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(54) **SOLID FUEL HEATING APPLIANCE**

FESTBRENNSTOFFHEIZGERÄT

APPAREIL DE CHAUFFAGE À COMBUSTIBLE SOLIDE

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(73) Proprietor: **CS THERMOS s.r.l.**
31020 San Vendemiano - TV (IT)

(72) Inventor: **Canzian, Sigismondo**
31020 SAN Vendemiano (TV) (IT)

(74) Representative: **Santi, Filippo et al**
Barzanò & Zanardo Roma S.p.A.
Via Piemonte 26
00187 Roma (IT)

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Description

[0001] The present invention generally relates to a solid fuel heating device, such as a stove or a boiler.

[0002] More particularly, the invention relates to a stove for heating rooms, equipped with a poly-fuel burner, which is able to burn, in addition to wood and to all types of wood pellets, also scraps of agricultural processing, i.e. organic matter, such as the "bio-mass".

[0003] Examples of bio-mass as solid fuel which can be used in the stove of the invention are the crushed and full olive pits (waste of olive oil processing), the pelletized pruning of vines (waste of grape growing), the cherry's kernels (waste of the cherries processing), the shells of almonds/hazelnuts/pinenuts (waste from the corresponding processing), the corn (dried to 13% and used mixed with wood pellet), the pellet of miscanthus (which does not require drying to become pellet), the agripellet (consisting of waste products of cereals mixed with wood or pruning) and the industrial pellet (made from twigs and bark).

[0004] Said examples of bio-mass fuels are called "energy pellet", because they have a great performance on combustion and are also available at a reasonable price; however, said types of biomass are considered not excellent for quality, because they tend to clog and block the traditional stoves, as they produce a lot of ash.

[0005] Furthermore, there still exist on the market many types of wood pellet with features and calorific power very different between them, which, however, very often clog the traditional stoves, as they produce a high silicon-rich ash-compound, which is extremely difficult to dispose.

[0006] EP2824049A describes a solid fuel heating appliance according to the preamble of claim 1.

[0007] The present invention aims to overcome the above mentioned drawbacks of the known art.

[0008] In particular, an object of the invention is to provide a solid fuel heating appliance which allows to burn different types of bio-mass and different types of pellet, also of poor quality, i.e. obtained with the tree's branches and bark and/or with exotic wood (silicon-rich).

[0009] Another object of the present invention is to provide a solid fuel heating appliance, which allows to use different solid fuels and which allows to carry out an automatic restart on request at the ambient temperature and/or a power modulation, according to which the stove goes to the minimum power to the achievement of the desired temperature, with consequent savings of electric energy, higher fuel utilization and improved efficiency of the stove.

[0010] A further object of the present invention is to provide a solid fuel heating appliance, which has advantages in terms of cost savings on the purchase of the fuel and which allows a periodic, automatic and simple cleaning. These and other objects are achieved by a solid fuel heating appliance according to the appended claim 1; further technical features of the solid fuel heating appli-

ance, which is the object of the invention, are contained in the other dependent claims.

[0011] First of all, it should be noted that, although the following description and the enclosed drawings relate specifically to a solid fuel stove, the present invention can be similarly employed, with the same effects and advantages, in other solid fuel heating apparatus, such as boilers, thermo-stoves, etc.

[0012] Advantageously, the heating apparatus of the present invention allows the use of any type of solid fuel, such as wood, pellet and bio-mass, and, specifically, not only pellet of excellent quality, but also pellet derived from production waste (bark and twigs) and pellet producing a high percentage of ash; the burner used in the above heating apparatus is also able to use different types of bio-mass, including hazelnut shells, almond shells, olive pits, vine shoots pellet, grape seed pellet, miscanthus pellet, etc., with a considerable saving of costs compared to the wood pellet of good quality and a high availability of the solid fuel, as it is not subject to discontinuous availability of the wood pellet on the market.

[0013] The heating apparatus can also be used with operation at shutdown, with automatic restart on request at the ambient temperature, or with a modulating operation, according to which the appliance is brought to a minimum power when the desired temperature is reached; in particular, the modulating operation increases the electric energy saving (as the resistors work for less time), the duration of the resistors (due to the low mechanical wear), and the exploitation of the fuel (because it is possible to get a better efficiency of the heating appliance).

[0014] The use of a poly-fuel burner provides advantages in terms of cost savings on purchasing the fuel and also allows a periodic cleaning of the appliance, in an extremely simple and quick way; the automatic cleaning is part, in fact, of the normal working cycle of the burner, which, at predetermined time, stops the falling of the fuel and carries out a complete cleaning of the external structure, together with a regular cleaning of the ash collection tray.

[0015] Moreover, an anti-dust filter, which is placed under the ash tray, is able to hold the environment dust and prevents it from being re-circulated by the hot air.

[0016] Finally, the design features of the heating appliance of the present invention allow to avoid any return of the flame from the burner to the solid fuel tank, any fumes compression and the relative increase in pressure that is produced into the heater and that could lead, together with the problems of clogging due to the wet pellet, to a dirty stove or to a clogged chimney, to the explosion of the front glass.

