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(54) **Device for feeding a burner with "Refuse Derived Fuels" (RDF)**

Zufuhrvorrichtung für Brenner mit Abfallbrennstoffen (RDF)

Dispositif pour l'alimentation de brûleurs à combustibles provenant de déchets (RDF)

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- **PATENT ABSTRACTS OF JAPAN vol. 007, no. 187 (M-236), 16 August 1983 (1983-08-16) & JP 58 088531 A (KOBE SEIKOSHO KK), 26 May 1983 (1983-05-26)**

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Description

[0001] The present invention refers to a device for feeding a burner with an unconventional and compressible solid fuel having low bulk density.

[0002] More in particular, the present invention refers to a device and its use for feeding a burner with an unconventional solid fuel having low initial apparent density and that can be compressed to a high density.

[0003] With the term "low bulk density unconventional and compressible solid fuel", as used in the present description and in the claims, reference is made to combustible substances resulting from urban waste processing or from car crashing such as, for instance, the RDF (Refuse Derived Fuels), coming from the treatment of the urban solid waste, or the so-called "fluff" resulting from the polymeric residues recovered from the car crashing.

[0004] It is well-known, from EP-A-0706839, that it is possible to produce a high-grade fuel, generally known as RDF, from the processing of urban solid waste. According to EP-A-0706839, the urban solid waste undergoes an automatic treatment consisting of a rough grinding, a drying process, a deodorization step in aerated heaps, a sieving and demetallization phase, to separate the inert material, and finally a fine grinding final step.

[0005] The so-obtained material has an inferior calorific value of about 14650 kJ/kg (3500 Kcal/Kg) and an amount of inert material lower than 20% by weight. It is, therefore, a material that can be used as recoverable source of energy and/or as an energy integration to the conventional fuels for furnaces, boilers and cement kilns.

[0006] The published Italian Patent Application No. MI96A2715, discloses a method for sorting RDF, or another unconventional fuel, derived from a urban solid waste processing plant which consists of several steps for separating the inorganic inert materials from the combustible ones. The resulting product is finely ground and is ready for the combustion application.

[0007] For this second step, the method disclosed in IT-A-MI96A2715 comprises several operative steps:

a) pressing the ground material in a parallelepiped-shaped container having a moving floor, such as, for instance, a conveyer belt, and containing an extractive screw disposed orthorgonally to the moving floor motion;
b) transporting the container to a combustion furnace, in case it is far from the RSU processing plant;
c) discharging the unconventional fuel, by scrapping the pressed mass with the extractive screw and activating the moving floor into a collecting device;
d) feeding the burner with the unconventional fuel, by connecting the collecting device with a pipe fed with compressed air.

[0008] The main drawback of this method for the RDF sorting, is that the scrapped material is discharged in the feeding pipe-line and fed to the burner through rotary cells which, because of their poor airtight, can cause reflows of air and material and, therefore, inefficiencies in the pneumatic transport lines and in the whole feeding system.

[0009] Moreover, the low bulk density of the scrapped material, from about 100 to about 180 Kg/m^3, is not an optimal condition for a correct running both of the feeding system and of the burner.

[0010] US-4,996,930 discloses a feed system for inceneration of contaminated material in an incinerator which operates at a reduced pressure with respect to the ambient pressure. The system is adapted to feed material at an high density.

[0011] The present inventors have now invented a device for feeding a burner with a solid unconventional fuel, such as RDF, which is able to overcome the drawbacks linked with the use of the rotary cells and with the solid fuel low density. This device, placed between the transporting container or the collecting device and the burner, enables to thicken again the material that has to be burnt, in order to be pneumatic any tight, and to feed the thickened material, through the compressed air, to the burner.

[0012] Therefore, the object of the present invention is to provide a device for feeding a burner with a low bulk density, unconventional and compressible solid fuel, which includes:

i. an entrance chamber having a feeding hopper;
ii. an advancing chamber for the forward moving of the fuel consisting of a cylindrical pipe having inside at least one rotating screw, moved by an outer rotative engine;
iii. a pressing chamber, inside which the solid fuel is pressed by the screw (ii) to a pressure of about 600 to 700 Kg/m^3; and
iv a cutting device put at the exit of the chamber (iii), connected to the rotating screw and bearing at least two self-sharping blades.

