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(54) **Adjustable Grate for a Burning Device**

Einstellbares Gitter für eine Verbrennungsvorrichtung

Grille Réglable pour un Dispositif à Combustion

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Description

[0001] This invention relates to a grate and more precisely an adjustable grate for a burning device.

[0002] A conventional furnace bottom structure may be simply, for example, a bricklaid surface. This is used, for example, in baking ovens. In such a case, no grate is applied at all.

[0003] Another typical furnace bottom structure consists of a grate which is normally made of cast iron in the shape of some kind of a grid and which is placed on the bottom of a burning device, such as the furnace of a sauna stove. An ash box is normally provided underneath the grate. The draught and the burning of wood are adjusted by opening the ash box slightly or possibly by adjusting air holes in the furnace door.

[0004] There is also such grates being made of two perforated plates or grate elements which are placed on top of each other and which can be rotated or moved in relation to each other in order to make openings of the grate larger or smaller. Document GB 2 081 436 A, describes this type of grate. However, nowadays demands for using advanced solid fuels, such as wood pellets, in fireplaces and furnaces has strongly increased due to fact that harmful particulate emissions is formed much more during the burning of chopped wood than during the burning of e.g. wood pellets.

[0005] Advanced solid fuels cannot be burnt on the furnaces having adjustable grate of the kind disclosed e.g. in the above mentioned document as such but separate solid fuel burner, such as pellet burner, is required. In many cases, such additional devices are usually quite space consuming which, among others, changes of the visual effect of a fire place and leads to reduced amount of wood being possible to burn in one go in a furnace.

[0006] It is an aim of the present invention to provide an improved grate structure on which wood pellets or other kind of advanced solid fuels can also be burnt, more in one go in a furnace and such that visual appearance of a fire place changes less than when using a separate solid fuel burners with previously known grates due to fact that so called combustion tube or fire pipe can be used with the grate when such solid fuels are burnt and by means of which burning can be easily and accurately controlled. Furthermore, the aim of the present invention is to provide a grate which also gives some other advantages.

[0007] The above-mentioned and other advantages of the present invention have been provided according to the characteristics of the appended claims.

[0008] The grate is intended to be used in a burning device which may be, for example, a burning device according to EP 1402217 or EP 1427963. The grate is intended to be used particularly in such a burning device which is intended for the burning of both chopped firewood and wood pellets. Such a burning device may be, for example, a heat storing fireplace with a special combustion space where it is possible to burn both pellets

and chopped wood. The combustion space consists of a vessel whose side wall is perforated for the passage of air. The grate is on the bottom of the vessel in such a way that the ash space of the fireplace remains under the grate; in other words, the ashes can fall to the ash space through the openings of the grate.

[0009] The grate consists of two perforated plates which are placed on top of each other and which can be rotated in relation to each other. Normally, the plates are circular, or plates of another shape are chamfered in such a way that rotating is possible. Normally, the plates are also installed concentrically, wherein they are rotatable in relation to each other around the centres of the plates. Normally, one of the plates is stationary and the other plate is rotated with respect to the stationary plate. By rotating at least one of the plates with respect to the other plate it is possible to place the plates in such a way with respect to each other that the apertures in each plate can be used to adjust the size of the openings formed through both of the plates in a suitable way. The apertures in each plate can be aligned in such a way that the size of the openings becomes larger, or the apertures are not quite aligned, in which case the size of the openings becomes smaller.

[0010] The apertures in at least one of the plates are arranged on the periphery of at least one circle. The apertures arranged on the periphery of the circle are elongated so that they are longer in the direction of the periphery of the circle than in the radial direction of the circle. The elongated shape of the apertures and the fact that the longitudinal direction of the aperture is substantially parallel to the periphery are important. When pellets are burnt, one should make sure that a sufficient amount of air flows through the grate but the pellets must not fall through the grate. When chopped wood is burnt, a sufficient amount of air must be supplied for the combustion of wood, and thus the same openings that were only partly open during the burning of pellets, are completely open. The openings may also be completely open when ashes are removed. As can be seen from the description above, the same grate can be used in connection with fuel types with relatively different dimensions.

[0011] According to an advantageous embodiment, both of the plates are similar, whereas the lower plate is perforated in said location, as will be shown in the drawings below. According to the invention, the upper plate is equipped with a central hole for a so-called combustion tube or fire tube. It is also possible that the lower plate is not perforated. This embodiment is particularly advantageous because of its resistance in practice, since the grate is not warped by the effect of heat and its usable life is thus long.

