center, and each blade is installed with a gap relative to underlying blade and with overlap in horizontal position. It is also provided that the diameter of the loading device pipe can be less than the diameter of the reactor pipe, and the diameter of the reactor pipe is less than the diameter of damper chamber.

[0010] The method can be realized in the reactor, which is schematically depicted in the following Figures:

Fig. 1 schematically shows the apparatus for industrial and household waste processing, wherein

1 - cylindrical vessel; 2 - conical bottom; 3 - vertical loading channel; 4 - device for waste loading; 5 - piston; 6 - drive of reciprocal; 7 - cooler; 8 - reactor pipe; 9 - bridge; 10 - damper chamber; 11 - pipe for supply of vapor and/or carbon dioxide; 12 - shell; 13 - guiding blades; 14 - heating tubes; 15 - impingement plate; 16 - pipe branch for discharge of gaseous products of processing; 17 - displacing device; 18 - mouth of displacing device; 19 - shell of displacing device mouth; 20 - external heater; 21 - bottom of displacing device; 22 - plate heater; 23 - driving mechanism; 24 - melt level sensor; 25 - plug of displacing device.

[0011] The Fig. 2 symbolically depicts the distribution of functional areas in reactor's operating volume, where various

stages of waste processing are occurred, wherein:

Area 1 - Sections of low-temperature processing;
Areas 3-5 - Areas of high-temperature processing.

[0012] The implementation of the invention and operation of the apparatus are described below.

[0013] The reactor for industrial and household waste processing has cylindrical vessel 1 with conical bottom 2. Device for waste loading 4 is installed in direction of the vessel 1, at that the lower end of the waste loading device 4 is located under reactor's cover. Vertical loading channel 3 of the waste loading device 4 is equipped with the piston 5 with the drive 6 of reciprocal motion and cooler 7. The lower open outlet end of the loading device pipe 4 is located at level of the lower end of the cooler 7. The pipe of the loading device 4 has an opening for waste supply into the loading device pipe 4 under the upper position of the piston 5. The loading device pipe 4 is turned into the reactor pipe 8 in such a way that the upper annular clearance between the pipe of the loading device 4 and reactor pipe 8 is blocked with the bridge 9.

[0014] Damper chamber 10 is located coaxially with reactor pipe 8 outside of it. The diameter of the loading device pipe 4 can be less than the diameter of the reactor pipe 8, and the diameter of the reactor pipe 8 is less than the diameter of damper chamber 10. The reactor pipe 8 contains the slits, which are enlarged downwards. The pipe 11 for supply of vapor and/or carbon dioxide is introduced into the damper chamber 10.

[0015] The shell 12 is placed coaxially to the reactor pipe 8 and the pipe of loading device 4 in the vessel 1, the lower end of said shell is located under the end of reactor pipe 8, and the upper one is located above the melt level. One or several screw surfaces or guiding blades 13 are installed in annular space between the damper chamber 10 and the shell 12, at that lower blades are made as sloped from the center to the periphery in radial direction and the blades are located above, in horizontal and vertical directions, the blades of the upper layer are equipped with aprons for liquid-gas flow guiding to the center. Also, the blades are installed with a gap relative to the underlying blade in vertical direction with overlap in horizontal direction. The blades are located spirally in vertical direction. Such way of blade making allows to have maximal dispensing of gas bubbles and to enlarge gas path in the melt, thus, to intensify heat mass exchange.

[0016] The heating tubes 14 are located in the area between the shell 12 and the vessel 1. The impingement plate 15 is located over the shell 12 with a gap. The upper part of the vessel 1 comprises the pipe branch 16 for gaseous processing products discharge.

[0017] The conical bottom 2 is connected with the displacing device 17, the mouth 18 of which is equipped with the covering 19. The displacing device 17 is made in the form of inverse cone and has the external heater 20, plug 25 with a drive and the bottom 21, which can be made as flap or as a gate valve. The bottom 21 is opened by the means of driving mechanism 23 and comprises plate heater 22.

[0018] The vessel 1 contains melt's level sensor 24.

[0019] The method is realized in said apparatus as follows:

Prior to start of heating, a gas-tight plug from waste is formed in the shaft of loading device 4.