[0013] The entrance chamber (i) of the device of the present invention, corresponds essentially to the initial part of the advancing chamber. The hopper is set in correspondence to this chamber and fed with the unconventional fuel by, for example, the conveyer belt.

[0014] The advancing chamber (ii) for the forward moving of the material can contain more than one screw, for example two or three screws, with mutually different phases in order to obtain a better pressing effect. It is preferred, though, to use only one screw, because otherwise, in addition to the better forward thrust effect, the material could also be subjected to a further fragmentation.

[0015] The material is pressed in the chamber (iii) where it reaches a density between 600 and 700 Kg/m^3,

obtaining pneumatic tight.

[0016] The pressing or compacting chamber is essentially cylindrical and has on the internal wall a plurality of contrasting elements, disposed lengthwise, which contrast the rotative moving of the material and enable its pressing. The contrasting elements may be either baffles emerging from the internal surface or lengthwise grooves.

[0017] Furthermore the pressing or compacting chamber can be designed in a frusto-conical shape in order to enhance the pressing effect and improve the start up of the machine.

[0018] The pressed material is consequently cut by the blades which rotate at the same speed of the rotating screw, being connected to the screw itself. In order to obtain an improved pressing effect and a continuous feed, it is better to use three or four blades, set symmetrically to the rotative axis, to contrast the screw forward thrust effect.

[0019] The cut material is sucked up by a current of air again scattered for the turbolence of the current itself and fed to the furnace in a uniform way.

[0020] The device for feeding a burner with a low bulk density, unconventional, solid fuel according to the present invention, can be better understood by referring to the enclosed figures, which represent an exemplifying and not limitative realization thereof. In particular, FIG. 1 is a partially sectioned side view of the device according to the invention; and FIG. 2 is a front section view according to the line AA of FIG. 1.

[0021] With reference to the figures, the device, according to the present invention, comprises an entrance chamber 1, as initial part of the advancing chamber 2, a pressing chamber 3 and a cutting element. 4.

[0022] The entrance chamber has an hopper 5 and a screw 6, moved by an outer engine, possibly at a varying speed, not shown in the figures. The screw extends in the advancing chamber for forward motion. In the pressing chamber are installed a rotative shaft 7, connected from one side to the screw and from the other side to the cutting element, and contrasting elements 10.

[0023] The cutting element consists of a flange 8 and of blades 9.

[0024] The operation of the present device is clearly understood from the figures and from the above description. The low density, unconventional and compressible solid fuel is charged through the hopper 5 and piles in the chamber 1 where it is taken by the screw 6 and moved forward along the advancing chamber 2. The material is pressed in the chamber 3 by the screw with the aid of the contrasting elements 10, which contrast the rotative moving imposed by the screw 6, enable the forward movement and allow the formation of an high density seal.

[0025] The pressed material is a sort of plug causing a pneumatic seal between the chamber 1 and the current of air, under pression, which pneumatically transfers the fuel from the device to the burner of the furnace.

[0026] When the material comes to a critical density, related to its compressibility, to the push action of the screw and to the chamber design, it reaches the exit of the machine where it is cut by the blades 9, which rotate in syncrony with the screw 6, being connected to the screw itself by the shaft 7.

[0027] The cut material falls into an air-compressed pipe line, not shown in the figures, which pneumatically transports the solid to the burner of the furnace. Therefore, the furnace is fed with a high concentrated fuel, scattered in air, as being the result of the scrapping of the material pressed in the chamber 3.

Claims

1. Device for feeding a burner with a low bulk density unconventional and compressible solid fuel, such as RDF (Refuse Derived Fuel) or polymeric residues recovered from scrapped cars, comprising:

   i. an entrance chamber with a feeding hopper;
   ii. an advancing chamber for moving the fuel forward, consisting of a cylindrical pipe having inside at least one rotating screw, moved by an outer rotative engine;
   iii. a pressing chamber wherein the solid fuel is pressed by the screw (ii) to a density of about 600 to 700 Kg/m^3; and
   iv. a cutting device at exit of the chamber (iii), connected to the rotating screw and bearing at least two self-sharping blades.

