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(54) Benævnelse: **LØBENDE TERMISK FORARBEJDNING AF BRUGTE ELLER PÅ ANDEN MÅDE NEDBRUDTE DÆK**

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JP-A- S55 160 087
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DESCRIPTION

Background of the invention

[0001] The expert estimates in the issue of the occurrence of used tyres reported their annual number to 700 million pieces of discarded tyres. The issue of their processing is solved throughout the duration of their use, but so far the results of the solution have not come into the capacity level of their occurrence. Used tyres, therefore, cumulate and become the environmental problem. The currently known technologies focus on the areas, of which the historically first appears to be the regeneration of the rubber by the action of superheated water vapour. The output is the so-called regenerate, which is used to additions into the rubber composition. Its production and the limited number of features compared to the original rubber, from which they arose, however, restrict this technology on a massive spread. The other direction in the technology of tyre processing is focused on the acquiring of rubber grit, which found its application/use in construction and in other areas, such as agriculture or engineering production. From these technologies are relatively well known the technologies using super-cooling of liquid nitrogen, when the rubber becomes fragile and then, in this state, it is disintegrated usually, in the hammer mills. Similar processing of rubber waste, when a mechanical shredder handles the deep-frozen rubber waste, is known for example from the document US 5735471. Other technologies use for obtaining the grits the various types of mills. Both types of technologies require the prior removal of foot parts with the content of the steel wires, alternatively even cutting into smaller parts. This limits this technology for complex processing of used tyres.

[0002] Another procedure for the use of used tyres is in their combustion. A tyre is by its calorific value at the level of quality black coal, but by its mechanical composition, in particular the content of the steel reinforcements, it is for practical combustion for the purpose of obtaining energy, hard to use. A combustion furnaces for obtaining the heat water vapour, such as the Helnan-Freud's combustion furnace operating in Great Britain, allow you to burn the whole tyres, but only by batch way, since the removal of steel reinforcements from the furnace requires a shutdown of the device. The process therefore takes place by batch regime. A different and somewhat more modern method of tyre combustion arises from the system of oil burners and blowers, which, together with the rotary furnace, causes that the temperature rises in over 1300 ° C and the steel sears and does not block the grates. The usability of such iron for recycling is sporadic.

[0003] A relatively trouble-free way to use tyres as a fuel is handled in the cement furnaces. Here the whole tyre will disappear and will be able to save other more expensive energy. The consumption of tyres in cement plants is, however, only a fraction of how many of them accumulate.

[0004] From the Czech utility model no. 20795 is further known a device for processing rubber

waste, in particular tyres, by the physical-chemical process, which consists of at least one gas-tight chamber, into which by a feed pipe the aggressive gas is supplied, such as O_3, moistened by the water mist, formed through at least one nozzle, to which the pressure water is brought from the tank. In the gas-tight chamber there are in lines one above the other, opposite each other, placed the top cylinders and contradictory bottom cylinders with a space for processed rubber waste. One from the lines of the cylinder is fixed, while the second of the lines of cylinders is vertically movable with pressure. On the input side of the gas-tight chamber there is located the input area with the input cap and the on output side there is located the output space with the output cap, whereas both spaces are provided with the output pipe with a against-explosive safety lock for exhaust of gas and both are from the internal space of the gas-tight chamber separated by internal closures. The disadvantage of this device is, in particular, in its relative complexity.

[0005] From the point of view of current technology knowledge it could appear the use of pyrolysis to be the final solution. The competent pyrolysis reactor for waste processing, in particular of tyres, it is known for example from the documents US 2011116986 or from the documents WO 9320396.

[0006] Pyrolysis, as it is performed in these devices, however, requires both relatively gently crushed input raw material, if possible, without any foreign admixtures, and also the external heating of the reactor. It moves the economy to a large burden of its own costs on grinding, and heating, so that the products are created only hardly, or with a small rate of profit they are in position to make the operations economically self-sufficient.

[0007] JP S55 160087 discloses a vertical internal heating furnace, wherein waste tire is introduced as such, without being cut or broken, into inlet at the top of furnace via a filling chamber comprising a pair of filling closures. As it travels down, it is pyrolyzed in the pyrolysis zone, with a rising high-temperature gas produced by the partial combustion of the tire and/or unreacted residue with air supplied to the combustion chamber via nozzles. Residual steel cord is discharged via an output chamber comprising a pair of output closures and pyrolysis gas is discharged from the reactor via an upper outlet, and then recovered as a gaseous fuel or a fuel oil which is liquefied by partial condensation.

