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(54) **A heater being automatically fed with uniform geometry fuel units**

(57) A heater being automatically fed with uniform geometry fuel units (2) whereby an improved combustion is obtained and it is adequate for domestic, commercial and industrial use; said heater comprises a supporting structure (16) and a combustion chamber (8) being supported by said supporting structure (16); the heater is

characterized in that the combustion chamber (8) is exclusively fed on fuel by automatic feeding means; said automatic feeding means have an inlet region for receiving the fuel supplied by a user and an outlet region for automatically delivering the fuel to the combustion chamber (8).

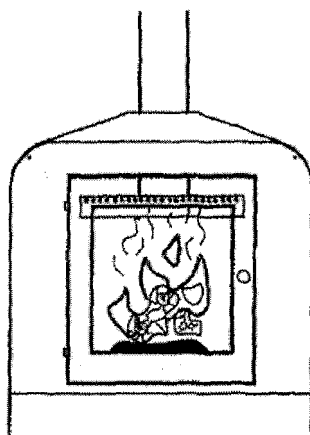


Fig. 1

Description

Background of the invention

[0001] As it is evident, the sustained growth of economy in Chile has led to a permanent increase of the energy demand. However, we know that the energy supply has been hindered by the country's lack of self-supply; its dependence on other countries has been one of its main problems, especially in respect of natural gas supply from Argentina.

[0002] Once the natural gas gasifying plant in Quintero starts operating, it will certainly permit a greater energy supply, although it is known that a higher cost of the energy will irremediably exist.

[0003] The problem inherent in the energy supply for domestic and commercial use has been most sensitive, since it involves an important social component. The energy destined to heating, food cooking and hot water supply certainly does not permit any interruption. In this scenario we could think that one of the natural and logical alternatives to be applied are renewable energies, such as firewood and biomass, which due to the diversity of climates could represent a significant alternative, where the Chilean central and south zones - having the greatest forest potential for wood production - are found, in addition to the historical culture of use of firewood ranges and stoves. As a consequence, mention is made of the problem of environmental pollution affecting very important cities of our country, such as Santiago, Rancagua, Chillán, Temuco, Osorno and others.

[0004] In effect, for over a decade the goodness of double combustion chamber firewood stoves appeared to be the solution, since everything suggested that by being most efficient they emit less contaminants into the external environment; however, everybody knows that there is a major variable, which is difficult to control by the agencies entrusted with environmental pollution matters, such as the need to use firewood suitable for heating purposes that has a low humidity content (under 20%). For this reason, it is of little advantage to have a stove manufactured according to a good technology if the wood is very humid; therefore, an excessive rise of the environmental pollution level is produced, since no practical regulations force the consumers to use only wood with 20% humidity or less.

[0005] In the practice, users can buy firewood in the informal market at a lower cost, but without its fitness for heating purposes being duly guaranteed. According to statistics delivered by CONAMA (the National Environmental Commission), it is estimated that during the year 2006 over 600 tons of PM 10 particulate material were discharged in Santiago, which is attributable to the use of firewood for heating and food cooking; these contamination levels are similar to those emitted by the industry and the overall collective transportation system of the city.

[0006] According to CONAMA, in 2006 over 70,000

firewood stoves were installed in Santiago and this figure would exceed one million in the country as a whole. A very strong expansion level has been projected and it could possibly reach three million firewood stoves by the year 2020. The reasons behind this expansion are the attraction and coziness offered by open fire stoves, in addition to their considerable heating capacity; however, their main attractive lies in their low operating cost; according to studies performed by Universidad Austral de Chile, firewood heating can be up to 14 times less expensive than electricity, 9 times cheaper than gas and almost 8 times cheaper than oil.

[0007] Firewood represents 17% of the energy consumption in Chile.

[0008] The market for firewood appliances in Chile is as follows:

(a) Yearly sales of double chamber combustion stoves: 70,000 units at an average unit value of CH\$150,000.-

(b) Yearly sales of firewood ranges: 80,000 at an average value of CH\$ 140,000.-

Summary of the invention

[0009] The present invention consists in contributing an appliance that uses biomass as fuel, equipped with closed combustion chamber, which incorporates a fuel feeding system in the form of briquets made of pressed sawdust using a high tonnage press. This fuel has been designed for the appliance according a specific geometric shape and dimensions, which is loaded to the stove around the combustion chamber. The fuel drops by gravity into the lower portion of the heater; next, each briquet is raised through the side portion of the supporting structure of the appliance by means of an internal conveyor.