[0017] Furthermore, the use of two adjacent resistors, which work simultaneously to trigger the ignition, allows to inflame any type of fuel, even very wet, and also in particular installations, as for example in high mountain where the combustion air is always colder than normal.

[0018] Moreover, the failure of a resistor does not bind

the operation of the product and the user can continue to use it; the service call to replace the defective resistance can then be handled at the earliest opportunity and, in the meantime, the ignition of the heating appliance is carried out by means of the other resistor.

[0019] These and other objects and advantages, which will be more clear in the following, are also more clear from the following description relating to a preferred embodiment of the solid fuel heating apparatus, which is the object of the present invention, and from the enclosed drawings, in which:

- figure 1 is a perspective view of solid fuel stove, according to the present invention;
- figure 2 is a perspective view of an enlarged detail of the solid fuel stove of figure 1, according to the invention;
- figure 3 is an exploded perspective view of the burner used in the solid fuel stove of figure 1, according to the invention;
- figures 4, 5, 6 and 7 show a series of views of other enlarged details of the burner of figure 3, according to the invention.

[0020] With reference to the above mentioned drawings, 21 generally indicates an external casing of a solid fuel stove, according to the present invention, which has a top cover 18 where there is formed a space 23 through which the solid fuel is inserted and from which a portion of a tube connected to the flue protrudes, a base 34 and an inner compartment 25 within which a burner 40 and the related combustion chamber are housed, said burner 40 and said combustion chamber being associated to a combustion air suction compartment 32, with a respective duct 30 and a containment chamber 24, and to an underlying container for collecting the ash and the waste generated by the combustion.

[0021] A pipe 27, which provided behind the stove, provides to insufflate a forced and adjustable jet of primary air taken from the outside, in order to cause the ignition of the combustion material and simultaneously the adjacent electrical resistors 26 are switched on, while the tangential fan 29, placed in the final part of the gas flue and before the discharge connection, is employed to force the secondary air within the combustion chamber and to extract the fumes resulting from the combustion.

[0022] The screw conveyor 42 is configured to load the solid fuel from the tank 36 to the combustion chamber and is able to "dose" the solid fuel, because by varying the speed and frequency of its motion it is possible to measure the quantity of solid fuel to be supplied to the burner 40 in a time unit.

[0023] In particular, according to the present invention, a first screw conveyor 42 picks up the solid fuel from the tank 36 and delivers it, through the load motor 22, upwards and in an oblique direction, before dropping it along a conduit 35 which is perfectly vertical; a second horizontal screw conveyor 20, which rotates in a clockwise

direction within the horizontal conduit 17, is configured to push the solid fuel inside the self-cleaning burner 40, where the fire is ignited by the two electric resistors 26 in about 5 minutes. The design feature of the above-mentioned loading of solid fuel avoids any backfire from the burner 40 to the tank 36, since the vertical duct 35 avoids any possibility of the flame to go up again towards the tank 36 and the horizontal screw container 20, which is driven by a specific motor 6 with a respective inductive sensor 7 so that the motor 6 is driven always more quickly than the load motor 22, push forward the solid fuel coming from the tank 36, until it is brought to the burner 40; thus, the vertical duct 35 is always free of accumulations of solid fuel, thus increasing the safety of the stove.

[0024] The burner 40 is formed by a shaped basket 2, coupled to an external conveyor 4, a mouthpiece 3 and a front attachment plate 5, which has a shaped duct 33 for passing the intake air.

[0025] The shaped basket 2 has an iron rotary ring 34, with slots 38 on its lateral surface and provided with supporting blades 37; the rotary ring 34 is screwed to a rotating shaft 31, which in turn is driven by a relative motor 8, with a related inductive sensor (not shown in the figures).

[0026] The shaft 31 rotates within a cylindrical duct (when there are placed two bushings made of Teflon®), which is fixed on the casing of the chamber 24 by means of fastening screws, which allow the centering of the basket 2 on the burner 40.

[0027] The ring 34 is thus rotated by the drive 31 and by means of the related inductive sensor, which controls the drive motor 8 for predetermined time intervals, so as to obtain a rotation of the ring 34 at discrete steps and for prefixed angles of rotation and so as to stop the ring 34 in the desired positions.

[0028] Therefore, the ring 34 rotates in spurts and clockwise, so that, during rotation, the combustion residues, which pass through the slots 38, are dragged upwards on the upper wall 11 of the conveyor 4 and towards the side duct 39 of the basket 2, which faces in correspondence of a hook or spur 9, which is welded in turn on the inner part of the mouthpiece 3.

[0029] The contrast action between the combustion residues conveyed upwards on the hook 9 causes a complete crushing and compacting of the heavy wastes, which are formed, for example, by the combustion of different types of biomass, and a final discharge of the ashes in the ash tray.

