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(71) Applicant: **Age Stufe S.r.l.**
37047 San Bonifacio (VR) (IT)

(72) Inventor: **ZANINI, Emanuele**
37047 SAN BONIFACIO (VR) (IT)

(74) Representative: **Fisauli, Beatrice A. M.**
Con Lor S.p.A
Via Renato Fucini, 5
20133 Milano (IT)

(54) **BRAZIER FOR HEATING APPARATUS AND HEATING APPARATUS COMPRISING SAID BRAZIER**

(57) A brazier (10) for a solid fuel heating apparatus, for example a stove or a boiler, suitable to contain the solid fuel during the combustion and make the combustion products go out.

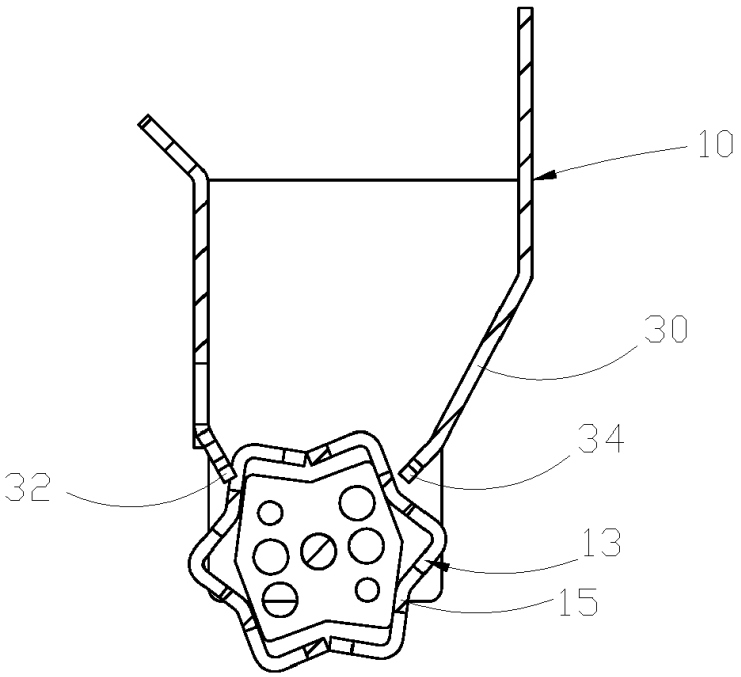

Fig. 12

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Description

[0001] The present invention refers, in general, to a brazier for heating apparatuses and to a heating apparatus comprising said brazier. More particularly, the present invention refers to a brazier for solid fuel stoves or boilers, preferably using pellets and capable of an autonomous cleaning.

[0002] Usually, heating apparatuses such as solid fuel stoves and boilers use the combustion products of a solid fuel to heat especially rooms as in the case of stoves, or liquids in case boilers are concerned.

[0003] The structure of a solid fuel boiler is similar to that of a stove. One of the differences consists in that while a stove is usually installed in a place where it is always visible and accessible for its maintenance also by a common person, a boiler is typically installed in less frequented technical rooms and has a more advanced automation so as to reduce the necessary upkeep. Another difference consists in that a stove diffuses heat in the surrounding ambient while a boiler keeps heat inside so as to transfer heat to a fluid.

[0004] An example of a solid fuel stove is the pellet-burning stove. The pellet-burning stove is similar to a wood-burning stove used to heat any type of ambient but uses pellets instead of wood as solid fuel. The pellet is considered as an ecologic product and is usually formed by utilizing waste from wood processing such as sawdust and the like.

[0005] Usually, the pellet is a fuel consisting of sawdust. At first, the sawdust is dried and then, it is compressed in the form of small cylinders having a diameter of some millimeters, typically 6 to 8 mm.

[0006] The structure of a pellet stove is similar to a conventional stove and comprises a reservoir containing the pellets to be burnt. Usually, the pellet reservoir is filled from the top.

[0007] An endless screw or an auger conveys the pellets from the reservoir to the inside of a brazier where the fuel is burnt by means of an electric resistance which becomes incandescent in the startup phase and triggers the flame.

[0008] In the sector of the solid fuel stoves, owing to the above-mentioned reasons, braziers of the fixed type are usually utilized which are shaped like a container which is open in correspondence of an upper mouth and has a perforated bottom to allow the combustive air to pass, the ashes produced by combustion being expelled in a drawer positioned below.

[0009] Both the brazier and the lower drawer need an ordinary cleaning which is done more or less frequently depending on the use in terms of time of operation, set power and type of fuel utilized.

[0010] For example, the combustion of the pellets in the known stoves in which the fuel is fed by gravity takes place in the brazier itself where the pellets, that is, the fuel and the oxygen, that is, the combustion agent react giving rise to combustion which in turn gives rise to heat, exhaust gas and ashes.

[0011] The ashes together with other substances that could be present in the pellets accumulate in the brazier, which makes difficult the passage of the combustive air through the holes and hinders the combustion.

[0012] This phenomenon is evident in particular if pellets with high ash content. Hence, it is necessary to manually clean the brazier, at regular intervals, in general once every 1-2 days. At first, this cleaning requires the shutdown of the stove as well as a waiting time for its cooling.