[0010] The movement of the fuel (briquets) conveyor is performed by a stepper electric motor, i.e. the motor feeds the briquets one by one into the fuel chamber according to the heating needs of the environment by means of a thermoelectric control mechanism.

[0011] The main characteristics of the present invention are the following:

(a) TO ESTABLISH A SINGLE AND REGULAR FUEL. The combustion chamber is closed in the front part and the user has no direct access to it, as it is now the case with all firewood stoves; it can be provided with a glass window that only permits to see the fire inside the chamber. In respect of the chamber, the appliance can only operate with a predefined fuel and not in the way the user commonly proceeds today, wherein very humid wood can be used without controlling the size and load of the combustion chamber.

The briquets are produced according to predefined standards of humidity, density, dimensions and raw material involved. This fuel can be sold in the formal

market inside a suitable packing that maintains the original humidity content, preferably not higher than 20%.

(b) AUTONOMY OF THE APPLIANCE. The standard stove considers a briquets transportation circuit that permits to load the unit with about 20 briquets of approximately 500 grams each, i.e., a 10 kg load inside the stove. If we consider an average consumption of 1.5 kg per hour, this means an estimated autonomy of 6 to 7 hours. In other words, the user can load its stove when going to bed and maintain the heating throughout the night.

(c) GREATER HEATING EFFICIENCY. In the use of this heating invention, the appliance can incorporate a turbine to drive the surrounding environmental air through the hot external part of the combustion chamber and thereby increasing the radiation efficiency of the heater; in other words, the heating capacity is comparatively increased in a shorter time as compared with the conventional firewood stoves equipped with single or double combustion chamber.

(d) VARIED APPLICATIONS. This appliance can have diverse applications; e.g., aside from heating, it can be used in firewood ranges where the stepper motor is substituted with a direct manual system for driving the briquets step by step inside the combustion chamber. In this way, the food cooking speed can be controlled according to the needs and the time availability of the user.

[0012] The stove can also be used to heat water in commercial and industrial boilers.

[0013] The appliance can be provided with a ceramic glass in its front part, so that the user can see the intensity of the fire, although access to the stove by introducing directly the fuel into the chamber is not possible, according to the principles already indicated for this invention.

[0014] In view of the foregoing, the present invention means a technical and practical solution that permits to control the fuel load to the stove, a feature that has not been contemplated in the current units equipped with combustion chamber through radiation; in this way, the aspect of environmental pollution can be controlled, especially in the cities already referred to in this specification.

[0015] The client can enjoy autonomy, inasmuch as he/she is not permanently concerned with the introduction of firewood to the heater in order to avoid its becoming extinguished.

Description of the drawings

[0016] For a better understanding of the characteristics and advantages of this invention, by way of complement, a number of drawings are enclosed, which are of an illustrative and not restrictive character, where:

Figure 1 illustrates a scheme of the operating prin-

ciple of a traditional double combustion chamber heater.

Figure 2 shows a scheme of the operating principle of a traditional firewood range without a double combustion chamber.

Figure 3 describes the principle of a heater according to the present invention, namely, every time the stepper motor is actuated, a single briquet is introduced inside the combustion chamber.

Figures 4 and 5 show the fuel briquets loading mechanism, according to the present invention, into the environmental loading side of the heater.

Figures 6 and 7 show a manual ignition mechanism of the heater of the invention.

Figure 8 shows, an automatic temperature control mechanism and manual "step" control, according to the present invention.

Figures 9 and 10 show a heat transfer mechanism by natural radiation and forced convection.

Figure 11, show an ash combustion discharge mechanism, according to the present invention.

Figure 12 illustrates a traditional firewood range incorporating the feeding mechanism with fuel side loading (briquets) according to the present invention.

Detailed description of the preferred embodiment of the invention

[0017] With reference to Figure 1, it is illustrated a scheme of the operating principle of a traditional double combustion chamber heater.

[0018] With reference to figure 2, it is illustrated a scheme of the operating principle of a traditional firewood range without a double combustion chamber.

[0019] With reference to figure 3, it is illustrated the principle of a heater according to the present invention, namely, every time the stepper motor is actuated, a single briquet is introduced inside the combustion chamber. Said combustion chamber can be made of steel and can correspond to the double or single combustion type.

[0020] Figures 4 and 5 describe the form of loading the appliance with briquets. Through the gate (1) briquets (2) are orderly introduced into the heater, since the fuel concerned has fixed and regular dimensions. The briquets descend by gravity to the pitch sheave (3) that includes radial lugs, which is driven by a stepper electric motor (4). The pitch sheave (3) permits that briquets pass one by one into the conveyor (5).

