

Apparatus for a heat treatment of a particular food product

The invention concerns to an apparatus for a heat treatment of a particular food product with a content of evaporable substances, such as fat, in a treatment chamber in which the product is subjected to heat stress from a heat source, in the form of for example one or more quartz lamps, and the gasses, which the product gives off in the process, are sucked off by means of a ventilator in an air current, which via a filter device for removing the gasses from the air and an air connection between the filter device and the treatment chamber, are discharged into open air, whereby the air connection is constructed as a convector.

A popular particular food product are French fried potatoes which, in considerable amounts, are served in portions in restaurants, grill bars, cafeterias or in the street from hot-dog stands. French fried potatoes are served either alone as a meal by themselves or in connection with other courses. In any case, there will be a demand for French fried potatoes being freshly heated and crispy immediately after the order has been placed. Since French fried potatoes are unsuitable for long term keeping in this condition, the preparation must necessarily take place by means of a process which quickly and easily can transform the raw and possibly pre-processed material into the ready product.

This demand is to the utmost full-filled by deep-fat frying, where a basket containing a portion of potato strips is lowered into a pool of melted lard or cooking oil. The lard or the oil is quickly absorbed by the potato strips which thereby are heated and given a crispy and crunchy consistency with an almost brown colour, mainly deriving from a caramelising of the sugar content of the potato pieces.

When the potato pieces are treated in this way, they will as French fried potatoes have a fatty or oily content of 30%. Considering the very big amounts of French fried potatoes which over the years are consumed especially in the industrialised countries, this otherwise so popular food product can be a serious threat to national health. Frequently consuming too much fat could in the long run be deposited as fatness and cause various diseases.

10 In order to eliminate these problems, various apparatuses have been invented concerning treatment of pre-processed potatoes containing a relatively low content of fat. With these apparatuses, it is possible to make crispy and tasty French fried potatoes with a moderate fatty content of approximately 15 6%.

In this way, the problem of the high fatty contents in deep-fried potatoes has been relieved, but in deep-frying as well as in more simple apparatuses, it still is a big problem 20 that the process sends smoke and smell out into the surroundings to the inconvenience of the serving staff and the customers present in the room. Some apparatuses have therefore been supplied with filters for cleaning the air before it reaches the room. Neither of these apparatuses have fully 25 lived up to the demands made on them.

The apparatus as invented is suitable for treatment of pre-fried potato pieces with a fatty content of e.g. approximately 6%. The potato pieces also contain water which 30 partly has to be removed in order to obtain the crisp and crunchy consistence of the potato pieces which is characteristic of French fried potatoes. This means that a successive renewal of the air in the treatment chamber has to take place as the process otherwise will be hampered or 35 stopped, when the air in the chamber has been saturated with vapour.



The air renewal takes place when the ventilator sucks air out of the treatment chamber while fresh air is pressed into it via an opening for influx of air in the wall of the chamber. In this way, an air current is produced which is to be thrown off into the open. Out of consideration for the surrounding environment, it is, prior to that, necessary to let the air current pass the filter device to remove the air contents of vapour, fat, smell and other impurities.

- 10 The temperature of the air in the treatment chamber can reach about 250° C at least in the final step of the process. If air with such a high temperature is sent through the filter device, this might be damaged and might work with reduced effectiveness so that the air will not be cleaned  
15 satisfactorily. To relieve this problem, the air current could be increased in excess of the optimum progress. However, that would imply extra running expenses for heating the additional air volume and furthermore both ventilator, filter and other construction details of the apparatus would have to be laid  
20 out with correspondingly large dimensions, whereby the apparatus would be clumsy and bulky, and it would be exorbitantly costly to produce.

By using the air connection between the treatment chamber and  
25 the filter device as convector, the air can now be cooled down to a temperature most suitable for the filter device. Normally, the various components will be built in a cabinet. In the wall of the cabinet, it would be a good idea to construct holes as well above as under the area where the  
30 convector is placed. The buoyancy in the heated air surrounding the convector will then force a secondary air current past the convector, whereby the primary air current in the convector is cooled down. In the same way, a secondary air current can be sent past areas of the cabinet wall which are  
35 close to the very hot treatment chamber. Thereby, these areas



are cooled and will therefore not be uncomfortably hot for the persons who are to operate the apparatus.

When the components of the apparatus are built in a cabinet, 5 it will be appropriate to construct a lead-in opening with a corresponding door in both cabinet and treatment chamber. By interconnecting the two doors with a suitable rod system, they can be made to open and close simultaneously. The serving staff will therefore only have to open the outer door of the 10 cabinet to get immediate access to the treatment chamber when this has to be filled with a new portion of potato pieces. In this connection, the two doors can be hinged in such a way that they, in open position, together form a lock between the treatment chamber and the cabinet, through which the product 15 easily and safely can be poured into the treatment chamber.