[0013] There exist on the market also braziers, utilized in the sector of boilers, which are provided with movable elements intended to improve the operations of cleaning of the brazier, for instance braziers with a movable bottom.

[0014] An example of a known brazier with movable bottom is visible in Figures 1 to 5 where the brazier is denoted by the reference letter A.

[0015] At the lower end of the brazier A, an oscillating bottom B is fixed to a shaft C so as to rotate relative to the brazier A. Slits E are formed in the oscillating bottom B to allow the combustive air to pass through and feed the flame inside the brazier A.

[0016] The lower end of the brazier A comprises teeth D that result to be inserted in the slits E of the oscillating bottom B.

[0017] In order to perform the normal cleaning of the brazier A, an operator rotates the oscillating bottom B by means of the shaft C so that it is possible to pass from a closed configuration as visible in the figures 2, 3 and 4, to an opened configuration as visible in the figures 1 and 5 in which the oscillating bottom B is completely rotated.

[0018] In the opened configuration, embers and ashes that were supported by the oscillating bottom B fall, by gravity, under the brazier A in the drawer below where embers and ashes are collected.

[0019] Consequently, the combustion of the embers can not proceed because the brazier A is emptied.

[0020] After performing the cleaning of the oscillating bottom B, the operator brings back the oscillating bottom B to its closing configuration so as to prepare the brazier A for a new combustion operation.

[0021] Hence, the oscillating bottom B according to the prior art must remain in its closed configuration to support embers and relative ashes so as to allow a correct combustion inside the brazier A.

[0022] Consequently, the oscillating bottom B like other movable bottoms realized according to the known art, for example the bottoms shaped like trap-doors, are always in touch with the embers and are, therefore, always exposed to high temperatures which could cause an overheating provoking deformations in the bottom itself.

[0023] Besides, it is necessary to keep in mind that a pellet stove must be thoroughly cleaned at least once a year according to the model and its utilization. A cleaning like this requires the interventions of a skilled artisan.

[0024] Furthermore, in the case the brazier is automat-

ed, with motorization of the oscillating bottom B, sensors are provided to constantly verify the configuration in which the same oscillating bottom B is disposed in order to avoid problems of a failure in the ignitions and ensure a certain safety in the operation.

[0025] The object of the present invention is to offer a solid fuel brazier and a heating apparatus provided with said brazier, for example a stove or boiler, and preferably a pellet stove or a pellet boiler, which overcome the problems of the braziers and heating apparatuses of known type.

[0026] Another object of the present invention is to obtain a brazier and an apparatus provided with said brazier which are simple to manage and easy to clean. Another object of the present invention is to realize a brazier and an apparatus provided with said brazier whose manual cleaning interventions are reduced or even annulled.

[0027] Another object of the present invention is to offer a brazier and an apparatus provided with said brazier whose utilization is flexible.

[0028] The above mentioned objects and further ones are reached by a brazier for a solid fuel heating apparatus, for example a stove or a boiler utilizing a solid fuel, said brazier being suitable for containing the solid fuel during the combustion and letting the combustion products go out.

[0029] The brazier comprises a delimiting wall having lower edges hat define a lower opening and a bottom rotating relative to the wall and arranged under the wall so as to close the lower opening.

[0030] The brazier is characterized by the fact that the bottom comprises a curved plate-shaped body which extends on a cylindrical surface of main development with axis coinciding with the axis of rotation of the bottom so that the bottom rotates relative to the wall, the solid fuel is supported by an ever-different portion of the plate-shaped body and the lower opening is kept closed.

[0031] In other words, the plate-shaped body has a development of 360 degrees around the axis of rotation of the bottom.

[0032] The plate-shaped body comprises preferably at least one raised portion with respect to eh surface of main development, at least one slit being formed in the at least one raised portion to allow air to pass for the combustion and to allow the combustion products such as ash to go out of the brazier on maintaining in any case the solid fuel on the plate-shaped body. Furthermore, the lower edges of the wall comprise preferably at least one projecting portion adapted to fit into the one or more slits as the bottom rotates so as to clean the one or more slits and facilitate the discharge of the combustion products from the brazier through the lower opening, but keeping in any case the solid fuel on the plate-shaped body between the delimiting wall.

[0033] The bottom, in particular the plate-shaped body, would be stressed by the high temperatures due to the combustion but only as concerns a bottom portion. However, in the configuration according to the invention, if the position of the bottom is varied, also the portion of plate-shaped body supporting the fuel and exposed to heat is changed. Thus, it is possible for the preceding portion to cool and all this is performed without interrupting the combustion being done in the brazier.

[0034] Besides, the action of the projecting portion, for example teeth, compacts the ash and facilitates the ash to go out of the brazier. In addition, the projecting portion prevents ash to deposit on the bottom of the brazier, in particular on the edges of the slits.

[0035] Advantageously, the one or more raised portions may have a helical development with respect to the axis of rotation of the bottom so as to facilitate the moving of the combustion products also in a direction parallel to the axis of rotation.