[0021] Said conveyor (5) may correspond to a chain mechanism equipped with devices for guiding the briquets (2), being driven by toothed pinions made of steel or other heat-resistant material; the pinions are connected by means of an axis made of steel or other suitable material.

[0022] In the normal operating phase, once the stepper motor (4) is driven by means of a thermoelectric signal, the following simultaneous movements are produced:

1. The pitch sheave (3) effects one step.
2. The upper rotary gate (9) opens and a briquet falls into the chamber (8).
3. The conveyor (5) effects one pitch movement.

[0023] Once the briquets loading inside chamber (8) is complete and the respective motor (4) stops, the upper gate (9) closes and the pitch sheave (3) also stops.

[0024] Figures 6 and 7 illustrate the initial manual ignition mechanism of the heater; this takes place by displacing the ignition lid (6) in order to enable the introduction of an inducer element, paper or the like, which through a match can cause the ignition of the briquets (2) placed over the rack or grid (7) inside the combustion chamber (8).

[0025] Said ignition lid (6) can be opened to a greater or lesser extent in order to permit the entry of a greater or smaller air flow into the combustion chamber (8).

[0026] Figure 8 describes the fuel entry control systems into the combustion chamber. There are two options for controlling the entry of fuel into the combustion chamber, namely:

- Automatically, through thermoelectric signals. This means that a room temperature sensor device has been provided, either by means of a thermostatic bulb (10) or an environment thermostat (11). These elements have been previously set for a comfortable temperature and will transmit an energy signal to the stepper motor (4). The minimum movement is of one pitch, i.e., the equivalent to introducing one briquet into the combustion chamber.
- Manually: the user has the option to press the push-button (12), whereby the stepper motor is actuated and one briquette enters into the combustion chamber. Every time the motor is in standstill and the user presses the pushbutton (12) this will cause one pitch for feeding the combustion chamber.

[0027] Figures 9 and 10 illustrate the main forms in which the appliance of the present invention transfers heat into the environment, namely, by means of radiation through the glass and the upper part of the heater and by forced convection through the air flow entering by the heater rear part operated by the turbine (13), which drives the environmental air through the heated external surface of the combustion chamber and thereby picks up the heat generated by the combustion chamber (8). Said turbine can be a steel fan driven by an *ad hoc* electric motor.

[0028] Between the combustion chamber (8) and the briquets compartment in the heater supporting structure (16) a thermal insulation layer (17) has been installed, with the object of avoiding an overheating in the briquets storage zone.

[0029] Figure 11 describes the form of extracting the ash generated by the briquets combustion inside the combustion chamber. The procedure consists in opening the lid (6) and displace it laterally and by means of the

scraper (14) the ash into the rear part of the rack is moved (7), which falls into the ashtray (15); the latter element can be extracted by the user from the supporting structure (16) of the stove for its disposal.

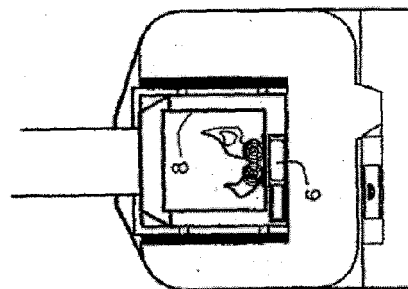
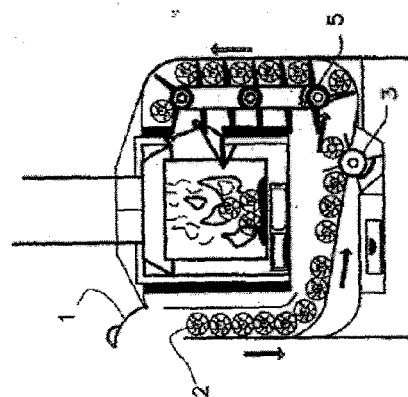
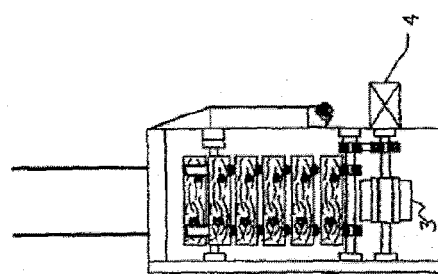
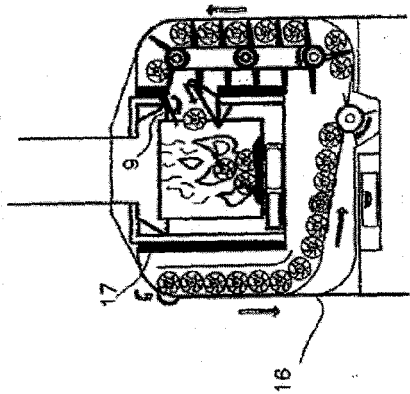
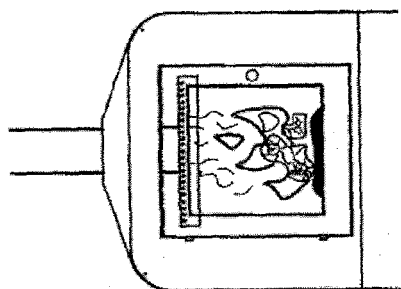
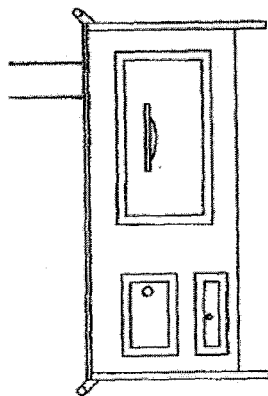
5 [0030] Said ashtray (15) can consist of a metallic pan for retaining the ash, from which ash can be eventually extracted by the user for its elimination.