The convector can be constructed in many different ways within the scope of the invention. Thus, it can be constructed as a channel with ribs which give the convector a large surface for 20 effectively transmitting the heat contents of the primary air current to the secondary air which flows past the convector. In an especially advantageous embodiment, the convector can consist of a number of heat-conducting pipes which are placed at intervals side by side in such a way that the secondary air 25 current can pass between the pipes which for example can be made of copper or another heat-conducting material.

For heating the potato pieces, radiant heat from e.g. quartz lamps can advantageously be used. This is a very intensive 30 form of energy providing a quick and precise heat treatment of the potato pieces with minimum energy loss to the surroundings. The heat-ray element will then naturally be placed inside the treatment chamber which may be constructed in different ways. For example, the chamber may be a rotating 35 cylinder in which the potatoes during the rotation are tumbling between each other and are therefore uniformly

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irradiated on all sides. In a preferred embodiment, the treatment chamber is stationary, and the potato pieces will be rotated by rotating a driving wheel with carriers.

5 The stationary construction of the treatment chamber means that the in- and out-lets and the closing mechanism of these can be constructed in a simple and reliable manner. The out-let can thus conveniently be constructed permanently in the bottom area of the treatment chamber. In this way, the  
10 ready French fried potatoes will automatically fall out under the influence of the gravitational pull when a slide gate in front of the emptying opening is pulled away. By letting the driving wheel continue to rotate during this, a complete emptying of the treatment chamber takes place.

15

The French fried potatoes fall through a shaft which is constructed in the cabinet and has an opening at the bottom, through which a sleeve for collecting the French fried potatoes can be inserted. The fresh French fried potatoes will  
20 immediately after the heat treatment continue to smell, however, the smell will be sucked into the treatment chamber via its air in-let, as the ventilator under this will continue to be operating.

25 The quartz lamps, which, as mentioned, subject the potato pieces to intense radiant heat, will necessarily have to operate with a rather high surface temperature, which for example can exceed 800° C. At such high temperatures, there is a risk that substances in the vapours, which the potato pieces  
30 give off when they are irradiated, can disintegrate near or on the quartz lamps and form malodorous and unhealthy compounds of e.g. aldehydes which can be both saturated and with a double bond in 2-position.

35 As example of such aldehydes can be mentioned acrolein or 2-propenal which has a pungent and unpleasant smell, and

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higher unsaturated aldehydes which smell like acrolein though with a slightly less strong and pungent smell.

In order to eliminate these disadvantages, it is the object of the invention to show a heat treatment chamber of the kind mentioned in the opening paragraph which is arranged in such a way that the vapours, which the potato pieces give off when they are irradiated, cannot come near or into contact with the heat source.

10

Another object of the invention is to keep the temperature of both the heating element and its immediate surroundings at an appropriate low level.

15 This is, according to the invention, achieved by the fact that the chamber comprises means to ventilate the heat source. The ventilating air blows the vapours in the chamber away from the heat source and its immediate surroundings, whereby the content of the vapours of e.g. fats and oils is secured  
20 against the disintegration which could occur if the vapours were to enter the very hot zone near the heat source or came into direct contact with its surface. The heat source is furthermore cooled to a pre-chosen temperature whereby it will attain a long life.

25

By simultaneously cooling the immediate surroundings of the heat source, it is prevented that e.g. fat vapours which come near or into contact with the immediate surroundings of the heat source disintegrate.

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In an preferred embodiment according to the invention, the means for ventilating the heat source comprise an air shaft which, if convenient, via a filter device connects the chamber to the open, an open cabinet placed in the chamber above the  
35 grid for mounting the heat source, an inlet duct connecting the cabinet to the open, and at least one ventilator for

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5 sending an air current into the cabinet via the inlet duct. Thereby, an air current is formed past the heating element for keeping the vapours from the process at a distance of both the heating element and the cabinet, which, at the same time, both are cooled to a predetermined temperature.

10 The opening of the cabinet can, according to the invention, advantageously face the grid where the product which is to be heat treated is. When the heat source is extending along the opening, and the air duct ends behind the heat source, the air current passing through the cabinet opening will effectively blow the vapours from the process away from the heat source.

15 To ensure that the air current obtains a uniform course in the full extent of the heating element, a perforated air distributor plate can, according to the invention, be put in between the mouth of the inlet duct in the cabinet and the heat source. This plate can furthermore be bright on at least the side facing the heat source, whereby the air distributor  
20 plate, at the same time, obtains an advantageous effect as a reflector to the heat source.

A chamber in which a food product is to be heat-treated or prepared, must frequently be flown through by fresh air for  
25 absorbing and removing steams, fat vapours and other vapours which the product might give off when it is heated. If the vapours are not removed, the process will not be able to pass off satisfactorily, and the finished product will therefore not obtain the desired quality. In case of many food products,  
30 for example French fried potatoes, it is desired that they are prepared with a crisp and delicious crust which require admission of oxygen which exactly is present is the passing air.

35 The air current which therefore is necessary to optimally prepare a tasty food product in the chamber, can, in one

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embodiment, be formed merely by the air serving to ventilate the heat source.