[0012] The combustion tube is a tube extending centrally upwards in the combustion space and having open ends and a perforated side wall. The combustion tube is used together with holes in the wall of the combustion space to generate, when pellets are burnt, a flow of combustion gases into the combustion tube, in which the com-

bustion gases are burnt. The combustion tube can also be used for turning the upper plate of the grate, for adjusting the openings of the grate. The combustion tube is normally not used when chopped wood is burnt.

[0013] It is also possible to provide different apertures in the lower plate than in the upper plate, because the desired function can also be achieved, for example by equipping the upper plate with elongated apertures arranged on the periphery of a circle, but the lower plate with apertures whose longitudinal direction is in the radial direction of the circle; in other words, the single apertures of the lower plate can form openings extending through the plates with several apertures of the upper plate.

[0014] The grate may also comprise firing tubes for conveying a material for facilitating the ignition and auxiliary air ducts for conveying air. These tubular parts are particularly advantageous to use when the burning device is automatically controlled; in other words, it is possible to perform accurately timed functions when these are needed for facilitating the ignition or for boosting the combustion.

[0015] The invention will be described in more detail with reference to the appended drawings which show an embodiment of the invention.

[0016] Thus, Fig. 1 shows a grate according to the invention seen in a slanted view in the "burning position", and

[0017] Fig. 2, in turn, shows the grate according to the invention in the ash removal position.

[0018] The grates shown in the figures are depicted as plates 2, 3 with a circular form, but in view of the function of the invention it is insignificant whether the plates have a circular or different shape. What is essential, however, is that the mutual position of the plates 2, 3 can be changed by rotating with respect to a given point.

[0019] The grate 1 consists of two substantially plate-like elements 2, 3 placed on top of each other and connected to each other in a suitable way to form a compact unit. The grate 1 is mounted or supported to the burning device in any way known as such, normally at the lower grate element 2. Preferably, a suitable space is left for ash underneath the grate 1.

[0020] In this embodiment, the upper plate 3 is provided with an octagonal central hole. This opening is intended to accommodate a "fire tube" according to an embodiment in use, for rotating the upper grate element. The central part of the lower grate element 2 is equipped with perforations 5 to allow the flow of air from below into the combustion space. The lower grate element 2 is also equipped with a central hole 9, through which it is also possible, in some embodiments, to introduce air into the combustion space. If both of the grate elements 2 and 3 are equipped with corresponding holes, a pin-like or sleeve-like shaft element can be placed through the holes to keep the elements 2 and 3 together. On the other hand, the hole 9 can also be covered, if necessary.

[0021] Also the tubular parts marked with the reference numeral 4 are intended for conducting air from below into

the combustion space.

[0022] The plate 2 is equipped with a number of circumferentially arranged apertures 6 which are elongated in this embodiment.

[0023] The upper grate element 3 is, in principle, plate-like and equipped with apertures 6 corresponding to the apertures 6 of the lower grate element 2. In Fig. 2, the apertures 6 are on top of each other, wherein the same reference numeral 6 indicates the apertures of both grate elements 2 and 3. In this embodiment, the apertures 6 are substantially identical in both of the grate elements 2, 3. In Fig. 2, the apertures 6 are open as much as possible. This position could be called the ash removal position, because the removal of the ash produced by burning is then easy and possible through the apertures 6.

[0024] The upper grate element 3 can be turned to a fixed angle in relation to the grate element 2 in a rotating manner. As can be easily seen, by turning it is possible to make the size of the apertures 6 larger and smaller from the small size of Fig. 1 to the large size of Fig. 2 in a stepless manner.

[0025] The pin-like parts indicated with the reference numeral 7 are hollow, and via them it is possible to facilitate the ignition of the material to be burnt, because any material to facilitate ignition can be introduced via the tubes 7 into the combustion space which is placed on top of the grate 1, as is obvious. For example, the tubes 7 can conduct air heated outside to facilitate the ignition.

[0026] Another function of the tubular parts 7 is to facilitate the sticking together of the grate elements 2 and 3. However, the grate elements 2 and 3 are primarily kept together, for example, by means of a pin inserted in the central hole in the grate 1 or by providing either one of the grate elements 2, 3 with a collar or the like that is supported by parts in the other grate element. For their part, the parts 7 are also used as stops for the movement between the grate elements 2, 3.

[0027] The movement between the grate elements 2 and 3 is limited to a suitable range, for example, by means of a stop pin indicated with the reference numeral 8. The pin 8 is fixed to the upper grate element 3 and it moves in a slot in the lower grate element 2. It is obvious that there are also many other ways of stopping which are known in abundance from a variety of technical fields. Because the function of the movement is to open and close the apertures 6, the required movement is relatively small, maybe in the order of about 15 degrees in the average, wherein the part 8 is suitable for this purpose.

