Title: WOOD-FIRED OVEN WITH APPARATUS FOR ELIMINATING POLLUTANTS

Abstract: Wood-fired oven for cooking dough products, such as pizza and bread, provided with an apparatus for eliminating the fumes comprising a bypass pipe connected to the flue by means of connectors, a two-stage mechanical filtering cyclone situated so as to intercept the fumes circulating in the bypass pipe and a catalytic filtering unit situated downstream of said mechanical filtering unit. It is envisaged using an axial fan connected to the bypass pipe for effecting circulation of the fumes from the lower connection pipe to the upper connection pipe, having, arranged along it, the two mechanical and catalytic filtering units.
WOOD-FIRED OVEN WITH APPARATUS FOR ELIMINATING POLLUTANTS

DESCRIPTION

Field of application
The present invention concerns a wood-fired oven with an apparatus for eliminating pollutants.

The oven in question is intended to be used advantageously for cooking food products such as, in particular, dough products such as bread, pizza or the like by means of the combustion of wood, charcoal or similar products.

Background art
As is known, an increasingly important problem in the sector relating to the production of pizzas or similar products using a wood oven is that of eliminating the pollutants emitted during combustion.

As is known, there exist numerous different solutions on the market, aimed at limiting said emission of pollutants.

A first solution envisages using electrically heated ovens. This solution requires the ovens to be kept closed during cooking of the products in order to limit the consumption of electric power.

However, cooking the pizza in a closed oven results in a deterioration of the organoleptic properties as well as the taste of the pizza in particular owing to the
presence of the greater amount of moisture which forms inside the electric oven compared to an open wood-fired oven.

A further drawback of electric ovens consists in the less crumbly texture and a less well-defined taste of the pizza which is obtained once cooking has been completed, in particular following mixing of the volatile aromas which are emitted by the various ingredients which form the pizza and which are partly deposited again on its surface.

A further drawback of electric ovens consists in the fact that the pizza dough is unable to absorb all the highly valued and pleasing aromas which are released by the fumes in a wood-fired oven.

In order to avoid the abovementioned mixing of aromas it is known to cause the flow of hot air to pass through a catalytic filter. This solution does not solve, however, all the remaining drawbacks associated with the moisture or the absence of the aromas transmitted by the wood fumes.

A second solution envisages using ovens heated by means of the combustion of gas. These ovens are able to recreate a cooking chamber with a heat distribution fairly similar to that which can be obtained with a wood oven.
Gas ovens, however, have the drawbacks associated with ensuring safe conditions, the absence of the aromas which are produced only with wood combustion and which, as mentioned, enhance the taste of the pizza, and the induced circulation of toxic carbon powders and particles, with an unpleasant taste, which may be released in particular from the surface of the oven.

As is known, cooking with a wood-fired oven is the best solution in terms of the organoleptic, cooking and taste properties of the pizza.

In accordance with this solution the fumes produced by the burning of wood pass over the product and are expelled by the chimney without the volatile aromas produced, of varying taste, being able to mix again and impregnate the dough giving it a uniform taste and creating a mixture of aromas which impairs the quality of the product.

At present the main drawback of wood-fired ovens for cooking pizzas and similar food products such as focaccia, calzoni, etc., consists in the need to eliminate the pollutants which are emitted by the combustion process.

On the other hand, the particular characteristics of wood-fired ovens used for cooking dough products make the use of traditional filters, such as electrostatic
filters, unsuitable, owing to the high concentration of particles which would soon saturate the capturing layers, or the use of classic mechanical filters, which require complex and frequent cleaning operations.

Disclosure of the invention

In this situation the main object of the present invention is therefore to eliminate the drawbacks of ovens of the known type mentioned above, by providing a wood-fired oven which allows the pollutants to be to be eliminated by means of a special apparatus, without impairing the organoleptic qualities of the products to be cooked.

Another object of the present invention is to provide an oven which requires a limited amount of maintenance.