[0008] US 4746406 discloses a system for recovery of pyrolysis gas comprising a particle separator, a pre-cooler, a hot separator comprising two outlets, one connected to a tank, a cooler working with a cooling brine having a temperature of -3 to -5°C connected to a cold separator having two outlets.

Summary of the invention

[0009] The above disadvantages of the prior art are to a large extent removed by the process according to claim 1.

Description of the drawings

[0010] The invention is further clarified by a schematic drawing of an exemplary implementation of a device where the continuous processing of used or otherwise degraded tyres according to the invention is carried out.

Example of embodiment of the invention

[0011] The process of the present invention is carried out in a device consisting of a vertically arranged reactor 1 for the thermal decomposition of these waste tyres into the organic decomposition products in the form of low molecular hydrocarbons, and residual inorganic waste shares. In the upper part of the reactor 1 there is created a filling chamber 2 with a pair of filling closures 3 for filling its internal space by the waste tyres and in the bottom part of the reactor 1 there is formed the input chamber 8 of the residual inorganic shares with a pair of output closures 9.

[0012] In the lower part of the reactor 1 there are in its walls arranged the nozzles 5 for input of air for generating of a mild gaseous inert medium by oxidation of unreacted residues of organic matter from the treated tyres. The output chamber 8 of the residual inorganic shares by a pair of output closures 9 is located laterally outside of the axis of the reactor 1, while in the axis of the reactor 1 there is at its bottom arranged the generator of gaseous inert medium and nozzles for generating of a gas inert medium are in its internal space connected to the pipe bearing the control valve 6 for setting the passage of air from the external space of the reactor 1 to exothermic heating of gaseous inert medium at the desired temperature.

[0013] In the upper part of the inner space of the reactor 1 under the filling chamber 2 is then created an output opening 11 of this inert gas media, together with the therein dispersed organic decomposed products in the form of aerosol.

[0014] The device is further made up of a separator 12 of solid particles, mainly soot, into which the aerosol enters by the input opening 14 whereas the separator 12 is equipped with the double case 13 for its cooling by the air. By the output vent 15 then the aerosol without solid particles from the separator 12 goes out and is through the outlet opening 16 brought into the cooler 17, provided with a cooling circuit 18 with the flowing cooling water and outlet output 19 of cooled aerosol, which is through the supply input 20 brought into the separator 10 of the liquid particles.

[0015] The separator 10 of liquid particles is equipped with the first end output 21 of the liquid particles into the tank 22 and, second, a between-operating output 23 of the gaseous particles into the freezing chamber 24 for the separation of gases with a different condensing temperature, i.e. where by the decreasing of temperature from - 20 to - 40 °C separates the

gases with condensation temperatures above the stated temperature.

[0016] The reactor 1 is also equipped with the conveyor 27 of processed tyres to its filling chamber 2 and with extrusion equipment 7 for the disposal of residual inorganic shares from the bottom of the reactor 1 into a laterally located output chamber 8.

[0017] The reactor 1 is after the filling of the processed tyres closed by at least one of the pair of filling closures 3 and by at least one of the pair of output closures 9. After the initial heating of processed tyres in the lower part of the reactor 1 by flame or by electrical heating to the operating temperature of 600 °C there starts the reaction which is carried by the commencement of the generation of a gas inert medium in generator 4 and by running the exhaust vent, which is part of the separator 10 of the liquid particles. By the control valve 6 there is set the passage of air to the oxidation of the content of the space around the generator 4, thereby the inert gaseous medium exothermically heats to a temperature whose value is governed by the flow rate of the air by the control valve 6. This medium then continues through the reactor 1 to the outlet opening 11 and thermically decomposes the tyres placed in this space, while the degradation products in a state of low molecular hydrocarbons are distributed in the medium in the form of aerosol.

[0018] The continuity of the process is provided in this device by the fact that when the open top and the closed bottom of a pair of filling closures 3, the conveyor 27 will fill the filling chamber 2 of the reactor 1 by processed tyres, whereupon the upper of the pair of filling closures 3 closes. Then the content of the filling chamber 2 by opening the lower of a pair of filling closures 3 is put into the reactor 1. This mode of filling is repeated periodically in accordance with the consumption of the tyres inside the reactor 1. Similar it is in the case with a output of wires and inorganic wastes from the reactor 1, when during the open top and the closed bottom of the pair of output closures 9 by linear movement of extrusion equipment 7 these inorganic wastes are pushed out from the bottom of the reactor 1 into the space of the output chamber 8. Then by the closing of the upper and by the opening of the bottom of a pair of output closures 9, the content of the output chamber 8 gets out into the already non-illustrated container.