[0020] The heating tubes 14 and the heater 20 are permanently switched on and they heat up the melt within the reactor vessel and displacing device to the temperature of 900-950 °C. The flap bottom 21 is adjoined to the displacing device 17. The plug 25 is at the upper position. Dispensed waste portions are supplied to the loading device pipe 4 under the piston 5 in the moments when the piston is at the uppermost position. At motion of the piston 5 downward the waste is compressed due to pipe wall friction and upon achievement of primarily installed plug they move it along the loading channel. And this is repeated sequentially portion by portion.

[0021] Due to cooling of waste in cooler area and heating up from the melt, temperature area is formed in the vertical loading channel, this area consists of several sections, where the following processes take place:

Area 1. Area of vertical loading channel is the area of low-temperature processing. It is intended for drying of waste (raw materials) fed into the reactor, their destruction and low-temperature processing. This area is symbolically divided by temperature ranges for 5 sections:

section 1 (temperature variation range is 20÷100 °C) - area the cooler of loading channel, within which the following processes take place:

- compressing of loaded raw materials and formation of gas-tight plug;
- initial warming up of raw materials, evaporation of free moisture;
- starting of vapor formation at boiling of free moisture (drying of plug material).

section 2 (temperature variation range is 100÷200 °C) - a part of loading channel, within which the following

processes take place:

- vapor formation and partial overheating of water vapor (depending on temperature and pressure by section of plug material);
- starting of raw materials destruction processes.

section 3 (temperature variation range is $200 \div 350$ °C) - a part of loading channel, within which the following processes take place:

- intensification of processes of organic polymers decomposition and destruction;
- formation of saturated and non-saturated carbons;
- change of aggregate state of low-melting materials of organic and inorganic origin.

section 4 (temperature variation range is $350 \div 450$ °C) - a part of loading channel, within which the following processes occur:

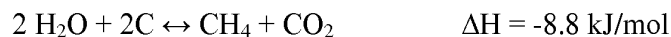
- decomposition and destruction of organic compounds with covalent bonds cleavage in polymers and crystal lattices of organic compounds;
- change of aggregate state of low-melting materials, transition of plug materials to plastic state.

section 5 (temperature variation range is $450 \div 550$ °C) - a part of loading channel, within which the following processes take place:

- evolution of light tarry compounds, hardening of plastic material and carbonization of external material layers;
- predominance of reactions of synthesis of, mainly, simple saturated and non-saturated hydrocarbons.

[0022] At that case the top limit of this temperature range within this area becomes less than the temperature of aromatic hydrocarbons formation.

[0023] Area 2. Area of gas dynamic liquid melt. Operating area. This is the area of high-temperature processing with the temperature range, maintained by heaters - heating tubes from 850 to 950 °C. Therein complete decomposition of raw materials, thermal shock processes for destruction, cleavage of non-saturated hydrocarbons and aromatic rings at practically total lack of reactions of aromatic rings formation, purification of formed gases from liquid and solid processing components, and beginning of catalytic process for carbon gasification occur according to main reactions:



and to a lesser extent



[0024] The dynamics of melt in this area is performed due to bearing capacity of gas formed at raw materials processing, both in the area of loading channel and in operating area as such.

[0025] Constructive realization of this area represents a liquid-gas system, which is equipped with special blades, located between the damper chamber and the shell of operating area, intended for:

- delay of gas and non-reacted residue of raw materials in melt;
- maximal agitation of melt and formed gas;
- dispersion of gas component;
- gas purification.

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[0026] All of this is, in turn, is required for intensification of chemical reactions. Moving along the surfaces of operating area gas captures lower layers of warmed melt, providing to it complex traveling locus by blades and surfaces, turbulizing melt flow, which, in turn, is used for gas purification from liquid and solid components of raw materials processing.

[0027] The difference between gas and melt rates results in the dispersion of gas in the melt.

10 **[0028]** The dispersion of gas and turbulization of liquid-gas flow promotes the maximal agitation in this area, additionally, they preset the dynamics to the whole molten volume in the reactor, which, in turn, is necessary for:

- improving of heat withdrawal from heating surfaces;
- washing out of inorganic residue from internal walls of the vessel and operating surfaces of the reactor;
- 15 - distribution and intensification of carbon movement dynamics in the whole molten volume;
- arrangement of dynamics in the area of dynamic purification of melt from inorganic components.