A further object of the present invention is to provide an oven which, by means of energy recovery, is able to achieve considerable savings in energy.

A further object of the present invention is to provide an oven which is constructionally simple and inexpensive to produce and operationally entirely reliable.

Brief description of the drawings

The technical features of the invention, in accordance with the abovementioned objects, may be
clearly determined from the contents of the claims indicated below and the advantages thereof will emerge more clearly from the detailed description below, provided with reference to the accompanying drawings, which show a purely exemplary and non-limiting embodiment thereof and in which:

FIG. 1 shows an external perspective view of an example of an oven according to the present invention;

FIG. 2 shows an internal perspective view of the oven according to Figure 1 with some parts removed so that other parts may be seen more clearly;

FIG. 3 shows a perspective view of a detail of the oven according to the present invention relating to a portion of the pipe for discharging the fumes;

FIG. 4 shows an enlarged view of a portion of the pipe according to Figure 3;

FIG. 5 shows a perspective view of an enlarged detail of the oven according to the present invention, relating to an apparatus for eliminating the pollutants emitted by the combustion chamber;

FIG. 6 shows a portion of the apparatus according to Figure 5, relating to filtering means;

FIG. 7 shows a constructional variant of the apparatus for eliminating the pollutants emitted by the oven combustion chamber.
Detailed description of a preferred example of embodiment

With reference to the attached drawings, 1 denotes in its entirety the oven according to the present invention.

With reference to the accompanying figures, the oven 1 is provided with a support structure 2 formed by a base 3 and by a dome 4 which defines a combustion chamber 5 and has an access opening 6.

A cladding able to insulate thermally the combustion chamber 5 is provided on the outside of the dome 4.

From the latter there extends upwards, in an entirely conventional manner, a flue 7 for expelling the smoke produced inside the combustion chamber 5.

The base 3 is particularly solid so as to support the weight of the oven and is provided with a bottom support structure consisting of bricks or pillars, with a compartment 30 for storing the wood, which has, arranged above it, a working surface which is formed at a suitable height such that the pizza maker is able to work properly.

The surface is formed with a layer obtained by casting reinforced concrete with an electrically welded meshwork and arranging on top a layer of insulating material supporting the cooking surface of the oven made of refractory material such as bricks, tiles and cast or
prefabricated refractory cement.

The layer of insulating material consisting, for example, of sand, expanded clay or rock wool has the function of keeping the cooking surface hot, preventing the dispersion of heat and therefore allowing a reduction in the amount of wood used.

The dome may be made, for example, of refractory bricks or prefabricated refractory cement so as to be able to withstand the high temperatures of the oven which may reach temperatures on the surface even as high as 400°C.

The properties of the materials, the thickness and the shape influence the capacity of the dome to absorb/release heat.

The dome is surrounded by a cladding able to contain the insulating material in order to retain the oven heat for a longer period of time and allow cooking without using too much wood.

During the cooking of dough products such as pizza and bread the wood burns on one side of the oven in a position almost against the wall so as to allow the flames resulting from burning of the wood to pass along the inner wall of the dome, heating the refractory material from which it is made.

Functionally speaking, the dome of the oven absorbs
the heat and then returns it uniformly over time acting as a thermal flywheel, mainly by means of irradiation with rays perpendicular to its surface.

During normal operation, the inlet mouth 6 of the oven 1 is preferably open so as to fuel combustion of the wood.

According to the idea forming the basis of the present invention, an apparatus 10 for eliminating the fumes is envisaged, said apparatus comprising a by-pass pipe 11 connected at at least two different heights to the flue 7 by means of a lower connector 12 for removing the fumes and an upper connector 13 for introducing the fumes.

Ventilation means 14 are envisaged, being connected to the bypass pipe so as to effect circulation of the fumes from the lower connection pipe 12 to the upper connection pipe 13, along which two units, i.e. an upstream mechanical filtering unit 15 and a downstream catalytic filtering unit 16, are connected.