[0036] Furthermore, the lower edges of the wall may comprise at least one comb with teeth adapted to fit into the one or more slits. This conformation allows the teeth to always remain fixed in their position because the movement of the bottom and the consequent movement of the plate-shaped body bring the slits close to the teeth which insert in the slits and perform the operation of cleaning and discharging.

[0037] Advantageously, in the brazier according to the invention, there may be comprised a first portion and a second portion which are raised with respect to the surface of main development, the distance of the first raised portion from the axis of rotation being greater than the distance of the second raised portion from the axis of rotation.

[0038] In this conformation, the bottom may have sectors corresponding to the more raised portions in which the fuel is moved more than in other sectors corresponding to the portions which are raised only a little in comparison with the middle distance from the axis of rotation.

[0039] Thus, the plate-shaped body comprises raised portions which form a series of crests and valleys which are repeated continuously as the angle of rotation varies around the axis of rotation of the bottom, slits being formed only in the crests.

[0040] In this configuration, only the crests have the slits. In any case, the structure of the crests is continuous and strong.

[0041] The lower edges of the wall may thus comprise projecting portions, each projecting portion being adapted to be inserted in a respective slit as the bottom rotates so as to keep the solid fuel on the plate-shaped body between the delimiting wall and to let go out only the combustion products, namely the ash, through the slits.

[0042] Besides, a hole may be formed in the delimiting wall for the insertion of the fuel.

[0043] The objects and the advantages of the invention are also reached by a brazier for a solid fuel heating apparatus, suitable for containing the solid fuel during the combustion in a wall of lateral delimitation and letting go out only the combustion products. The brazier is characterized by the fact of comprising a bottom rotating around an axis of rotation and comprising a main plate-shaped

body; the main body having a wavy profile with constant thickness and being shaped like a hollow star; the main body comprises preferably first portions and second portions, these first portions and second portions having different distances from the axis of rotation; the first portions having a greater distance from the axis of rotation than the middle distance; the second portions having a smaller distance from the axis of rotation than the middle distance. Slits may be formed in the first portions. Teeth may be formed on the lower edges of the wall, these teeth being adapted to be inserted in the slits.

[0044] The objects and advantages of the invention are also reached by a heating apparatus, for example a solid fuel stove or boiler, characterized by comprising a brazier having features as defined previously.

[0045] Further characteristics and details of the invention will be better understood from the following specification, which is supplied by way of non-limiting example, as well as from the accompanying drawings, wherein:

Figure 1 is a side view of a brazier according to the prior art as previously described;
Figure 2 is a side view of the brazier in Figure 1;
Figure 3 is a side view of the brazier in Figure 1, sectioned according to plane X in Figure 1;
Figures 4 and 5 are a bottom view and an axonometric view of the brazier in Figure 1, respectively;
Figures 6 and 7 are a front view and a rear view of a brazier according to the invention, respectively;
Figure 8 is a view of a detail of the brazier in Figure 6;
Figure 9 is an axonometric view of the brazier in Figure 6;
Figure 10 is a front view of the brazier in Figure 6;
Figure 11 is a side view of the brazier in Figure 6;
Figure 12 is a side view of the brazier in Figure 6, sectioned according to plane X in Figure 6;
Figure 13 is an axonometric view of a detail of the brazier in Figure 6;
Figure 14 is an axonometric view of an element of the brazier according to a variant of the invention.

[0046] As visible in the figures 6 to 9, reference number 10 denotes a brazier for solid fuels, realized according to the invention.

[0047] A rotating bottom 12 is rotatably connected to the brazier 10. The rotating bottom 12 comprises a main plate-shaped body 15 in which slits 13 are formed.

[0048] A hole 14 is laterally formed near the bottom of the brazier 10 so that it is possible to insert an ignition plug.

[0049] The rotating bottom 12 is connected to a first transmission shaft 16 which in turn is connected through a joint 20 to a second transmission shaft 18.

[0050] The joint 20 comprises a first plate 22 connected to the first transmission shaft 16 and a second plate 24 connected to the second transmission shaft 18. The first plate 22 and the second plate 24 are suitably connected to each other through two screws 23.

[0051] The brazier 10 comprises an inclined wall 30 restricting the space of the brazier 10 from an upper mouth to the rotating bottom 12, in correspondence of a lower mouth, also defined exhaust opening, having a passage section of smaller dimensions than those of the passage section of the upper mouth.

[0052] At its lower mouth, the brazier 10 comprises also two combs and precisely a first comb 32 and a second comb 34, both combs being provided with a plurality of teeth which insert in the slits 13 of the rotating bottom 12.

[0053] The main body 15 of the rotating body 12 has an elongated shape in the direction of the axis of the transmission shaft 16. Moreover, as visible in Figure 12, the section of the main body 15 has a wavy profile with constant thickness and is shaped like a hollow star.

[0054] Through this conformation, the main body 15 of the rotating body 12 has portions that are spaced differently from its axis of rotation.

[0055] The portions of the main body having a greater distance from the axis or rotation than the middle distance are called crests below while the portions of the main body having a smaller distance from the axis of rotation are called valleys below.

[0056] As visible in Figure 12, the section of the main body 15 is thus formed by a series of crests and valleys that are repeated continuously as the angle of rotation varies around the axis of the rotating bottom 12.