[0029] Along with mentioned above, reactions with reagents (CaO, K₂O, Na₂O, NaOH, KOH etc.), fed into the reactor with raw materials or formed with it, are intensified within the operating area due to melt dynamics. One of the functions of these reagents is to accept CO₂, for example:

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30 **[0030]** Gases, formed within the area of low-temperature processing, form gas bubbles in the melt, which on the way to the surface in closed volume of the operating area capture the melt, forming gas lift flow in such a way. While lifting the gas is warmed up by the melt both by convection and heat radiation. But at the first stage of the process warming up is weak due to poor transparence of gas, contaminated with liquid and solid processing products, small surface of the bubble relative to its volume, as well as due to endothermic nature of chemical reactions taking place.

35 **[0031]** Carbon dioxide (CO₂), which is contained in gas of loading channel, passes into the melt and reacts with inorganic components of the latter and raw materials both in areas of low-temperature and high-temperature processing, forming at that corresponding carbonates. Similar interaction occurs at the initial stage, when gas and inorganic compounds are not sufficiently heated. This reaction occurs with heat evolution, which facilitates warming up of the reagents. Formed carbonates move within the melt with gradual heating. In the upper part of operating area or warming area, 40 thermal decomposition of carbonates occurs with isolation of CO₂ in a form of the smallest bubbles. In such a way carbon dioxide is dispersed and distributed in the whole volume of melt within the reactor, where it reacts with carbon.

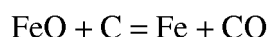
[0032] The use of reagents - acceptors of carbon dioxide allows:

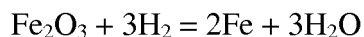
- to remove a part of carbon dioxide from gas being obtained at the outlet of the reactor;
- 45 - to decrease the effect of endothermic reactions of pyrolysis and gasification on temperature of gas and melt inside loading channel and operating area;
- to increase the reactivity of CO₂ due to dispersing thereof.

50 **[0033]** Molten salts of alkali and alkaline-earth metals is powerful redox environment where reduction of elementary chemical elements from oxides takes place, carbon is oxidized by reactions with H₂O and CO₂ with formation of gases containing H₂, CO, CO₂, CH₄ and other components under the influence of gas dynamic processes and high temperature. Organic and inorganic structures are destroyed with simultaneous formation of new chemical compounds.

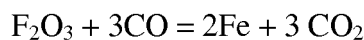
[0034] Metals are reduced from oxides. On the example of iron oxides this process can be represented by the following reactions:

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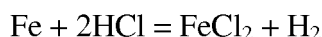
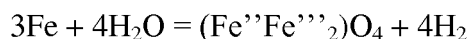


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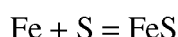


[0035] Then formed metals can interact with compounds, which are present in the melt, for example:

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[0036] Thermodynamic properties of the melt play important role in activation of these processes, namely, high heat capacity and thermal conductivity, which, correspondingly, are three and more orders higher than gas has, which is, in turn, facilitates the increasing of efficiency of energy transfer in the process of thermal decomposition of raw materials and carbon gasification.

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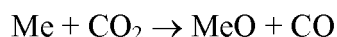
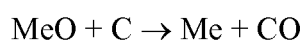
[0037] Increased activity of ionic state of alkali and alkali-earth metal salts at high temperatures has catalytic influence with intensification of organic mass destruction. Owing to the introduction of metal ions into carbon structure of raw materials the weakening of the structure occurs followed by the cleavage of carbon bonds, opening of aromatic rings etc.

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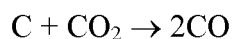
[0038] One of the mechanisms of interaction of carbon with an oxidizing agent in melt is connected with the formation of intermediate compounds of metals - oxides and hydroxides, playing a role of catalysts.

[0039] For example:

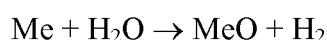
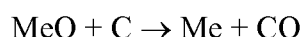
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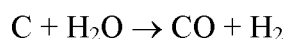
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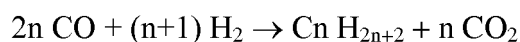


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[0040] Other metals, such as iron, nickel and chromium, have similar catalytic influence on chemical processes in melt. These metals are reduced in molten environment, and after that they start to effect formation of, predominantly, saturated hydrocarbons, mainly methane CH_4 , and, to a lesser extent, ethane C_2H_6 and propane C_3H_8 , from the mixture of hydrogen and carbon dioxide:

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[0041] Aromatic hydrocarbons are not formed due to the following factors:

- low partial pressure of non-saturated hydrocarbons;
- high temperature (more than 800 °C);
- presence of H₂O, H₂, metals oxides and hydroxides, which have catalytic action on aromatic hydrocarbons destruction due to dehydration.