Advantageously, the flue 7 is replaced along its initial section by an insertion adapter 17 consisting of a tubular body with the two connectors 12 and 13 fixed thereto and with a circulator 18 mounted coaxially inside a widened base 19 situated in the vicinity of the lower connector 12. This circulator 18 consists of a spirally
extending plate tapering downwards and able to direct the fumes towards the lower connector 12.

The circulator 18 imposes, in other words, on the flow of fumes from the combustion chamber a movement with a rotational component able, on the one hand, to favour the entry of the fumes into the lower connector 12 and, on the other hand, favour the separation of the larger particles contained in the fumes as a result of the centrifugal force.

In accordance with a preferred embodiment of the present invention the cyclone filter is of the two-stage type and comprises a main cyclone 20 and a plurality of secondary cyclones 21.

In greater detail, the main cyclone 20 is mounted coaxially with respect to the bypass pipe, while the secondary cyclones 2 are mounted circumferentially side-by-side in a number defined depending on the type of oven and the power of the fan. The main cyclone 20 has a first fume intake opening 22 situated underneath the lower connector 12 and a first fume discharge opening 23 situated slightly above the lower connector 12.

The secondary cyclones 21 in turn have a second fume intake opening 24, which is situated underneath the first fume discharge opening of the main cyclone 20, and a second discharge opening 25 able to convey the fumes
towards the second connector 13 via a conveying section 26.

The conveyor 26 extends from the support base 27 of the secondary cyclones 21 and has a conical form which tapers upwards. The same support base 27 is provided centrally with a first flow conveying part 28 having a substantially conical shape with the side wall which extends upwards and follows in a parallel manner the progression of the conveyor 26. A second flow conveying part 29 with a substantially conical shape having the apex directed downwards and centred with respect to the fume discharge opening 23 of the main conveyor 23 extends from the support base 27.

The particles separated by the cyclone filter 15 fall into a receiving pipe 9 which forms a continuation, downwards, of the sleeve containing the cyclone filter 15 and which is accessible from the outside of the oven support structure for easy disposal. The ventilation means 14 consist of an axial fan with the impeller mounted directly on the motor shaft. The fan 14 draws in the air from the lower connector 12 and re-introduces it into the upper connector 13.

In the event of a malfunction of the fan 14 or blockage of the bypass duct 11, the flow of smoke continues along its path inside the flue 7.
Therefore, the oven 1 according to the present invention is intrinsically safe since any malfunction affecting the apparatus never gives rise to dangerous conditions of any kind.

In order to intercept also the smallest particles present in the fumes, it is possible, in accordance with a constructional variant of the present invention, to manufacture the impeller of the fan using catalytic material.

Preferably, the cladding of the oven 1 may incorporate a window revealing the electric panel with the logic control unit 3 for performing manually and easily activation or deactivation of the apparatus 15 in order to eliminate pollutants.

Advantageously it is possible to envisage a heat recovery section comprising an exchanger arranged so as to intercept the fumes inside the flue.

In accordance with a constructional variant of the present invention, the apparatus 10 for eliminating the fumes may be configured as schematically shown in Figure 7.

According to this layout the bypass duct 11 removes the smoke directly inside the flue 7 by means of an inner pipe 60 provided with bottom lateral slits 51.

The smoke drawn in is then forced to enter again
into the flue 7 along a section situated further downstream by means of the action of the fan, not shown in the figure, connected to the upper connector 13', or preferably into the duct part 11 outside the flue 7.

On the inside of the connector 11, preferably inside the pipe 60 arranged inside the flue 7, the following are arranged in succession, downstream of the slits 51: heating means 52 consisting preferably of a resistance, a mechanical filtering unit 53, composed preferably of one or more metal meshworks with different size meshes, a catalytic filter 54 and, if necessary, also a heat recovery exchanger 55.

The flue 7 has, in the region of the inner pipe 60, a widened portion which is defined between its connecting sections 62 and 63 so as to allow housing of the abovementioned mechanical and catalytic filtering devices.