[0057] However, the section may have developments different from the crests and valleys represented in the figure.

[0058] The slits 13 are suitably formed in the portions corresponding to the crests of the main body 15 so as to be obtained in the portions that are more distant from the axis of rotation of the rotating bottom 12. Moreover, the slits 13 are formed in correspondence of the first comb 32 and second comb 34 so that the teeth of the first comb 32 and the teeth of the second comb 34 may be inserted into the slits 13.

[0059] In any case, the portions corresponding to the valleys are maintained full in order to ensure a structural solidity to the rotating bottom 12.

[0060] As visible in Figure 13, the brazier 10 comprising a rotating bottom 12 realized according to the invention may be coupled to a pellet stove in which a motor is installed to actuate the rotation of the transmission shaft 16 according to a predetermined development.

[0061] The working of the brazier 10 and rotating bottom 12 according to the invention is described below with reference to Figures 10 and 12, beginning from a condition of stove off.

[0062] As visible in Figure 12, the brazier 10 is configured to contain solid fuel, preferably in the form of pellets that are inserted, for example, from the upper mouth of the brazier.

[0063] The pellets reach, by gravity, the rotating bottom 12 and are inflamed by means of a spark-plug, not visible in the figure.

[0064] According to a predetermined behavior, for ex-

ample by imparting a complete rotation to the transmission shaft 16 every hour, it is possible to improve the combustion conditions inside the brazier 10.

[0065] The choice of the predetermined behavior of the rotation of the rotating bottom 12 is suitably set according to the typology of pellets used, for example pellets with a high content of ashes or pellets including other substances that make the cleaning more difficult. Another parameter to be considered in the choice of the behavior is the typology of the stove or the stove power.

[0066] When the rotating bottom 12 is put in rotation, the pellets and the ash remain inside the brazier 10, i.e. on the rotating bottom 12 itself, and are not discharged, by gravity, in the underlying drawer as it happens in the braziers of the prior art.

[0067] The embers and ashes in the brazier 10 are thus moved in a vertical direction thanks to the star shape having crests and valleys.

[0068] Besides, the content in the brazier 10 is also pushed owing to the rotation towards a comb, for example the first comb 32, so that the ash is pushed towards a side of the brazier 10 where the ash comes in touch of the walls of the brazier 10 and the first comb 32 and is thus compacted.

[0069] Once the ash has been compacted and the ash volume has been thus suitably reduced, the rotating bottom 12 pushes the ash to descend through the slits 13 so as to reach, by gravity, the underlying drawer.

[0070] Through the compacting operation in brazier 10, the ash collecting drawer becomes mores autonomous and needs to be emptied less frequently. Hence, it is synergistically obtained a cleaning of the brazier 10 and a compacting of the ashes without the need to shut down the stove as in the case of the stoves provided with braziers realized according to prior art.

[0071] The rotating bottom 12 may be rotated continuously at a very slow speed or less frequently at a higher speed, for example with a frequency of a few minutes per hour, or according to other modes in order to obtain a great flexibility of behavior and use, said modes being completely automatic and continuous.

[0072] Thus, the slits 13 are constantly cleaned through the rotation that brings the slits to meet the first comb 32 and second comb 34 in succession in order to obtain a complete cleaning of the slits.

[0073] Furthermore, it is possible to obtain another advantage by subjecting an ever-different portion of the rotating bottom 12 to the high temperatures of combustion so that overheating and deformation are avoided and it is possible to ensure a reduced thermal stress to the rotating bottom 12. In this way, the rotating bottom will have a greater durability.

[0074] The shape of the section of the rotating bottom may deviate from the shape as previously described, for example the rotating bottom may have a different development depending on which portion of angle of rotation with respect to the axis of the rotating bottom has to be interested by the action of the cleaning combs. In this way, it is possible to obtain a different behavior depending on the relative rotation of the rotating bottom in respect to the brazier to which the rotating bottom is connected.

[0075] In fact, according to a variant of the invention, a brazier comprises a rotating bottom interested by a non-uniform pattern of crests and valleys.

[0076] A first half of the section of the rotating bottom has a first development with crests and valleys having a significant deviation. The second half of the section has a second development with crests and valleys having a much more reduced deviation.

[0077] In this way, if the rotating bottom is put in rotation when the embers and ashes are supported by the first half of the bottom having a significant deviation between valleys and crests, such embers and ashes are moved very much.

[0078] On the contrary, when the embers and ashes are supported by the second half of the bottom having a much more reduced deviation, the embers and ashes are moved more smoothly.

[0079] Obviously, the rotating bottom may be realized with portions having deviations between crests and valleys different beginning from the half as described above so that the rotating bottom is provided with different portions which may actuate different movements of the content in the brazier.

[0080] According to another variant of the invention, illustrated in Fig. 14, a brazier comprises a rotating bottom interested by a spiral development of crests and valleys developing like a spiral along the axis of rotation of the rotating bottom. The slits remain orthogonal to the axis of rotation of the rotating bottom so as to maintain a form compatible with the combs and the rotation of the rotating bottom itself.

[0081] In this way, the content of the brazier is moved also in a direction parallel to the axis of rotation of the rotating bottom itself.