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[0042] At sufficient amount of H₂O and corresponding introduced catalysts at this temperature the process for vapor conversion of hydrocarbons with formation of gas mix takes place, where said mix maximally contains H₂ and CO, the most suitable for further synthesis of hydrocarbon fuel.

[0043] Area 3. Area of melt cutting off.

10 **[0044]** The area of melt cutting off is used for change of direction of upward gas flow at the outlet from reactor operating area following by its distribution in the whole volume of heating area.

[0045] The cutter is made as a plate and is also used for:

- opening of gas bubbles and maximal dynamic distribution of gas and molten elements;
- 15 - final gas purification from liquid and solid elements;
- dynamic hammering of solid carbon residue under melt mirror within the heating area;
- breaking of solid foam formations on the surface of the heating area under the influence of melt flow reflected from the cutter.

20 **[0046]** Area 4. Gas area of the reactor.

[0047] Gas area is located over the melt mirror and has a volume, which is approximately equal to one third of the cylindrical shell of the reactor. It is intended for maximal separation of obtained gas from the melt. This area is the continuation of reaction areas, and its temperature varies within the limits of 900 - 700 °C. The reactions of interaction of warmed gases, water vapors and pyrocarbon are continued in the whole volume of gas area.

25 **[0048]** Area 5. Area of reactor heating.

[0049] The heating area is located between the internal wall of reactor vessel and the shell of operating area. It contains heating tubes, performing indirect internal heating of molten salts to the temperature of 950 °C by electrical or other method.

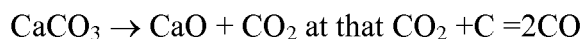
[0050] This area is, per se, a circulation circuit with the heating of melt.

30 **[0051]** In this area the following take place under influence of thermodynamic and physical-chemical processes:

- warming up of both the melt and solid carbon residue, which is obtained at solid carbon residue processing, to the temperature of 950 °C
- penetration of the melt into carbon pores;
- 35 - activation of carbon;
- weakening of bonds in carbon lattice under influence of alkali and alkali-earth metals.

[0052] All of this is the continuation of processes in reactor operating area and, finally, results in catalytic carbon gasification, partially, in heating area as such, but to a higher extent, in reactor operating area, where the melt containing activated carbon is further supplied. In the same heating area, the process for catalytic carbon gasification occurs with the participation of, mainly, carbon dioxide, formed at decomposition of carbonates of alkali and alkali-earth metals, supplied together with the melt from reactor operating area.

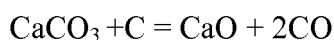
40 **[0053]** These interactions can be described by the example of calcium carbonate (CaCO₃), which is formed in the loading channel and the beginning of reactor operating area from components of loaded raw materials. With passing of carbonates along the loading channel and melt of operating area, they are warmed up. At the temperature above 800 °C calcium carbonate is thermally not stable and interacts with carbon according to reactions:

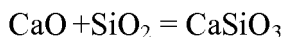


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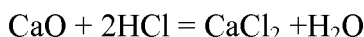
[0054] At that case the gas in heating area is passed in direction opposite to falling melt flow, containing carbon as well as inorganic residue of raw materials.

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[0055] HCl is formed at decomposition of chlorinated organic molecules present in raw materials.

10 **[0056]** The decomposition of carbonates, depending on their warming rate, can occur both in the heating area and the upper part of the operation area.

[0057] Area 6. Area of dynamic purification of the melt.

[0058] The area is located in the lower part of internal volume of the reactor between the operation area and the cone of displacing system.

15 **[0059]** It is characterized by annular centrifugal movement of the whole molten volume in this area. Just in the area inorganic components, supplied together with raw materials into the melt, as well as the components formed and not reacted during the process of operation of the reactor, are separated by densities. For example, such as CaSiO_3 , CaCO_3 , CaS , CaO , SiO_2 etc.

[0060] Area 7. Area of the displacing system.