[0030] Furthermore, the finer ash produced in the burner 40 is discharged directly towards the removable drawer placed below the ring 34, through the slots 38 and the shaped opening 10 formed on the upper wall 11 of the conveyor 4.

[0031] Therefore, the technical features mentioned above allow to burn any type of solid fuel, such as wood pellet and different type of bio-mass, within heating apparatus operating with solid fuel, such as stoves, thermostoves, boilers, etc.

[0032] According to preferred embodiments, the rotation of the ring 34 takes place in discrete steps and for angles of 90°, so as to ensure that the horizontal duct 17, from which comes out the solid fuel, and the electric resistors 26 are always positioned, when the ring 34 is stopped, at the spaces provided between the supporting blades 37 (which, in turn, are preferably four and placed at 90° one from the other, according to a radial shaping).

[0033] The compartment air intake 32 is placed on the lower part of the burner 40 and conveys the combustion air, via the duct 33, towards the slots 38 of the ring 34; moreover, the particular shape of the conveyor 4 forces the incoming combustion air to pass only in correspondence of the slots 38 placed at the bottom and centrally with respect to the conveyor 4, so that the combustion is optimal.

[0034] The electric resistors 26, which heat the air up to bring it to a temperature such that the solid fuel is ignited, are arranged near the lower part of the rotating ring 34, since, in this way, they are able to ignite the fuel in the most shortest time, while the horizontal duct 17, which conveys the solid fuel inside the melting pot of the burner 40, comes out at the upper portion of the basket 2, so that the flame which arises on the basis of the melting pot cannot overheat the duct 17.

[0035] The technical features of the solid fuel heating appliance, which is the object of the present invention, are clear from the above description, as well as the related advantages.

Claims

1. Solid fuel heating appliance, comprising a burner (40) and a related solid fuel combustion chamber, within which is blown, through a pipe (27), air taken from outside for the ignition of said solid fuel, said ignition occurring through the powering of at least two adjacent electrical resistors (26), said solid fuel being conveyed within a melting pot of said burner (40) via at least one filling and dosing screw conveyor (42), which draws the solid fuel from a tank (36) that is rechargeable from outside, wherein said burner (40) includes a shaped basket (2), which is coupled, at least partially, with a conveyor (4), a frontal mouthpiece (3) and a fixing plate (5), which has a shaped duct (33) for sending air into said burner (40), said shaped basket (2) being composed of a rotating ring (34), which is mounted in front of said electrical resistors (26) and which is mounted in front of a duct (17) carrying said solid fuel within said melting pot, said basket (2) being provided with lateral slots (38) for passing through the solid fuel wastes and with central supporting blades (37), said ring (34) being mounted on a rotating shaft (31) which is configured to move the ring (34) for prefixed time intervals and for prefixed angles, and wherein said conveyor (4) has at least one first surface (11) facing to a plurality

of said slots (38) and a side duct (39), which is placed laterally with respect to said first surface (11), **characterized in that** during the rotation of said ring (34) said solid fuel wastes are dragged firstly on said first surface (11) of the conveyor (4) and then towards said side duct (39), which is placed in correspondence of a hook (9), which is welded, in turn, to and internally of said frontal mouthpiece (3), in order to carry out a complete crushing and compression of said solid fuel wastes.

2. Heating appliance according to at least one of the preceding claims, **characterized in that** a removable drawer for collecting ashes is placed below said ring (34) and said side duct (39).
3. Heating appliance according to at least one of the preceding claims, **characterized in that** said supporting blades (37) are placed at 90° from each other, according to a radial shaping.
4. Heating appliance according to at least one of the preceding claims, **characterized in that** said shaped duct (33) of said fixing plate (5) conveys combustion air on the slots (38) of said ring (34) which are placed below and centrally with respect to said conveyor (4).
5. Heating appliance according to at least one of the preceding claims, **characterized in that** said electrical resistors (26) are arranged near the lower part of said ring (34).
6. Heating appliance according to at least one of the preceding claims, **characterized in that** said duct (17) carrying said solid fuel is placed horizontally and perpendicular to said basket (2) and flows in correspondence of an upper portion of the basket (2).
7. Heating appliance according to claim 6, **characterized in that** a first screw conveyor (42), driven by a first motor (22), is used to draw said solid fuel from said tank (36) and to carry it along a substantially vertical direction, before dropping it along a vertical duct (35), while a second screw conveyor (20), which rotates within said duct (17) and which is horizontal, will push the solid fuel inside said melting pot.