[0082] The ease of management of the rotating bottom, subject-matter of the invention, makes the brazier applicable to any apparatus operating with pellets or other solid fuel and extremely versatile so that the brazier can be installed on pre-existing heating apparatuses in order to equip these apparatuses with the features and advantages of the invention.

[0083] It was proved that after two months of testing it was not necessary any manual cleaning operations on the brazier and rotating bottom by using the brazier according to the invention while maintaining a continuous combustion. It is to be understood that further variants of the rotating bottom and brazier, subject-matter of the invention, may be comprised in the scope of protection of the invention.

Claims

1. Brazier (10) for a solid fuel heating apparatus, suitable for containing the solid fuel during the combus-

tion and making only the combustion products go out, comprising:

- a delimiting wall (30) having lower edges that define a lower opening;
- a bottom (12) rotating relative to the wall (30) around an axis of rotation and arranged below the wall (30) so as to close the lower opening;

characterized by the fact that
the bottom (12) comprises a curved plate-shaped body (15) which extends on a cylindrical surface of main development with axis coincident with the axis of rotation of the bottom (12) so that as the bottom (12) rotates relative to the wall (30), the solid fuel is supported by an ever-different portion of the plate-shaped body (15), the lower opening being kept closed;
the plate-shaped body (15) comprising at least one raised portion with respect to the surface of main development, at least one slit (13) being formed in the at least one raised portion to allow air to pass for the combustion and to allow the combustion products to go out of the brazier, on maintaining in any case the solid fuel on the plate-shaped body (15);
the lower edges of the wall (30) comprising at least one projecting portion (32, 34) adapted to fit into the at least one slit (13) as the bottom (12) rotates so as to clean the at least one slit (13) and facilitate the exhaust of the combustion products from the brazier through the lower opening, but keeping the solid fuel on the plate-shaped body (15) between the delimiting wall (30).

2. Brazier (10) according to the preceding claim, wherein the at least one raised portion has a helical development with respect to the axis of rotation of the bottom (12).

3. Brazier (10) according to one of the preceding claims, wherein the lower edges of the wall (30) comprise at least one comb (32, 34) with teeth adapted to fit into the at least one slit (13).

4. Brazier (10) according to one of the preceding claims, wherein there are comprised a first raised portion which is raised with respect to the surface of main development, and a second raised portion which is raised with respect to the surface of main development, the distance of the first raised portion from the axis of rotation being greater than the distance of the second raised portion from the axis of rotation.

5. Brazier (10) according to one of the preceding claims, wherein raised portions are comprised in the plate-shaped body (15) which form a series of crests and valleys which are continuously repeated as the angle of rotation varies around the axis of rotation of the bottom (12), slits (13) being formed only in the ridges.

6. Brazier (10) according to the preceding claim, wherein the lower edges of the wall (30) comprise projecting portions (32, 34), each projecting portion being adapted to be inserted in a respective slit (13) as the bottom (12) rotates so as to keep the solid fuel on the plate-shaped body (15) between the delimiting wall (30) and to let go out only the combustion products through the slits (13).

7. Brazier (10) according to one of the preceding claims, wherein a hole (14) is formed in the delimiting wall (30).

8. Brazier (10) for a solid fuel heating apparatus, suitable for containing the solid fuel during the combustion in a wall (30) of lateral delimitation and making go out only the combustion products, **characterized by** the fact of comprising a bottom (12) rotating around an axis of rotation and comprising a main plate-shaped body (15); the main body (15) having a wavy profile with constant thickness and being shaped like a hollow star; the main body (15) comprising preferably first portions and second portions, said first portions and second portions having different distances from the axis of rotation; the first portions having a greater distance from the axis of rotation than the middle distance; the second portions having a smaller distance from the axis of rotation than the middle distance, slits (13) being formed in the first portions, teeth (32, 34) being formed on the lower edges of the wall (30), said teeth being adapted to be inserted in the slits (13).