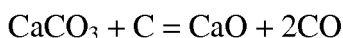
20 **[0061]** The area of the displacing system is located at the bottom of reactor volume, between its cone part and the lower gate. The displacing area is made as truncated cone with slight angle of opening. It has separate external heating element, which warms up and maintains the temperature of 900 °C inside the displacing volume.

[0062] In this volume finally separation of inorganic elements by density, separation from the melt, concentration and formation of infusible residue occur.

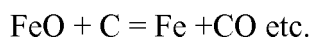
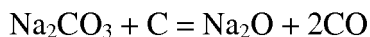
25 **[0063]** The lower part of the cone is equipped with the gate, intended for short-term opening at removal of formed residue and for draining of the whole molten volume of the reactor.

[0064] The presence of carbonates CaCO_3 , Na_2CO_3 and carbon in displacing system, which did not react at the temperature of ~ 900 °C provides for the continuation of carbon gasification reactions with formation of CO:

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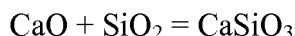


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[0065] Under these conditions reactions of silicate formation and crystallization simultaneously take place:



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[0066] $\text{Na}_2\text{O} + \text{SiO}_2 = \text{Na}_2\text{SiO}_3$ followed by maximal displacing of the melt with infusible inorganic residue.

[0067] During operation permanent monitoring of composition of obtained gas is carried out. In case of increase of carbon dioxide concentration on more than 3%, the salts, oxides or oxide hydrates of alkali-earth metals, for example, calcium oxide, are added to waste before the loading.

50 **[0068]** The principle of reactor operation is the implementation of constant melt circulation under the influence of gases formed as the result of organic waste processing. It is performed as follows: the melt, set in motion and discharged under the influence of gas lift from the space between damper chamber and operation area shell, as well as twisted on screw surfaces or special blades, and hampered from the impingement plate, is supplied with twisting into the area between operation area shell and reactor vessel. At that the melt passes downwards along the surfaces of heating tubes, carrying carbonaceous solid components of processing. The increasing of raw materials supply volume results in more intensive gas formation, and hence leads to more intensive melt circulation, which, in turn, allows to compensate increased heat consumption for raw materials processing at the expense of more intensive heat exchange of heating tubes with the melt.

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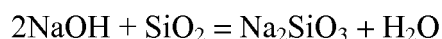
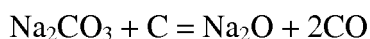
[0069] Solid non-fused slugs formed as the result of the processing and fed into the reactor together with the raw

material, are separated from main melt volume in the cone part of the reactor and deposited in the displacing device, with displacement of lighter melt from said device. This results in increase of the melt level in the reactor. When the sensor of melt level signalizes that the melt level is increased on value, which corresponds to the volume of displacing device, waste supply is stopped. The locking plug of the displacing device is lowered by means of the drive into the mouth of the displacing cone, at that the cooling agent - air or water, are supplied into the covering around the mouth. The melt in a gap between the plug and the mouth is crystallized, separating the melt in the reactor vessel from slugs in the displacing device.

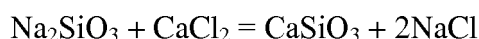
[0070] Simultaneously the plate heater is switched on. The salt in the area of contact of cone end of the displacing device and flap bottom is melt, the bottom is thrown off by the means of the drive, and the content of displacing device is removed. During all this process the heater and heating tubes are still switched on. The bottom is closed by the drive, and the plate heater is switched off. The supply of cooling agent to the mouth covering of the displacing device is stopped. The salt is melted under the influence of high temperature in a gap between the plug and the mouth of displacing device, and the plug is raised by means of the drive, releasing the mouth.

[0071] The introduction of the waste is renewed and all process is continued.

[0072] The contamination of melt and increasing of its dynamic viscosity gradually occurs during operation, which slow down heat and mass exchange processes. Silicon dioxide as sand is added to waste for melt regeneration. The formation of silicates occurs.



[0073] At development of molten salt regeneration method the properties of electrolytes were used, namely the capacity of strong bases to displace weak bases from melts (solutions) of salts thereof. The exchange reaction with the salts of alkali-earth metals results in formation, for example, of calcium silicate CaSiO_3 , which is more heat-resistant than Na_2SiO_3 :



[0074] Calcium silicate is precipitated as crystals, at that melt's dynamic viscosity and residue melting temperature decrease due to formation of sodium chloride.