2. Device according to claim 1, wherein said advancing chamber contains mutually dephased screws.

3. Device according to claim 1 or 2, wherein the solid fuel is pressed in said chamber where it reaches a density between 600 and 700 Kg/m^3, generating a pneumatic seal.

4. Device according to any of the preceding claims, wherein said pressing chamber is essentially cylindrical or frusto-conical and has on the internal wall a plurality of contrasting elements disposed lengthwise.

5. Device according to any of the preceding claims, wherein the cutting device comprises blades set symmetrically to the rotative axis of the screw.

6. A burner fed with a solid unconventional fuel having a low bulk density and a high compressibility, such as RDF (Refuse Derived Fuel) or polymeric residues recovered from scrapped cars, by a device comprising:

   i. an entrance chamber with a feeding hopper:

ii. an advancing chamber for moving the fuel forward, consisting of a cylindrical pipe having inside at least one rotating screw, moved by an outer rotative engine;
iii. a pressing chamber wherein the solid fuel is pressed by the screw (ii) to a density of about 600 to 700 Kg/m^3; and
iv. a cutting device at exit of the chamber (iii), connected to the rotating screw and bearing at least two self-sharping blades.

7. Use of the device claimed in any of the preceding claims 1-5, for feeding a burner with a solid unconventional fuel having a low bulk density and a high compressibility, such as RDF (Refuse Derived Fuel) or polymeric residues recovered from scrapped cars.

Patentansprüche

1. Zufuhrvorrichtung für einen Brenner mit verdichtbaren festen und unkonventionellen Brennstoffen niedriger Schüttdichte, wie RDF (Refuse Derived Fuel, Abfallbrennstoffe) oder aus aus verschrotteten Fahrzeugen wiedergewonnen polymerischen Resten, welche aufweist:

I. eine Einlaßkammer mit einem Zuführschacht,
II. eine Vorschubkammer zum Vorbewegen des Brennstoffes, welche aus einem zylinderförmigen Rohr besteht, welches im Inneren wenigstens eine rotierende Schraube aufweist, welche durch einen äußeren rotierenden Motor angetrieben wird,
III. eine Druckkammer, in welcher der feste Brennstoff durch die Schraube (11) zu einer Dichte von ungefähr 600 bis 700 Kg/m^3 verdichtet wird und
IV. einer Schneidvorrichtung am Auslaß der Kammer (III), welche mit der rotierenden Schraube verbunden ist und wenigstens zwei selbstschärfende Klingen beinhaltet.

2. Vorrichtung nach Anspruch 1, **dadurch gekennzeichnet, daß** die Vorschubkammer zwei zueinander phasenversetzte Schrauben beinhaltet.

3. Vorrichtung nach einem der Ansprüche 1 oder 2, **dadurch gekennzeichnet, daß** der feste Brennstoff in der Kammer auf eine Dichte zwischen 600 und 700 Kg/m^3 verdichtet wird, wobei eine pneumatische Dichtung erzeugt wird.

4. Vorrichtung nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, daß** die Verdichtungskammer im wesentlichen zylinderförmig oder kegelstumpfartig ist und auf der inneren Wand eine Vielzahl von in Längsrichtung angeordneten sich abhebenden Elementen aufweist.

5. Vorrichtung nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, daß** die Schneidvorrichtung einen zur Rotationsachse der Schraube symmetrischen Klingensatz aufweist.

6. Brenner, welcher mit einem unkonventionellen festen Brennstoff, welcher eine niedrige Schüttdichte und eine hohe Kompressibilität aufweist, wie beispielsweise RDF (Refuse Derived Fuel / Abfallbrennstoffe) oder aus verschrotteten Kraftfahrzeugen wiedergewonnene polymerische Reste durch eine Vorrichtung gespeist ist, wobei die Vorrichtung aufweist:

I. eine Einlaßkammer mit einem Zuführschacht,
II. eine Vorschubkammer zum Vorbewegen des Brennstoffes, welche aus einem zylinderförmigen Rohr besteht, welches im Inneren wenigstens eine rotierende Schraube aufweist, welche durch einen äußeren rotierenden Motor angetrieben ist,
III. eine Druckkammer, in welcher der feste Brennstoff durch die Schraube (II) zu einer Dichte von ungefähr 600 bis 700 Kg/m^3 verdichtet wird und
IV. eine Schneidvorrichtung am Auslaß der Kammer (III), welche mit der rotierenden Schraube verbunden ist und wenigstens zwei selbstschärfende Klingen beinhaltet.