9. Heating apparatus, **characterized by** comprising a brazier according to one of the preceding claims.

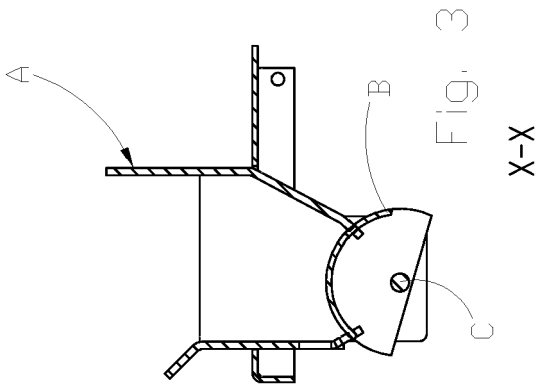

Fig. 3

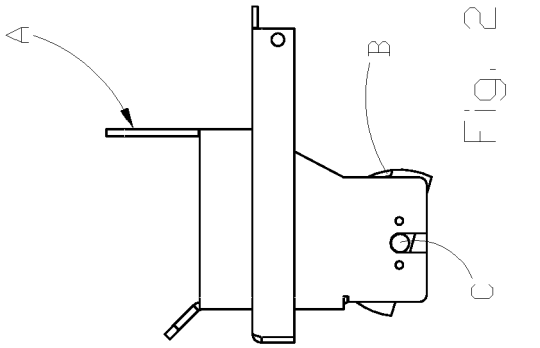

Fig. 2

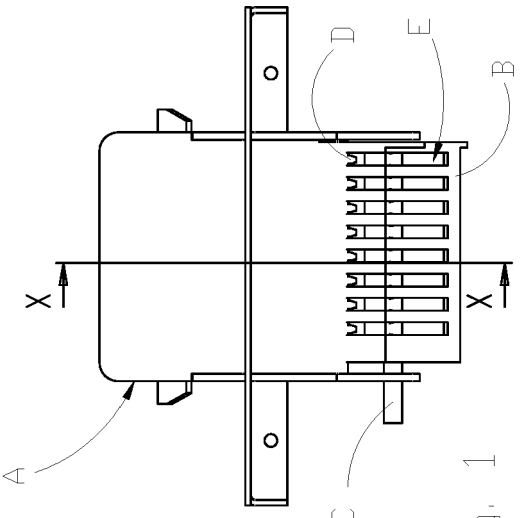

Fig. 1

X-X

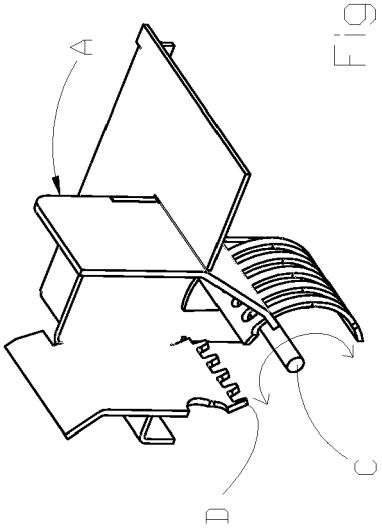

Fig. 5

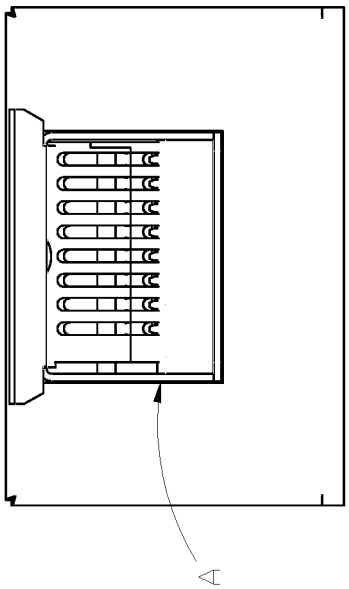