[0075] As the above description discloses the principles of the invention, with examples provided for illustration, one should realize that the use of the invention comprises all usual variations, adaptations and/or modifications, forming a part of the scope of the following claims, and equivalents thereof.

Claims

1. A method for processing of organic industrial and household waste, comprising the supply of waste into the apparatus through the vertical loading channel of the device of waste supply into molten mix of salts and/or alkalis into the area of high-temperature waste processing, which **characterized in that** movable gas-tight plug is formed in the loading channel from waste by compressing of waste with a piston, and from the area of low-temperature waste processing in the volume of loading channel, at that in area of low-temperature waste processing the temperature regime is set within the range from 20 to 550 °C along the loading channel, temperature regulation is performed by dosed supply of water vapor and/or carbon dioxide into the loading channel, into the volume of products formed during low-temperature waste processing.

2. The method for processing according the claim 1, which **characterized in that** metals, oxides, salts or oxide hydrates thereof are added into melt as catalysts.
3. The method for processing according the claim 1, which **characterized in that** water vapor is supplied into high-temperature processing area.
4. The method for processing according the claim 1, which **characterized in that** carbon dioxide, is supplied into high-temperature processing area.
5. The method for processing according the claim 1, which **characterized in that** the melt is regenerated by addition of silicon dioxide to waste.
6. An apparatus for realization of the method for waste processing according the claims 1-5, comprising of the vessel with conical bottom, device for waste loading with vertical loading channel, shell, which is located concentrically to the vessel, screw surfaces in the shell, heating tubes, cutter, which is located over the shell, displacing device, which is connected through the mouth with conical bottom of the vessel, which **characterized in that** the vertical loading channel of the loading device comprises the loading device pipe with the reactor pipe placed coaxially with it, and the lower open end of the loading device pipe is located at the level of the upper end of the reactor pipe, loading device pipe is equipped with the cooler in the area of gas-tight plug formation, and the reactor pipe comprises the longitudinal slits, which are enlarged downwards, at that the damper chamber is located outside of the reactor pipe is located, wherein water vapor and/or carbon dioxide is supplied.
7. The apparatus according the claim 6, which **characterized in that** the screw surfaces inside the shell are made as the blades, at that the lower blades are made elevated from the center to the tips in radial direction, the blades, which are located over them, are made horizontal in radial direction, the blades of the upper layer have aprons for guiding of liquid-gas flow to the center, and any of blades is installed with a gap relative to underlying blade.
8. A device according the claim 6, which **characterized in that** the diameter of the loading device pipe is less than the diameter of the reactor pipe, and the diameter of reactor pipe is less than the diameter of damper chamber.