[0019] In this an exemplary implementation of the invention it is a reactor 1 with a square base of side 1 meter and a height of 4.5 metres, in which after processing 1426 kg of used tyres the following has been obtained: 626 litres of liquid fuels with a calorific value of EUR 34.3 MJ/kg, 170 kg of liquefied gas, 173 kg of iron and 137 kg of ash. As the gaseous inert medium there was used the medium that contained in the volume the amount of 64 % of the nitrogen, 13.5% of carbon dioxide and 0.1% carbon monoxide, whereas the remainder was formed by the superheated water vapour, and whose temperature at the inlet to the reaction amounted to 620 ° C and at the output 220 °C.

List of reference numbers

[0020]

1 Reactor
2 Filling chamber
3 Filling closures
4 Generator of the heating medium
5 Nozzles
6 Control valve
7 Extrusion equipment
8 Output chamber
9 Output closures
10 Separator of liquid particles
11 Output opening
12 Separator of solid particles
13 Double case
14 Input opening
15 Output vent
16 Input vent
17 Cooler
18 Cooling circuit
19 Outlet output
20 Supply input
21 First end output

22
Tank of liquid particles
23
Between-operating output
24
Freezing chamber
25
Second end output
26
Third end output
27
Conveyor

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US5735471A [0001]
- CZ20795 [0004]
- US2011116986A [0005]
- WO9320396A [0005]
- JPS55160087A [0007]
- US4746406A [0008]

LØBENDE TERMISK FORARBEJDNING AF BRUGTE ELLER PÅ ANDEN MÅDE NEDBRUDTE DÆK

PATENTKRAV

1. Fremgangsmåde til løbende forarbejdning af brugte eller på anden måde nedbrudte dæk i en kontinuerlig forarbejdningsindretning, der består af en reaktor (1), hvor disse affaldsdæk nedbrydes termisk til de organiske nedbrydningsprodukter i form af lavmolekylære carbonhydrider og uorganiske rest-affaldsdele, hvor der i en øvre del af reaktoren (1) er placeret et påfyldningskammer (2) med et par fyldningslukkemekanismer (3), hvis indre rum fyldes med affaldsdækkene, og hvor der

i den nederste del af reaktoren (1) uden for en akse på reaktoren (1) sideværts er placeret et udgangskammer (8) med et par udgangslukkemekanismer (9), i hvilke de uorganiske restdele anbringes ved hjælp af ekstruderingsudstyr (7), meds der i reaktorens (1) akse ved dennes bund er anbragt en generator (4) af en gasformig inert type, og i den nedre del af reaktoren (1) er anbragt dyser (5) til tilførsel af luft, ved hjælp af hvilken det milde gasformige inerte medium genereres via oxidation af ureageret organisk restmateriale fra de forarbejdede dæk, hvor dyserne er forbundet til et rør, der bærer en reguleringsventil (6) og luftgennemgang fra reaktorens udvendige rum (1), og

hvor der i den øverste del af reaktorens indvendige rum (1) under påfyldningskammeret (2) er placeret mindst en udgangsåbning (11),

hvor reaktoren (1) efter fyldning af reaktoren (1) med affaldsdækkene lukkes med mindst et af parrene af fyldningslukkemekanismer (3) og med mindst et af parrene af udgangslukkemekanismer (9),

en termisk nedbrydningsreaktion startes ved indledende flamme eller elektrisk opvarmning til driftstemperaturen på 600°C,

reaktionen udføres ved at påbegynde frembringelsen af et gasformigt medium i generatoren (4) og ved at køre en udstødningsventilation (15), som er en del af en første separator af væskepartikler,

ved hjælp af reguleringsventilen (6) indstilles luftens passage til oxidation af indholdet af rummet omkring generatoren (4), hvorved det inerte, gasformige medium opvarmes eksotermisk til en temperatur, hvis værdi styres af luftens strømningshastighed ved hjælp af reguleringsventilen (6), hvor det inerte gasformige medium, der fortsætter gennem reaktoren (1) til udløbsåbningen (11), bruges til termisk at nedbryde de dæk, der er placeret i dette rum, mens nedbrydningsprodukterne i en tilstand af lavmolekylære

carbonhydrider distribueres til mediet i form af aerosol,

dette inerte gasmedium, der, sammen med de deri opløste organiske nedbrydningsprodukter i form af aerosolen, føres gennem en anden tilvejebragt separator (12) af faste partikler og en tilvejebragt køler (17) ind i den første tilvejebragte separator (10) af flydende partikler fra den afkølede aerosol, som er udstyret med et første slutprodukt (21) af de flydende partikler til en tank (22) og et andet mellem-proces-produkt (23) for de gasformige partikler, der føres til direkte energianvendelse via forbrænding i termiske maskiner og føres ind i et frysekammer (24) til udskillelse af gasser med en kondenseringstemperatur, der er højere end temperaturen i dette kammer, hvorfra der endes op med et andet slutprodukt (25) af en del deri ikke-kondenserede gasser og et tredje slutprodukt (26) af den resterende del deri af ikke-kondenserede gasser.