10 [0031] Figure 12 illustrates a traditional firewood range incorporating the feeding mechanism with fuel side loading (briquets) according to the present invention.

Claims

- 15 1. A heater being automatically fed with uniform geometry fuel units (2) whereby an improved combustion is obtained and it is adequate for domestic, commercial and industrial use; said heater comprises a supporting structure (16) and a combustion chamber (8) being supported by said supporting structure (16); the heater is **CHARACTERIZED in that** the combustion chamber (8) is exclusively fed on fuel by automatic feeding means; said automatic feeding means have an inlet region for receiving the fuel supplied by a user and an outlet region for automatically delivering the fuel to the combustion chamber (8).
- 20 2. A heater according to Claim 1, **CHARACTERIZED in that** said automatic feeding means comprise a descent region and a pitch sheave (3) that includes radial lugs; the descending region defines a passage for the fuel units (2), which descend by gravity, being located between the inlet region and the pitch sheave (3).
- 25 3. A heater according to Claim 2, **CHARACTERIZED in that** said automatic feeding means comprise an ascent region defined by a conveyor (5), said ascent region defines a passage for the fuel units between the pitch sheave (3) and the outlet region.
- 30 4. A heater according to Claim 3, **CHARACTERIZED in that** said automatic feeding means comprise a stepper motor (4) that mechanically drives both the pitch sheave (3) and the conveyor (5); the lugs of said pitch sheave (3) are conveniently arranged in order that every time the stepper motor (4) is actuated, the pitch sheave (3) rotates one step and permits that one fuel unit passes to said conveyor (5); likewise, the conveyor (5) is conveniently defined so that every time that the stepper motor (4) is actuated, one fuel unit enters in said combustion chamber (8) from the conveyor (5) and across the outlet region; said combustion chamber (8) is provided with an upper gate (9) mechanically connected to said stepper motor (4), in order to be opened and closed in a coordinated manner upon the entry of the fuel units (2).
- 35 40 45 50 55