Functionally speaking, the fumes drawn by the fan through the slits 51 are forced to pass through the mechanical filter 53 arranged so as to protect the catalytic filter 54.

The electric resistance 52 has the function of burning by means of irradiation the particles deposited on the mechanical filter 53, cleaning it.

The invention thus conceived therefore achieves the
predefined objects.

Obviously it may assume, in its practical embodiment, also forms and configurations which are different from that illustrated above without thereby departing from the present scope of protection.

Moreover all the details may be replaced by technically equivalent parts, and the dimensions, the forms and the materials used may be of any kind according to requirements.
CLAIMS

1. Wood-fired oven with apparatus for eliminating pollutants, provided with a support structure, in particular made of masonry consisting of refractory material, a combustion chamber formed in said support structure and able to house inside it dough products, and at least one flue for evacuating the fumes communicating with said combustion chamber and having, arranged along it, said fume elimination apparatus;

characterized in that said apparatus for eliminating the fumes comprises:

- a bypass pipe connected to said flue by means of a fume removal connector and a fume inlet connector;

- a mechanical filtering unit situated so as to intercept the fumes circulating in said bypass pipe between said connectors and consisting in particular of a cyclone filter;

- a catalytic filtering unit which is situated so as to intercept the fumes circulating in said bypass pipe downstream of said mechanical filtering unit;

- ventilation means connected to said bypass pipe so as to effect circulation of the fumes from said lower connection pipe to said upper connection pipe.

2. Oven according to Claim 1, characterized in that said flue is provided in the' region of said lower
connector with a circulator able to cause in the fumes leaving said combustion chamber a rotating flow with a velocity component transverse with respect to the longitudinal axis of the flue which is able to favour conveying of the fumes inside said lower connector and the separation of particles from said fumes by means of a centrifugal effect.

3. Oven according to Claim 1, characterized in that said cyclone filter is a two-stage filter.

4. Oven according to Claim 3, characterized in that said two-stage cyclone filter comprises at least one main cyclone and at least a plurality of secondary cyclones;

    said main cyclone being mounted coaxially with respect to said bypass pipe and being provided with a first fume intake opening situated underneath said lower connector and a first fume discharge opening;

    said secondary cyclones being mounted circumferentially with respect to said bypass pipe and being provided with a second fume intake opening situated underneath said first fume discharge opening of said main cyclone and a second discharge opening able to convey the fumes towards said second connector via a conveying section.

5. Oven according to Claim 4, characterized in
that said conveyor has a form tapered upwards and is centrally provided with a flow conveying part having a substantially conical shape.

6. Oven according to Claim 1, characterized in that said ventilation means consist of a centrifugal fan situated so as to have an intake function in said bypass circuit.

7. Oven according to Claim 1, characterized in that said ventilation means consist of an axial fan which is situated so as to have an intake function in said bypass circuit and is provided with an impeller directly keyed onto the driving shaft.

8. Oven according to Claim 7, characterized in that said one catalytic filtering unit is obtained by means of the impeller of said centrifugal fan.

9. Oven according to Claim 1, characterized in that it comprises a collection pipe connected to said mechanical filter and accessible from the outside of the support structure of the oven for easy disposal of the separated particles.

10. Oven according to Claim 1, characterized in that said connector for removing the fumes is situated below said connector for introducing the fumes.

11. Oven according to Claim 1, characterized in that it comprises a heat recovery section comprising an
exchanger situated so as to intercept said fumes in said flue.

12. Oven according to Claim 1, characterized in that said bypass duct is provided with a pipe arranged inside said flue, from where the fumes are removed.

13. Oven according to Claim 12, characterized in that said pipe has, arranged along it, said mechanical filtering unit, in particular consisting of one or more metal meshworks.

14. Oven according to Claim 13, characterized in that said mechanical filtering unit is followed by said catalytic filter and is preceded by heating means consisting preferably of a resistance.

15. Oven according to Claim 12, characterized in that said bypass duct is provided with a widened portion in the region of said pipe.