[0028] For the rotation, the upper grate element 3 can be equipped with a suitable protrusion not indicated herein. If the structure according to the invention is used in connection with a generally cylindrical burning device, the protrusion could be a kind of a handle which is visible at the side and by means of which the burning process can be easily adjusted by changing the size of the openings 6.

[0029] The material for producing the grate according to the invention is particularly a plate made of metal, such

as cast iron. The material thickness and the size of the openings and the other details are always selected according to the use. The adjustment of the combustion is efficient when the grate according to the invention is used. The adjustment of the air-introducing aperture means pure combustion and also efficient combustion.

Claims

1. A grate (1) for use in a burning device, the grate (1)

- consisting of two plates (2, 3), an upper plate (3) and a lower plate (2) on top of each other, which are rotatable in relation to each other around a given point,
- both plates comprising apertures (6), the apertures (6) located such that by rotating the plates (2, 3) in relation to each other, the openings through both plates (2, 3), formed by more or less aligned apertures (6) of both plates (2, 3) are adjustable larger or smaller,
- at least some of the apertures (6) in at least one of the plates (2, 3) being arranged on the periphery of a circle, and
- the apertures (6) arranged on the periphery of a circle being elongated so that they are longer in the direction of the periphery of the circle than in the direction of the radius of the circle,

characterized in that the upper plate (3) comprises a central hole for a combustion tube or a fire pipe.

2. The grate (1) according to claim 1, **characterized in that** at least part of the apertures (6) of both plates (2, 3) are arranged on the periphery of the same circle.

3. The grate (1) according to claim 1 or 2, **characterized in that** the grate comprises tubular ignition tubes (7) for conveying a material for facilitating the ignition.

4. The grate (1) according to any of the preceding claims, **characterized in that** the grate comprises tubular auxiliary air ducts (4) extending from underneath of the lower plate (2) to the upper surface of it for conveying air.

5. The grate (1) according to any of the preceding claims, **characterized in that** the apertures (6) of both plates (2, 3) are arranged on the peripheries of at least two circles being of different size.

6. The grate (1) according to any of the preceding claims, **characterized in that** the lower plate (2) of the plates (2, 3) placed on top of each other is provided with air holes (5) in the area between the ap-

ertures (6).

7. The grate (1) according to any of the preceding claims, **characterized in that** the mutual movement is limited by means of a slot and a pin (8) moving therein.

Patentansprüche

1. Gitter (1) zur Verwendung in einer Verbrennungsvorrichtung, wobei das Gitter (1)

- aus zwei Platten (2, 3), einer oberen Platte (3) und einer unteren Platte (2) besteht, die übereinander angeordnet und relativ zueinander um einen gegebenen Punkt drehbar sind,
- wobei beide Platten Öffnungen (6) aufweisen, wobei die Öffnungen (6) so angeordnet sind, dass durch Drehung der Platten (2, 3) relativ zueinander die Öffnungen durch beide Platten (2, 3), die durch mehr oder weniger ausgerichtete Öffnungen (6) beider Platten (2, 3) gebildet werden, größer oder kleiner eingestellt werden können,
- wobei zumindest einige der Öffnungen (6) in mindestens einer der Platten (2, 3) auf dem Umfang eines Kreises angeordnet sind, und
- wobei die auf dem Umfang eines Kreises angeordneten Öffnungen (6) verlängert sind, so dass sie in Richtung des Umfangs des Kreises länger sind als in Richtung des Radius des Kreises,

dadurch gekennzeichnet, dass die obere Platte (3) ein Mittelloch für ein Verbrennungsrohr oder ein Feuerrohr aufweist.

2. Gitter (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** zumindest ein Teil der Öffnungen (6) beider Platten (2, 3) auf dem Umfang des gleichen Kreises angeordnet ist.

3. Gitter (1) nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** das Gitter rohrförmige Zündrohre (7) zum Zuführen eines Materials zum leichteren Zünden aufweist.

4. Gitter (1) nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** das Gitter rohrförmige Zusatzluftleitungen (4) aufweist, die sich zur Zufuhr von Luft von unterhalb der unteren Platte (2) zu deren oberen Fläche erstrecken.

5. Gitter (1) nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** die Öffnungen (6) beider Platten (2, 3) auf dem Umfang von mindestens zwei Kreisen unterschiedlicher Größen ange-

ordnet sind.