Patentansprüche

1. Festbrennstoffheizgerät, einen Brenner (40) und eine zugehörige Festbrennstoffbrennkammer umfassend, in der durch ein Rohr (27) Luft, die von außerhalb übernommen wird, für die Zündung des Festbrennstoffs geblasen wird, wobei die Zündung durch die Stromversorgung von mindestens zwei angrenzenden elektrischen Widerständen (26) auftritt, wo-

- bei der Festbrennstoff über mindestens einen Füll- und Dosierschneckenförderer (42) in einen Schmelztiegel des Brenners (40) befördert wird, der den Festbrennstoff aus einem Tank (36) zieht, der von außerhalb nachfüllbar ist, wobei der Brenner (40) einen geformten Korb (2) beinhaltet, der mindestens teilweise mit einem Förderer (4), einem vorderen Mundstück (3) und einer Befestigungsplatte (5) gekoppelt ist, die einen geformten Kanal (33) zum Senden von Luft in den Brenner (40) aufweist, wobei sich der geformte Korb (2) aus einem Drehring (34) zusammensetzt, der vor den elektrischen Widerständen (26) montiert ist, und der vor einem Kanal (17) montiert ist, der den Festbrennstoff in dem Schmelztiegel trägt, wobei der Korb (2) mit seitlichen Schlitten (38) bereitgestellt ist, um die Festbrennstoffabfälle hindurchzuführen, und mit zentralen Trägerschaukeln (37), wobei der Ring (34) auf einer Drehwelle (31) montiert ist, die konfiguriert ist, um den Ring (34) in zuvor festgelegten Zeitintervallen und zuvor festgelegten Winkeln zu bewegen, und wobei der Förderer (4) mindestens eine erste Oberfläche (11), die einer Vielzahl der Schlitten (38) zugewendet ist, und einen Seitenkanal (39) aufweist, der in Bezug auf die erste Oberfläche (11) seitlich platziert ist, **dadurch gekennzeichnet, dass** während der Drehung des Ringes (34) die Festbrennstoffabfälle zuerst auf der ersten Oberfläche (11) des Förderers (4), und dann in Richtung des Seitenkanals (39) geschleift werden, der entsprechend einem Haken (9) platziert ist, der wiederum an und innerhalb des vorderen Mundstücks (3) angeschweißt ist, um eine vollständige Zerkleinerung und Verdichtung der Festbrennstoffabfälle durchzuführen.
2. Heizgerät nach mindestens einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** eine herausnehmbare Lade zum Aufsammeln der Asche unter dem Ring (34) und dem Seitenkanal (39) platziert ist.
 3. Heizgerät nach mindestens einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** die Trägerschaukeln (37) entsprechend einer radialen Formgebung 90° voneinander platziert sind.
 4. Heizgerät nach mindestens einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** der geformte Kanal (33) der Befestigungsplatte (5) Brennluft in den Schlitten (38) des Ringes (34) fördert, die in Bezug auf den Förderer (4) unterhalb und zentral platziert sind.
 5. Heizgerät nach mindestens einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** die elektrischen Widerstände (26) nahe dem unteren Teil des Ringes (34) angeordnet sind.
 6. Heizgerät nach mindestens einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** der Kanal (17), der den Festbrennstoff trägt, horizontal und senkrecht zu dem Korb (2) platziert ist, und entsprechend einem oberen Abschnitt des Korbs (2) verläuft.
 7. Heizgerät nach Anspruch 6, **dadurch gekennzeichnet, dass** ein erster Schneckenförderer (42), der durch einen ersten Motor (22) angetrieben wird, verwendet wird, um den Festbrennstoff aus dem Tank (36) zu ziehen, und diesen entlang einer im Wesentlichen vertikalen Richtung zu tragen, bevor er entlang eines vertikalen Kanals (35) abstürzt, während ein zweiter Schneckenförderer (20), der sich innerhalb des Kanals (17) dreht, und der horizontal ist, den Festbrennstoff in den Schmelztiegel schiebt.
- ## Revendications
1. Appareil de chauffage à combustible solide, comprenant un brûleur (40) et une chambre de combustion de combustible solide associée, à l'intérieur de laquelle est insufflé, à travers un tuyau (27), de l'air puisé de l'extérieur pour l'allumage dudit combustible solide, ledit allumage résultant de l'alimentation d'au moins deux résistances électriques (26) adjacentes, ledit combustible solide étant transporté à l'intérieur d'un creuset dudit brûleur (40) par l'intermédiaire d'au moins un transporteur à vis de remplissage et de dosage (42), qui prélève le combustible solide à partir d'une cuve (36) qui est rechargeable à partir de l'extérieur, dans lequel ledit brûleur (40) inclut un panier (2) mis en forme, qui est couplé, au moins partiellement, à un transporteur (4), un embout frontal (3) et une plaque de fixation (5), qui comporte un conduit (33) mis en forme pour envoyer l'air dans ledit brûleur (40), ledit panier (2) mis en forme étant composé d'une bague rotative (34), qui est montée devant lesdites résistances électriques (26) et qui est montée devant un conduit (17) portant ledit combustible solide à l'intérieur dudit creuset, ledit panier (2) étant pourvu de fentes latérales (38) pour laisser passer les déchets de combustible solide et de lames de support (37) centrales, ladite bague (34) étant montée sur un arbre tournant (31) qui est configuré pour déplacer la bague (34) pendant des intervalles de temps prédéterminés et selon des angles prédéterminés, et dans lequel ledit transporteur (4) comporte au moins une première surface (11) étant face à une pluralité desdites fentes (38) et un conduit latéral (39), qui est placé latéralement par rapport à ladite première surface (11), **caractérisé en ce que** pendant la rotation de ladite bague (34) lesdits déchets de combustible solide sont amenés tout d'abord sur ladite première surface (11) du transporteur (4) et ensuite vers ledit conduit latéral

(39), qui est placé en correspondance avec un crochet (9), qui est soudé, à son tour, à et à l'intérieur dudit embout frontal (3), afin de réaliser un broyage et une compression complets desdits déchets de combustible solide.