5. A heater according to Claim 4, **CHARACTERIZED in that** the heater is equipped with a control mechanism being connected with a temperature sensor and with the stepper motor (4); said control mechanism defines the moment to actuate the stepper motor (4) in order to feed the combustion chamber (8) with fuel units, in such a way that the temperature measured by said temperature sensor is maintained within a comfortable range being predefined by the user. 5
6. A heater according to Claim 4, **CHARACTERIZED in that** the heater comprises a control mechanism being connected to user operated pushbutton (12) and to said stepper motor (4); the control mechanism is conveniently defined in order to permit that the combustion chamber (8) is fed by one fuel unit every time the pushbutton (12) is pressed by the user, provided the stepper motor (4) is not in movement when said pushbutton (12) is pressed. 10
7. A heater according to Claim 1, **CHARACTERIZED in that** the combustion chamber (8) is provided with a rack or grid (7) placed at its bottom part, through which air can enter into the combustion chamber (8) and ash can drop from the chamber into an ashtray (15) placed under said combustion chamber (8); the ashtray (15) can consist of a metallic pan for retaining the ash, from which ash can be eventually extracted by the user for its elimination. 15
8. A heater according to Claim 7, **CHARACTERIZED in that** the heater comprises a scraper (14), which when operated by the user it permits to push the ash from inside the combustion chamber and force it to drop into the ashtray (15). 20
9. A heater according to Claim 8, **CHARACTERIZED in that** the heater comprises an ignition lid (6), which when it is opened it connects the exterior to a cavity located under said grid (7) and above ashtray (15); the ignition lid (6) can be opened to a greater or lesser extent in order to permit the entry of a greater or smaller air flow into the combustion chamber (8). Said cavity also permits to introduce ignited paper or other elements during the ignition operation of said heater. 25
10. A heater according to Claim 1, **CHARACTERIZED in that** it comprises a turbine (13) that drives the surrounding air through the external cover of the combustion chamber (8), whereby an increase of the heat transfer through forced convection into the environment is produced; said turbine can be a steel fan driven by an *ad hoc* electric motor. 30
11. A heater according to Claim 1, **CHARACTERIZED in that** the uniform geometry combustion units are elaborated from mechanically pressed biomass having a humidity content lower than or equal to 20%. 35
12. A heater according to Claim 1, **CHARACTERIZED in that** said heater is included in a range or cooker of the "firewood" type, with the object of generating the necessary heat for cooking. 40
13. A heater according to Claim 1, **CHARACTERIZED in that** the heater inlet region coincides with a gate (1) that can be opened and closed by the user and is arranged in the supporting structure (16). 45
14. A heater according to Claim 1, **CHARACTERIZED in that** a thermal insulation (17) is placed in the zone adjacent to the combustion chamber, in order to avoid the overheating of the fuel units (2). 50
15. A heater according to Claim 1, **CHARACTERIZED in that** said combustion chamber is made of steel and it can correspond to the double or single combustion type. 55
16. A heater according to Claim 3, **CHARACTERIZED in that** the conveyor (5) corresponds to a chain mechanism equipped with devices for guiding the units (2), being driven by toothed pinions made of steel or other heat-resistant material; the pinions are connected by means of an axis made of steel or other suitable material.
17. A heater according to Claim 3, **CHARACTERIZED in that** passages have been arranged inside the supporting structure (16).



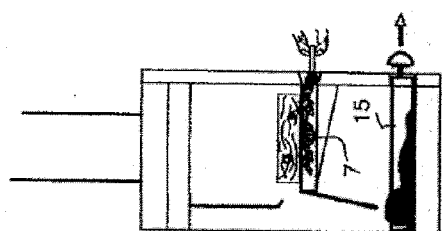


Fig. 7

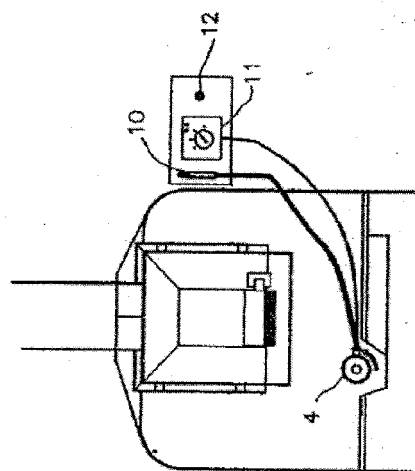


Fig. 8

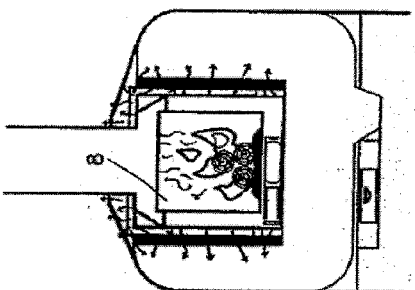


Fig. 9

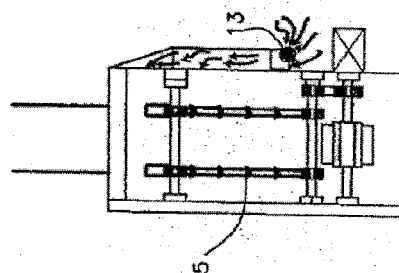


Fig. 10

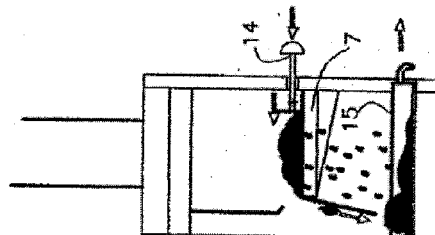


Fig. 11

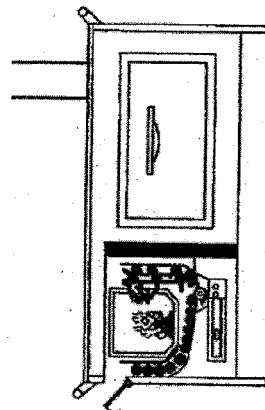


Fig. 12