6. Gitter (1) nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** die untere Platte (2) der übereinander angeordneten Platten (2, 3) in dem Bereich zwischen den Öffnungen (6) mit Luftlöchern (5) versehen ist. 5
7. Gitter (1) nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** die gemeinsame Bewegung durch einen Ritz und einen sich darin bewegenden Stift (8) begrenzt ist. 10

Revendications

1. Grille (1) destinée à une utilisation dans un dispositif de combustion, la grille (1) 15
 - consistant en deux plaques (2, 3), une plaque supérieure (3) et une plaque inférieure (2), l'une par-dessus l'autre, qui peuvent tourner l'une par rapport à l'autre autour d'un point donné, 20
 - les deux plaques comprenant des ouvertures (6), les ouvertures (6) situées de telle manière que, par rotation des plaques (2, 3) l'une par rapport à l'autre, les ouvertures à travers les deux plaques (2, 3), formées par des ouvertures (6) plus ou moins alignées des deux plaques (2, 3) sont ajustables plus petites ou plus grandes, 25 30
 - au moins certaines des ouvertures (6) dans au moins une des plaques (2, 3) étant agencées sur la périphérie d'un cercle, et
 - les ouvertures (6) agencées sur la périphérie d'un cercle étant allongées de telle sorte qu'elles sont plus longues dans le sens de la périphérie du cercle que dans le sens du rayon du cercle, 35

caractérisée en ce que la plaque supérieure (3) comprend un trou central pour un tube de combustion ou un conduit de fumée. 40
2. Grille (1) selon la revendication 1, **caractérisée en ce qu'**au moins une partie des ouvertures (6) des deux plaques (2, 3) sont agencées sur la périphérie du même cercle. 45
3. Grille (1) selon la revendication 1 ou 2, **caractérisée en ce que** la grille comprend des tubes d'allumage (7) tubulaires pour transporter une matière pour faciliter l'allumage. 50
4. Grille (1) selon l'une quelconque des revendications précédentes, **caractérisée en ce que** la grille comprend des conduites d'air auxiliaire (4) tubulaires s'étendant du dessous de la plaque inférieure (2) jusqu'à la surface supérieure de celle-ci pour transporter de l'air. 55

5. Grille (1) selon l'une quelconque des revendications précédentes, **caractérisée en ce que** les ouvertures (6) des deux plaques (2, 3) sont agencées sur les périphéries d'au moins deux cercles étant de taille différente.
6. Grille (1) selon l'une quelconque des revendications précédentes, **caractérisée en ce que** la plaque inférieure (2) des plaques (2, 3) placées l'une par-dessus l'autre est prévue avec des trous d'évent (5) dans la zone entre les ouvertures (6).
7. Grille (1) selon l'une quelconque des revendications précédentes, **caractérisée en ce que** le mouvement mutuel est limité au moyen d'une fente et d'une broche (8) se déplaçant dans celle-ci.