DRAWINGS

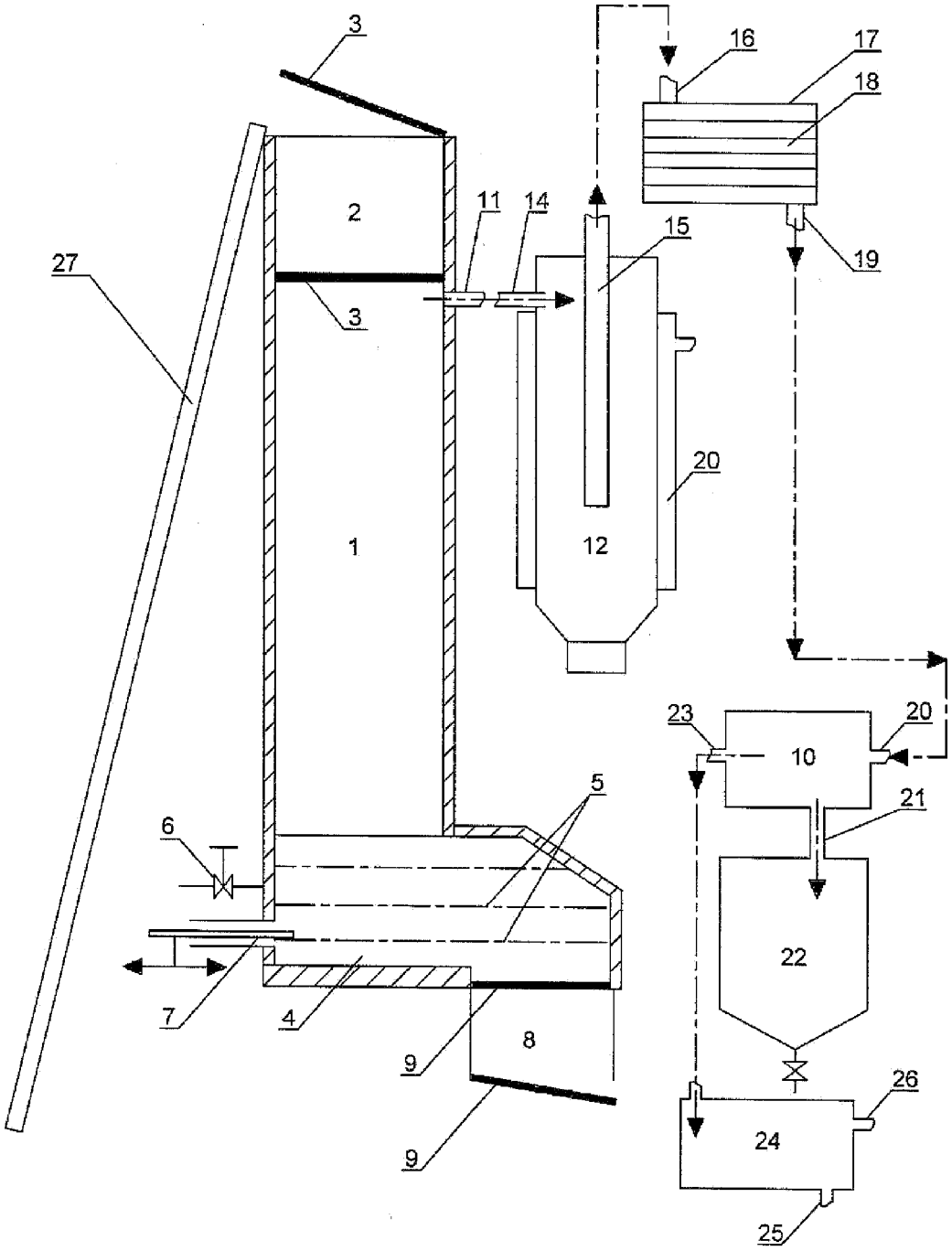

Fig. 1