Fig. 4

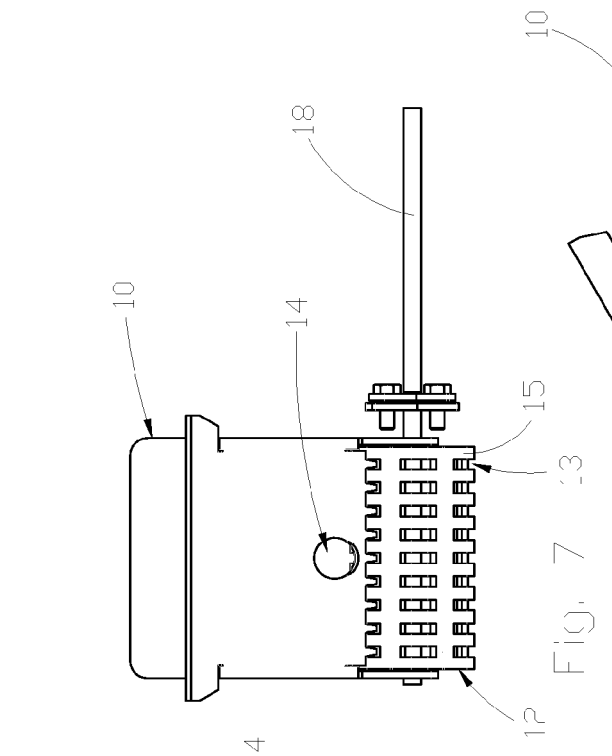

Fig. 7

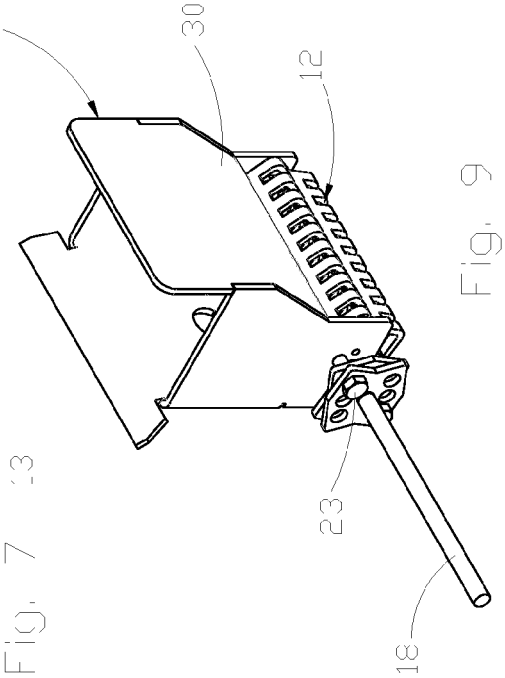

Fig. 9

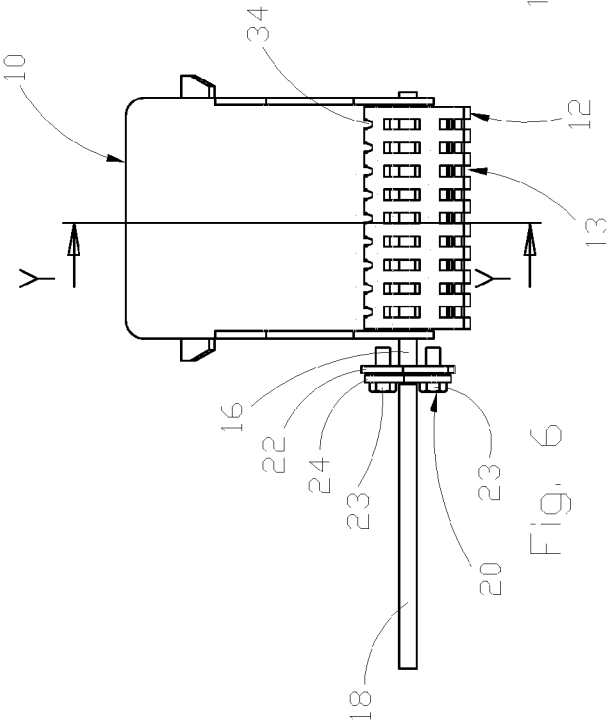

Fig. 6

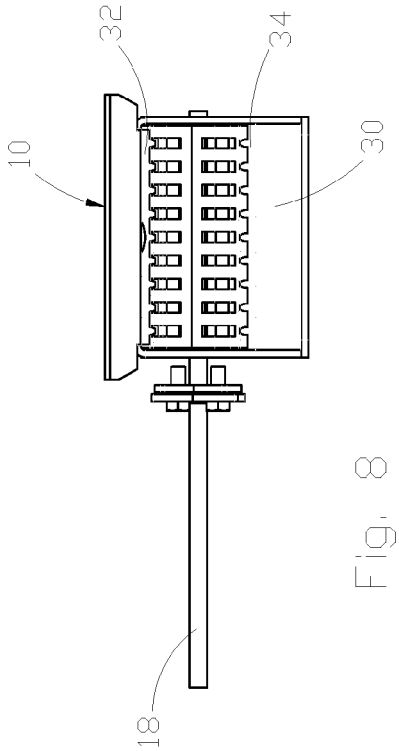

Fig. 8

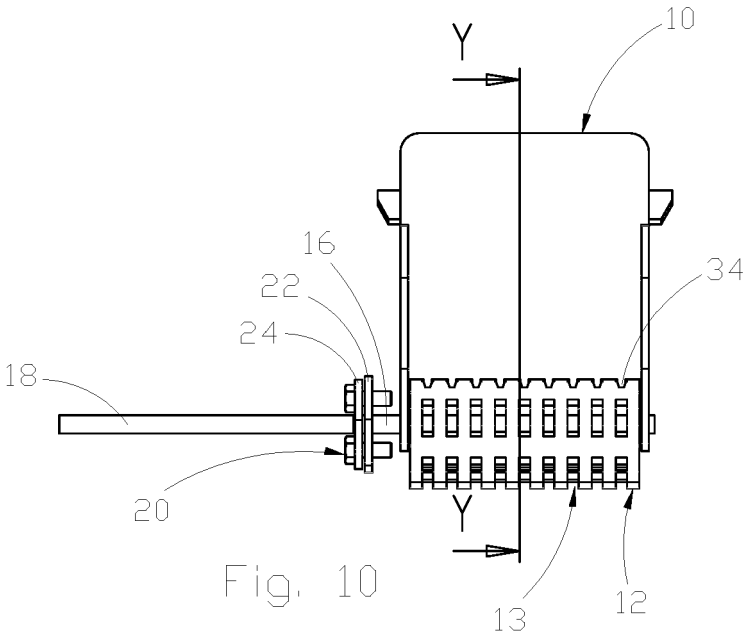

Fig. 10

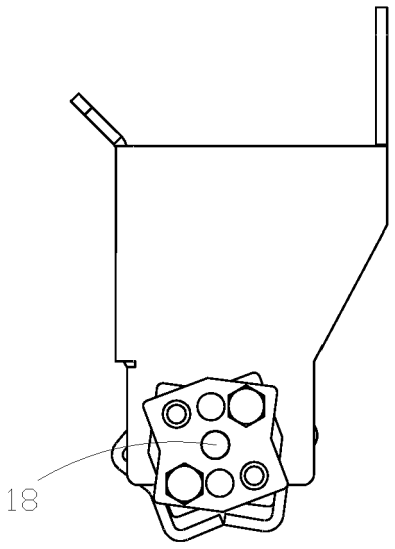

Fig. 11

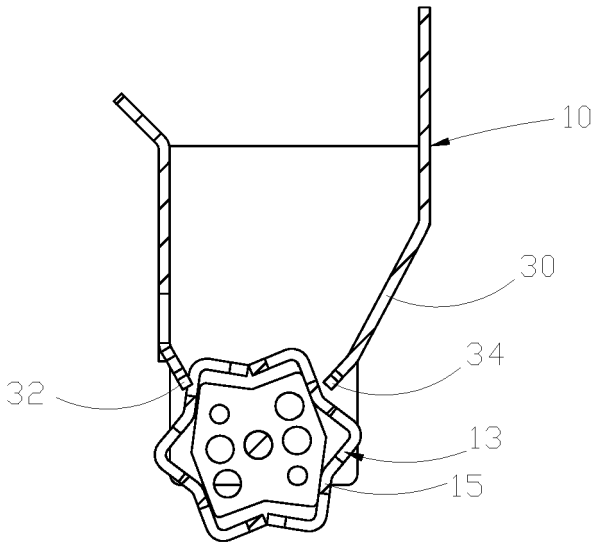

Fig. 12