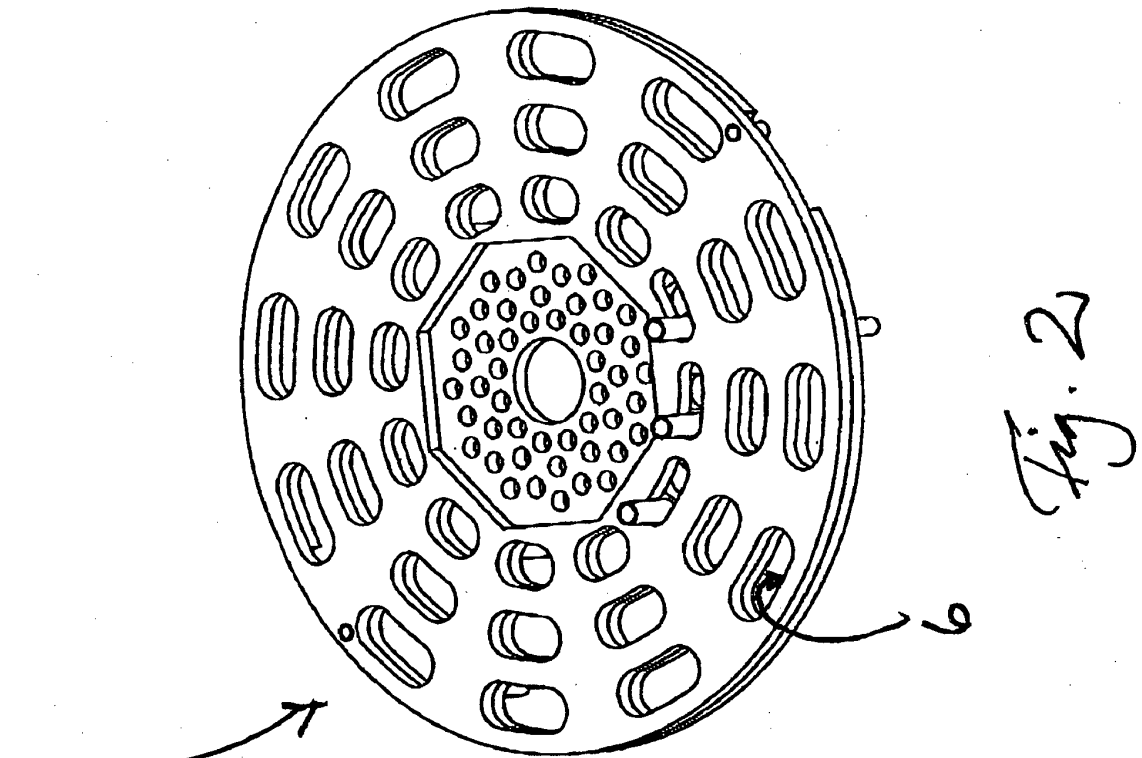


Fig. 2

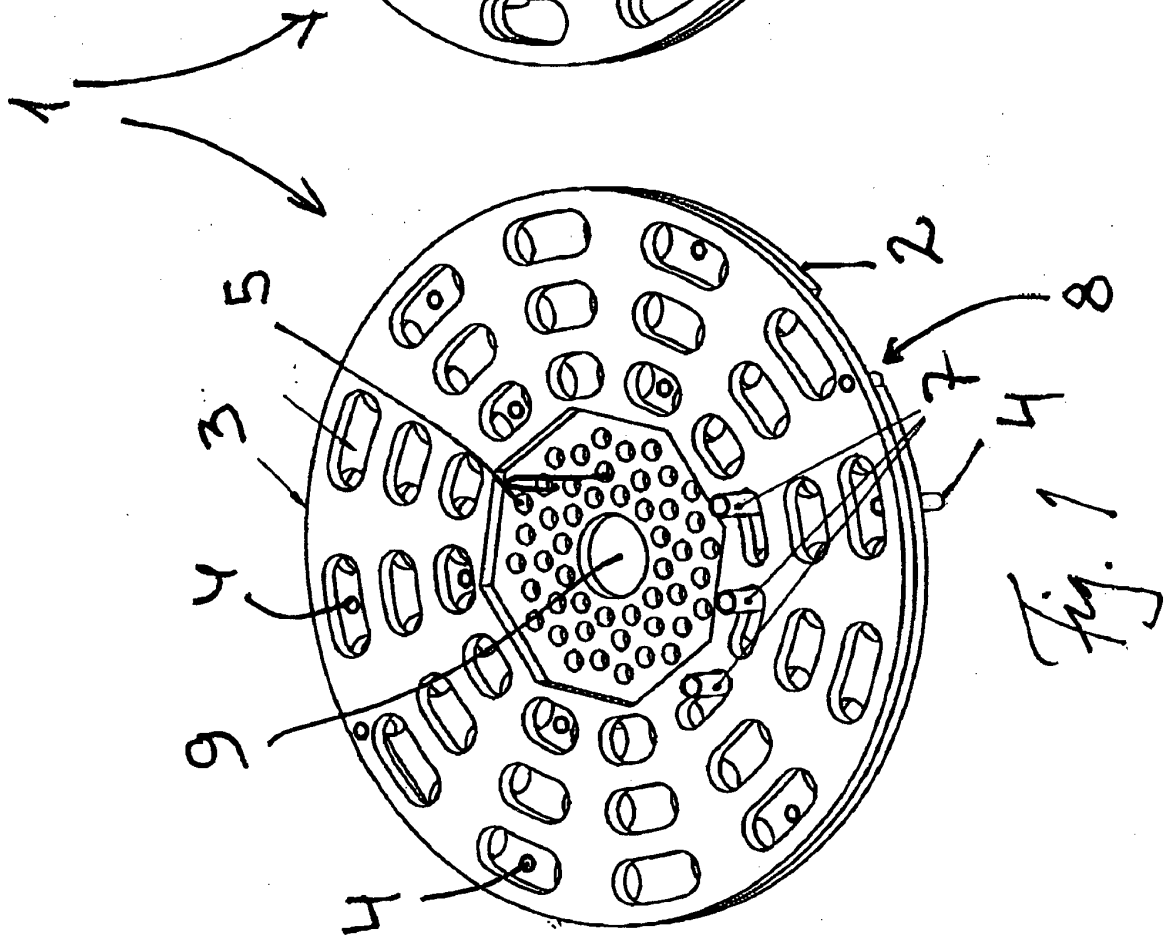


Fig. 1

REFERENCES CITED IN THE DESCRIPTION

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