7. Verwendung der in den vorstehenden Ansprüchen 1 bis 5 beanspruchten Vorrichtung zur Zufuhr von unkonventionellen festen Brennstoffen, welche eine niedrige Schüttdichte und eine hohe Kompressibilität aufweisen, wie beispielsweise RDF (Refuse Derived Fuel / Abfattbrennstoffe) oder aus verschrotteten Kraftfahrzeugen wiedergewonnene polymerische Rückstände, zu einem Brenner.

Revendications

1. Dispositif pour alimenter un brûleur à l'aide d'un combustible solide inhabituel et compressible, à faible densité volumique, tel que du Combustible Dérivé de Déchet (RDF) ou des résidus polymériques récupérés à partir de voitures mises au rebut, comportant :

i. une chambre d'entrée ayant une trémie d'alimentation,
ii. une chambre de progression destinée à déplacer le combustible vers l'avant, constituée d'un tuyau cylindrique ayant à l'intérieur au moins une vis rotative, mise en mouvement par

un moteur rotatif extérieur,
iii. une chambre de compression dans laquelle le combustible solide est comprimé par la vis (ii) jusqu'à une densité d'environ 600 à 700 Kg/m^3, et
iv. un dispositif de découpe situé à la sortie de la chambre (iii), relié à la vis rotative et supportant au moins deux lames auto-aiguisantes.

2. Dispositif selon la revendication 1, dans lequel ladite chambre de progression contient des vis mutuellement déphasées.

3. Dispositif selon la revendication 1 ou 2, dans lequel le combustible solide est comprimé dans ladite chambre où il atteint une densité comprise entre 600 à 700 Kg/m^3, créant un joint pneumatique.

4. Dispositif selon l'une quelconque des revendications précédentes, dans lequel ladite chambre de compression est essentiellement cylindrique ou tronconique et comporte sur la paroi intérieure une pluralité d'éléments d'opposition disposés longitudinalement.

5. Dispositif selon l'une quelconque des revendications précédentes, dans lequel le dispositif comporte des lames fixées symétriquement par rapport à l'axe rotatif de la vis.

6. Brûleur alimenté en combustible solide inhabituel ayant une faible densité et une grande compressibilité, tel que du Combustible Dérivé de Déchet (RDF) ou des résidus polymériques récupérés à partir de voitures mises au rebut, par un dispositif comportant :

i. une chambre d'entrée ayant une trémie d'alimentation,
ii. une chambre de progression destinée à déplacer le combustible vers l'avant, constituée d'un tuyau cylindrique ayant à l'intérieur au moins une vis rotative, mise en mouvement par un moteur rotatif extérieur,
iii. une chambre de compression dans laquelle le combustible solide est comprimé par la vis (ii) jusqu'à une densité d'environ 600 à 700 Kg/m^3, et
iv. un dispositif de découpe situé à la sortie de la chambre (iii), relié à la vis rotative et supportant au moins deux lames auto-aiguisantes.

7. Utilisation du dispositif revendiqué selon l'une quelconque des revendications 1 à 5, pour alimenter un brûleur à l'aide d'un combustible solide inhabituel ayant une faible densité volumique et une grande compressibilité, tel que du Combustible Dérivé de Déchet (RDF) ou des résidus polymériques récupérés à partir de voitures mises au rebut.