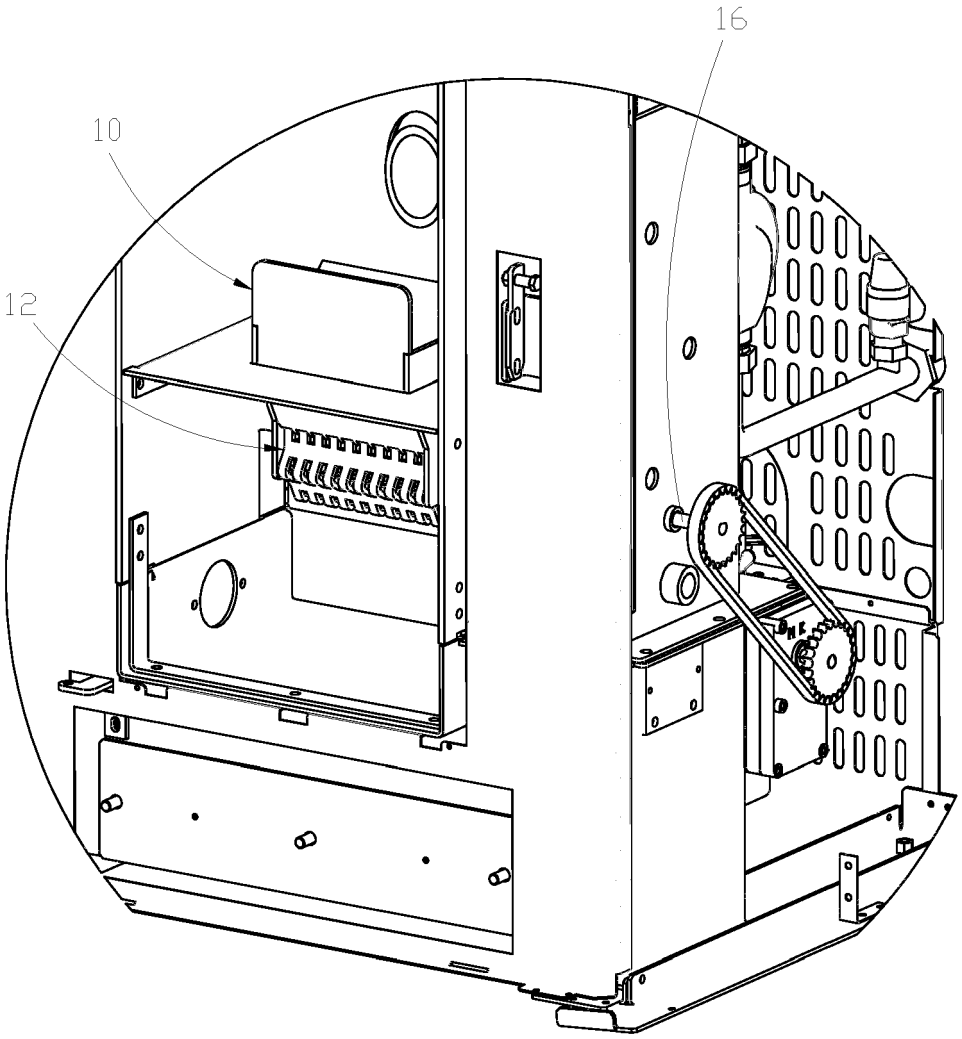

Fig. 13

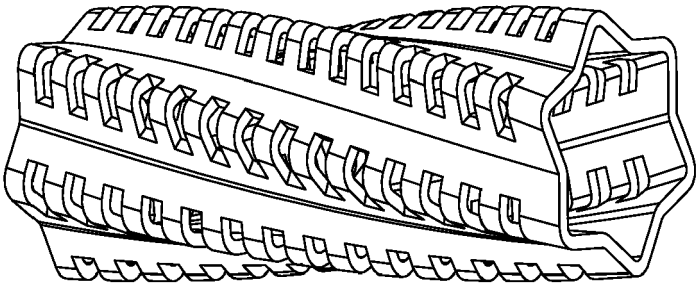

Fig. 14

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EUROPEAN SEARCH REPORT

Application Number
EP 15 16 7860

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	21 September 2015	Mougey, Maurice

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