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2. Appareil de chauffage selon au moins l'une des revendications précédentes, **caractérisé en ce qu'un** tiroir amovible de collecte de cendres est placé en dessous de ladite bague (34) et dudit conduit latéral (39). 10
3. Appareil de chauffage selon au moins l'une des revendications précédentes, **caractérisé en ce que** lesdites lames de support (37) sont placées à 90° l'une de l'autre, selon une mise en forme radiale. 15
4. Appareil de chauffage selon au moins l'une des revendications précédentes, **caractérisé en ce que** ledit conduit (33) mis en forme de ladite plaque de fixation (5) transporte de l'air de combustion sur les fentes (38) de ladite bague (34) qui sont placées en dessous et au centre par rapport audit transporteur (4). 20
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5. Appareil de chauffage selon au moins l'une des revendications précédentes, **caractérisé en ce que** lesdites résistances électriques (26) sont agencées près de la partie inférieure de ladite bague (34). 30
6. Appareil de chauffage selon au moins l'une des revendications précédentes, **caractérisé en ce que** ledit conduit (17) portant ledit combustible solide est placé horizontalement et perpendiculairement audit panier (2) et s'écoule en correspondance avec une portion supérieure du panier (2). 35
7. Appareil de chauffage selon la revendication 6, **caractérisé en ce qu'un** premier transporteur à vis (42), entraîné par un premier moteur (22), est utilisé pour prélever ledit combustible solide à partir de ladite cuve (36) et pour le porter le long d'une direction sensiblement verticale, avant de le lâcher le long d'un conduit vertical (35), tandis qu'un second transporteur à vis (20), qui tourne à l'intérieur dudit conduit (17) et qui est horizontal, va pousser le combustible solide à l'intérieur dudit creuset. 40
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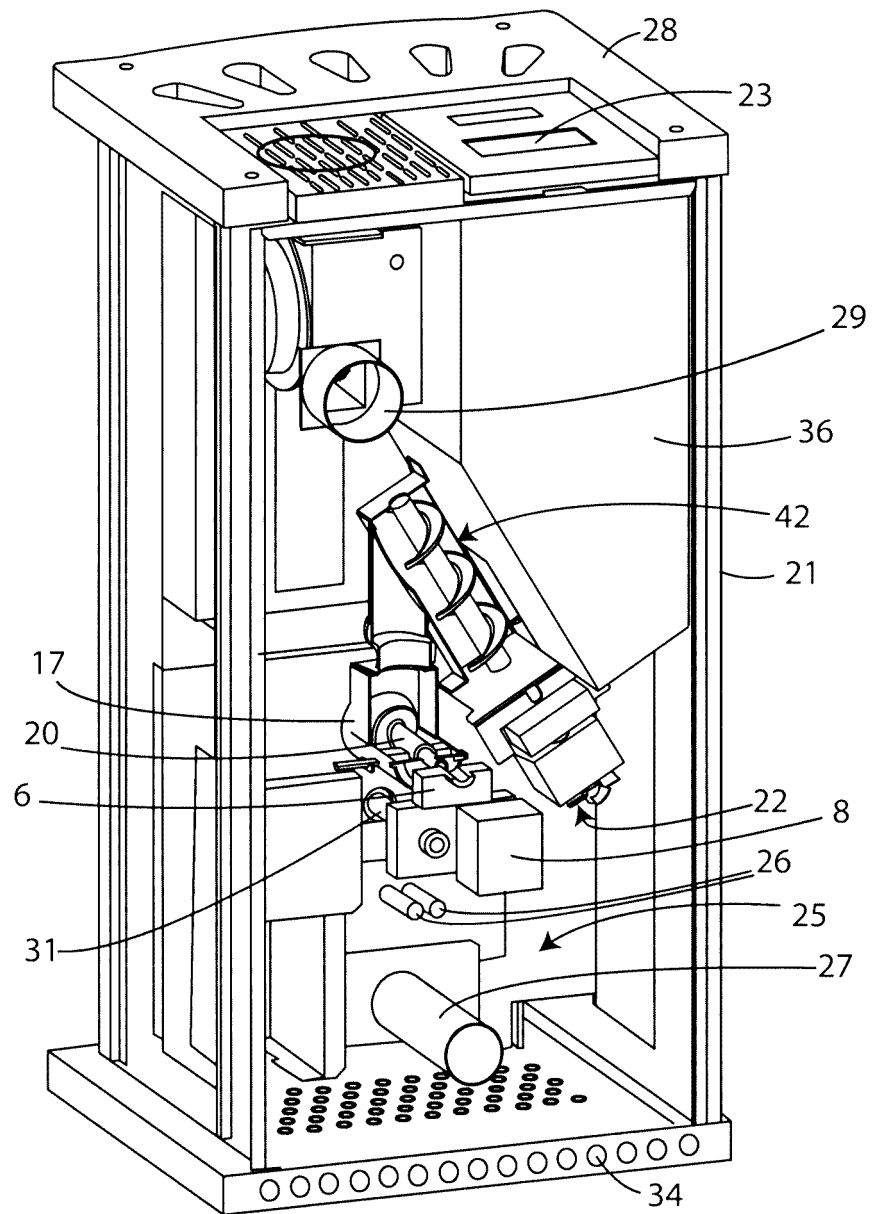