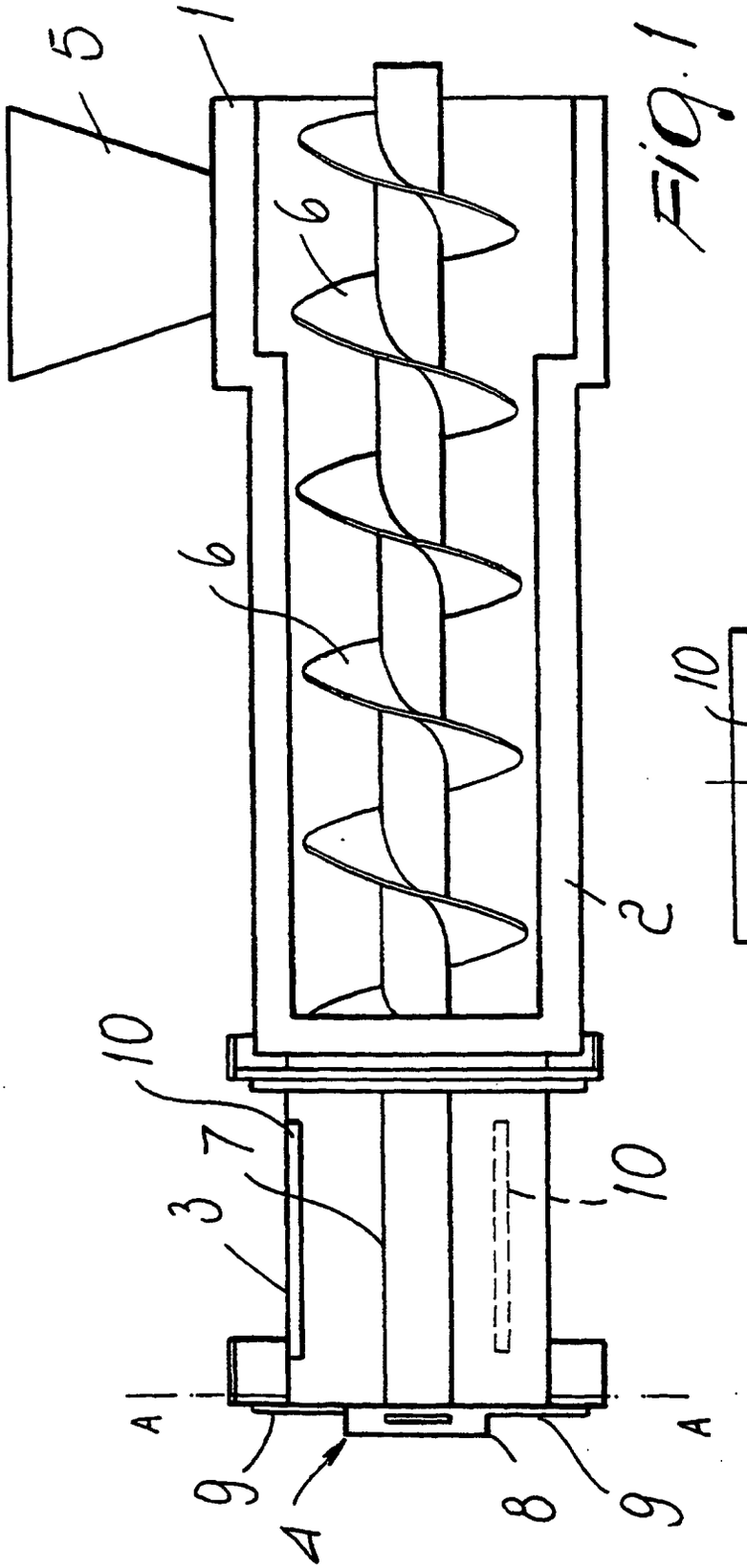

Fig. 1

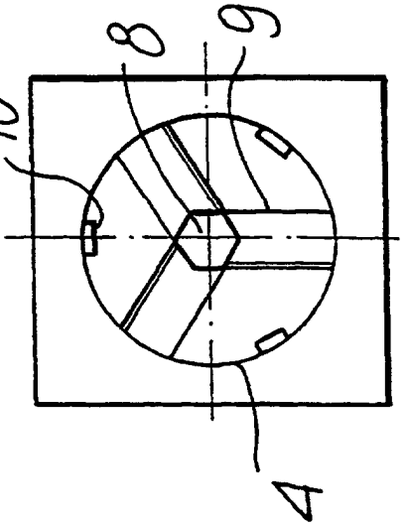

Fig. 2