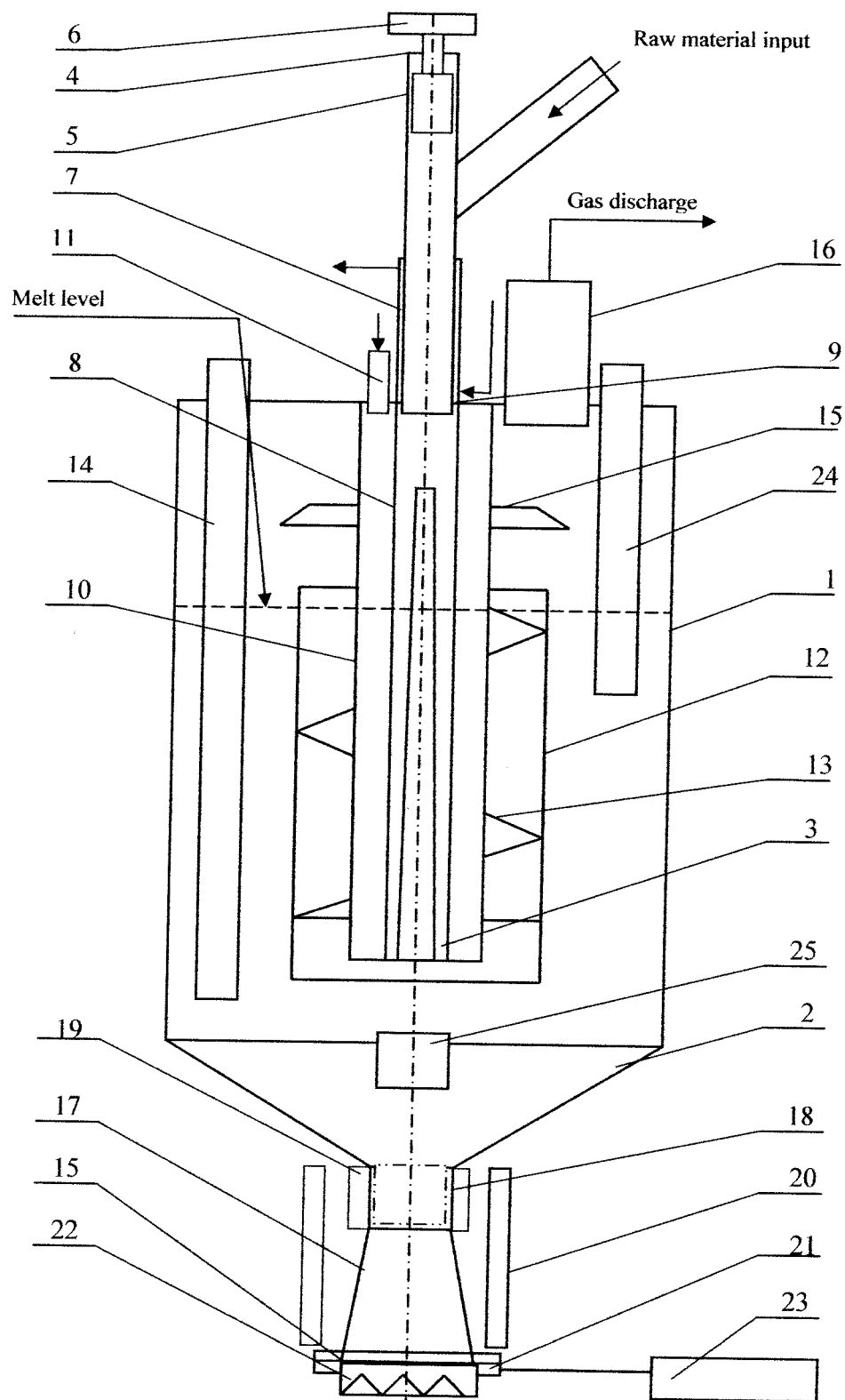


Fig. 1

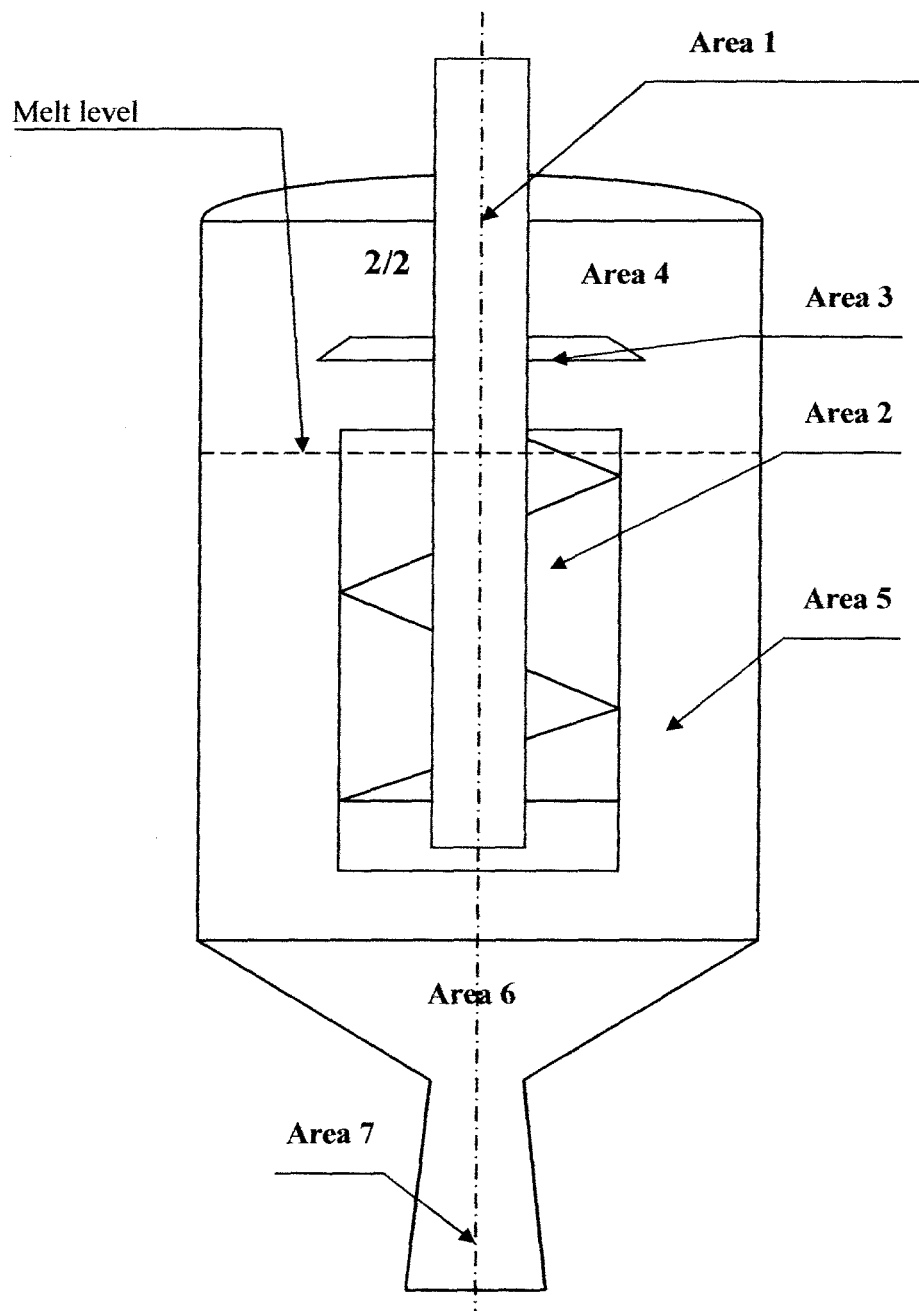


Fig. 2

INTERNATIONAL SEARCH REPORT

International application No.

PCT/UA 2008/000053

A. CLASSIFICATION OF SUBJECT MATTER		F23G 5/00 (2006.01) F23G 7/00 (2006.01)
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)		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched F23G 7/00, 7/07, 5/00, 5/027, A62D 3/00, 3/32, 3/34, 3/36, 3/38, G21F 9/00, 9/16, B09B 3/00		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) DWPI, EAPATIS, ESP@CE, ESP@CENET, PAJ, PCT, RUPTO, USPTO		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	UA 75555 C2 (OBSHESTVO S OGRANICHENNOY OTVETSTVENNOSTYU "EKOKOMINVEST") 15.04.2006, page 4 of the description, line 35 - page 5, line 15, figure 1	1-5 6-8
Y A	RU 2235946 C2 (TERMOSELEKT AG) 10.09.2004, the description, column 4, paragraph 4-7, column 5, paragraph 2, claims 1-2, figure 1	1-5 6-8
Y	WO 1994/023802 A1 (WABASH INC.) 27.10.1994, page 12, lines 11-33	2
Y	RU 2195727 C1 (MOSKOVSKOE GOSUDARSTVENNOE PREDPRIYATIE OBEDINENIY EKOLOGO-TEKHNLOGICHESKII I NAUCHNO-ISSLEDOVATELSKY TSENTR PO OBEZVREZHIVANIYU RAO I OKHRANE OKRUZHAYUSCHEY SREDY) 27.12.2002, the abstract, column 5, last paragraph, column 6, the penultimate line - column 7, line 3	5
☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 14 November 2008 (14.11.2008)		Date of mailing of the international search report 04 December 2008 (04.12.2008)
Name and mailing address of the ISA/ RU		Authorized officer
Facsimile No.		Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/UA 2008/000053

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	Bernadiner M. KH. et al. Ognevaya pererabotka i obrezvrezhivanie promyshlennykh otkhodov. Khimya, Moscow, 1990, pages 16, 20, 21, drawing 1.5	1-5

Form PCT/ISA/210 (continuation of second sheet) (April 2005)

REFERENCES CITED IN THE DESCRIPTION

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- RU 228021 [0003]
- UA 75555 [0004]