Fig. 1

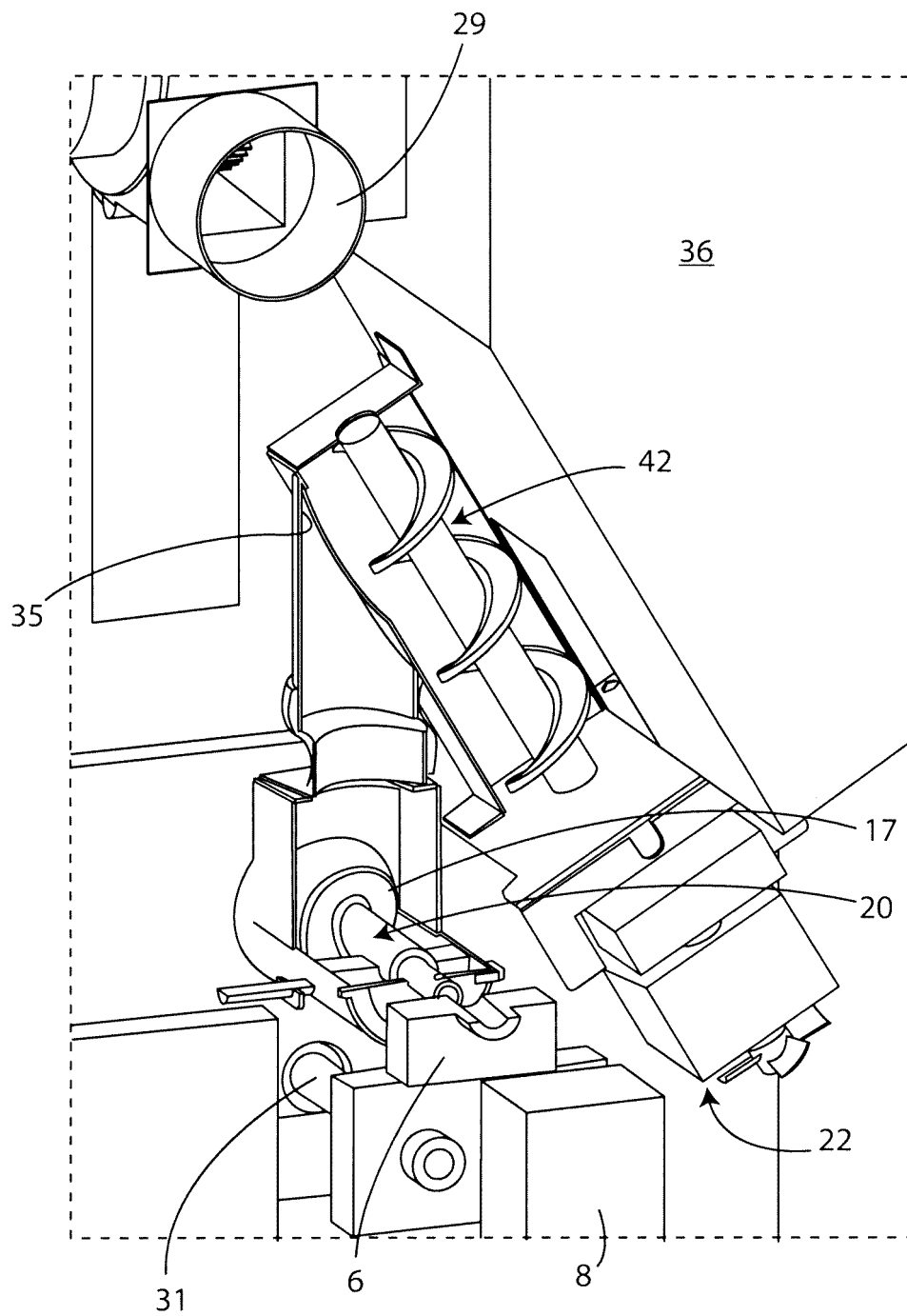


Fig. 2

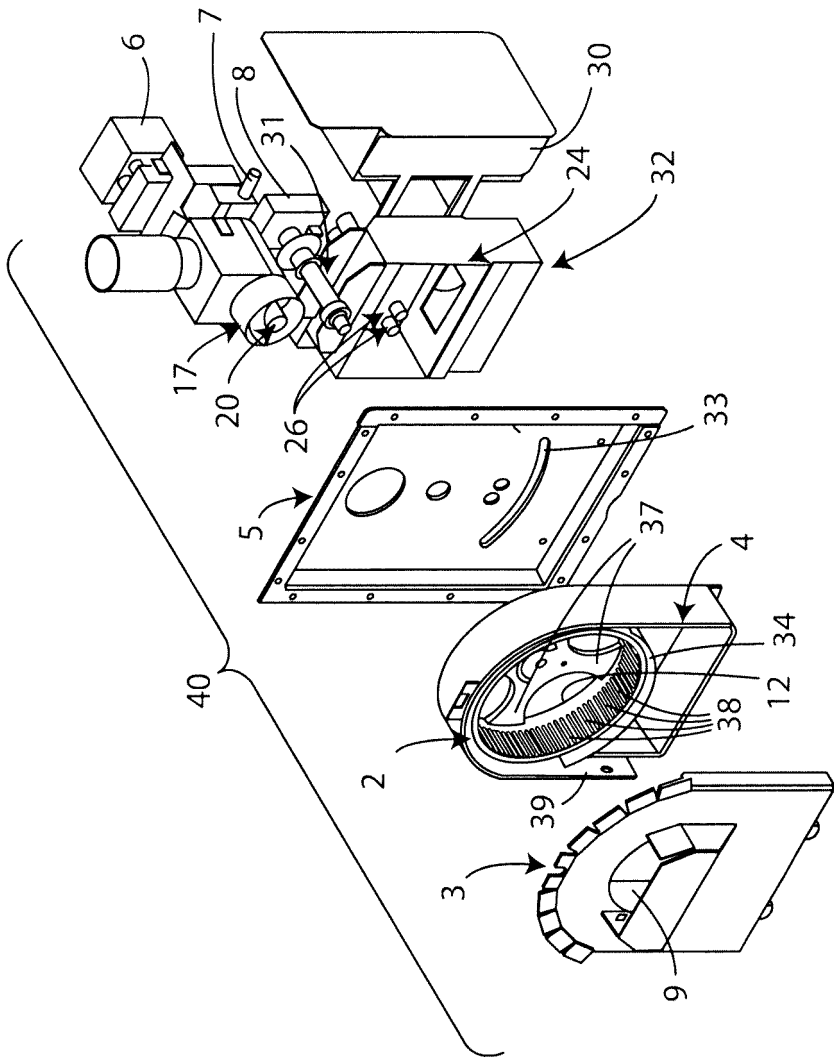


Fig. 3

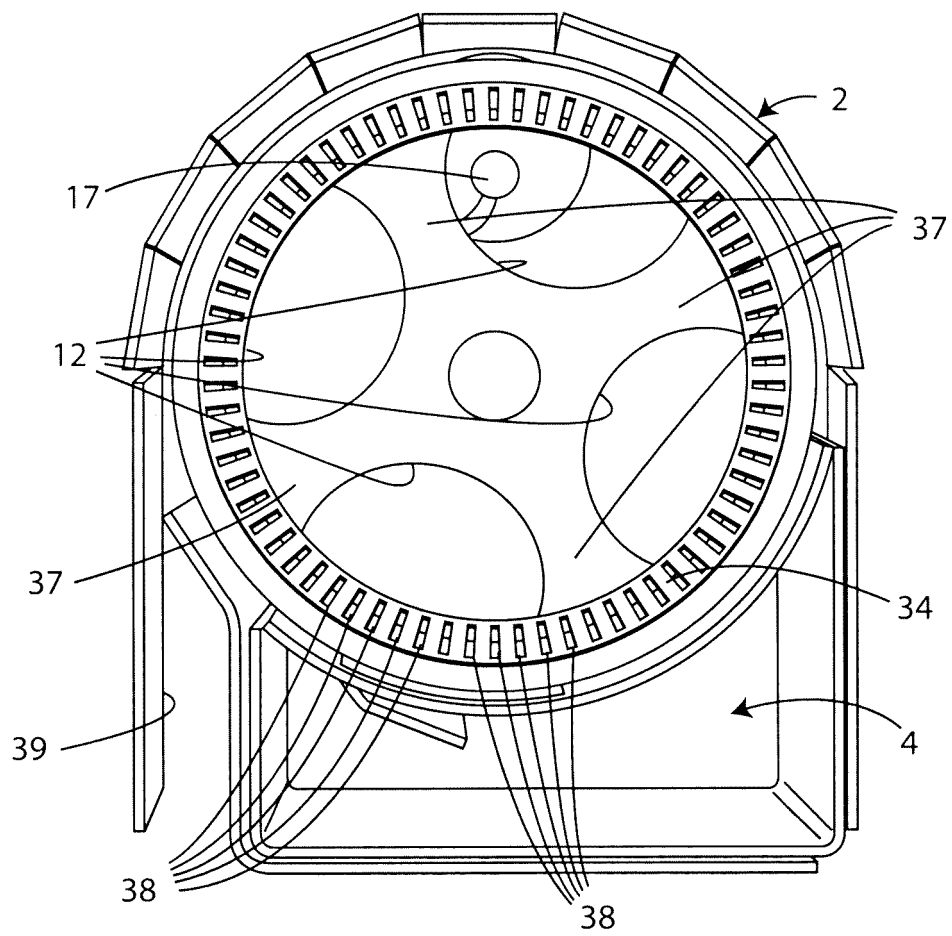


Fig. 4

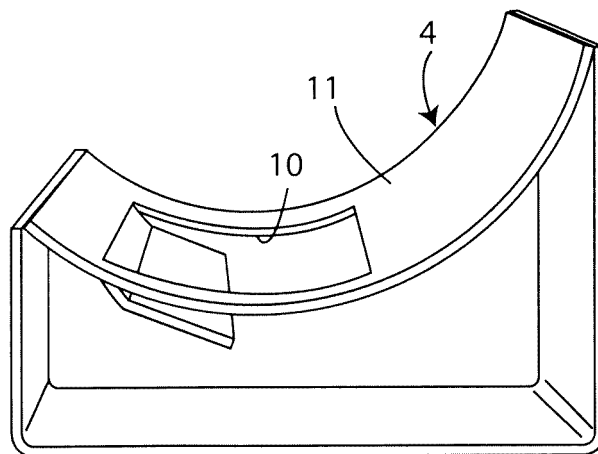


Fig. 5

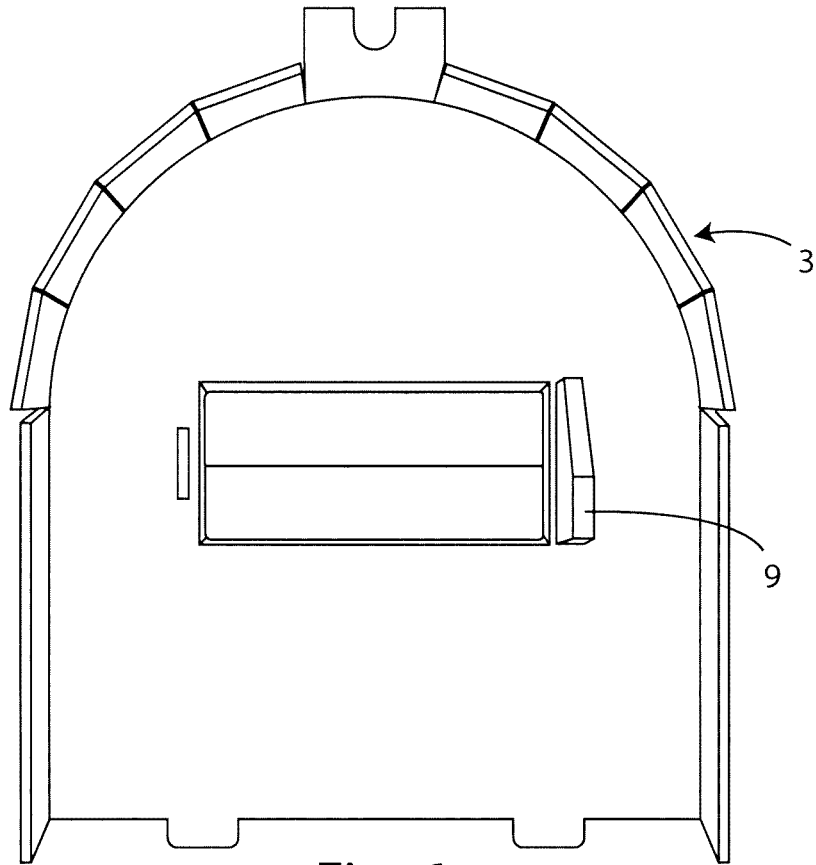


Fig. 6

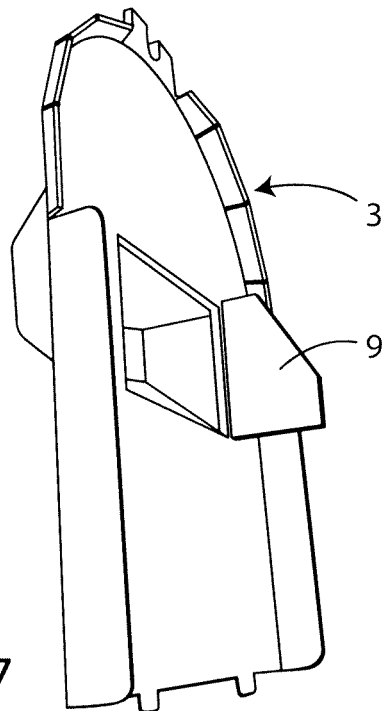


Fig. 7

REFERENCES CITED IN THE DESCRIPTION

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