In an advantageous second embodiment, the air current can be made up by a first and a second air current, whereby the first air current is led into the chamber via the inlet duct and the second via the grid which carries the food product. Thereby, it is ensured that all parts of the product will come into contact with the necessary volume fresh air.

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The air current or currents furthermore have the effect that a part of the heat from the heat source is transmitted to the product through convection. At the same time, the heat is distributed evenly around the product which thereby receives a complete uniform heat treatment on all its parts.

The convection and heat distribution will be especially effective, if the first air current is directed towards the grid and the second towards the heat source cabinet. In the zone where the two air currents meet, a strong turbulence is created which furthers the convection and ensures an effective heat distribution around the food product.

In e.g. the known structure, the grid is formed as a perforated wrapping on a rotating cylinder. When the cylinder during operation rotates, the individual parts of the particular product are tumbling between each other and are thereby advantageously tossed in such a way that all sides of all parts of the product are subjected to the same uniform and even heat stress of the heat source.

By providing the cylinder with journals which are journaled in bearings mounted on the cabinet wall, and by giving one of these journals a through axial hole, the inlet duct can furthermore be shaped in a pipe extending in through this axial hole and attached to the cabinet. In this case, at least

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one of the ventilators for sending an air current into the cabinet can furthermore advantageously be mounted in or at the end of this pipe.

5 The invention will be explained in greater details below, describing only exemplary embodiments with reference to the drawing, in which

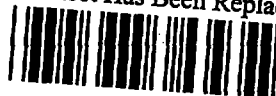
Fig. 1 is a lateral view of a cross section of a treatment  
10 chamber according to the invention,

Fig. 2 is the same, but seen from the front and partly in section, and

15 Fig. 3 shows, on an enlarged scale, a heat-source arrangement for the treatment chamber shown in fig. 1 and 2.

In fig. 1 and 2, a treatment chamber according to the invention is designated in toto by the reference number 1. The  
20 chamber is built up as a cabinet 2 in which a rotating cylinder 3 is placed. The cylinder is carried by a left journal 4 and a right journal 5, which run in bearings, 6 and 7 respectively, which are fastened to the cabinet walls. The cylinder 3 is made to rotate by means of an engine (not shown)  
25 which, with a belt 8 around a pulley 9 on the right journal 5, drives the cylinder.

The cylinder 3 has a perforated wrapping 10 which functions as a grid to a food product 11, which in the following is assumed  
30 to be pre-processed potato pieces which, by heating in the chamber, are to be prepared as French fried potatoes. On the wrapping 10 of the cylinder 3, a number of low carriers 12 are mounted which toss the potato pieces when the cylinder rotates.



The potato pieces 11 can in portions be poured into the cylinder via an opening 13 in the wrapping when a swingable lid 14 in the cabinet 2 is lifted.

5 Close beneath the wrapping 10 of the rotating cylinder 3 is placed two swing flaps, 15 and 16 respectively. The flaps can by mean of a not shown swing mechanism be made to swing around pivots, 17 and 18 respectively, from the closed position shown in fig. 1 to the open position indicated by a dotted line.

10

As mentioned, the flaps 15 and 16 are placed close beneath the wrapping 10 of the cylinder. As the flaps furthermore follow the wrapping along a curve with the same axis as the wrapping, the flaps will, in closed position, assume a part of the  
15 function of the wrapping as a grid, when the opening of the wrapping passes the spot above the flaps where the potato pieces 11 are tumbling around while the cylinder is rotating. For this reason, at least one of the flaps, for example the flap 16, can be shaped as a grid which, in this case, consists  
20 of a perforated plate.

In the cylinder is placed a heat-source arrangement, which can be seen on an enlarged scale in fig. 3 and which in toto is designated by the reference number 19.

25

The heat-source arrangement comprises a cabinet 20 which at the bottom has an opening 21. In sockets 22, which are attached in the cabinet 20 at the opening 21, there is placed a total number of, in this case, five quartz lamps 23. A wire  
30 25 is serving for supplying the quartz lamps with the necessary electricity.

The cabinet 20 is attached to a pipe 26 which, from the open, is extending into the cylinder 3 via a through axial hole 27  
35 in the right journal 5. In the pipe 26, there is furthermore placed an axial-flow fan 28 which is driven by a motor 29. A

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perforated plate 30 is furthermore placed in the cabinet 20 behind the quartz lamps 23.

When a portion of French fried potatoes is to be prepared, the operator opens the lid 14 and pours a portion of pre-processed potato pieces in through the opening 13 of the cylinder 3 which, during this, is made to stop at the lid 14 by means of a pre-programmed control (not shown).

10 The control then makes the cylinder rotate in the direction of the arrow for an adequate period of time, e.g. a couple of minutes, while the potato pieces are tumbling around in the bottom area of the cylinder a bit above the middle in the direction of rotation.

15

At the same time, the quartz lamps are lighted, and as the opening 21 of the cabinet 19, as shown, is facing the potato pieces 11, these now receive an intense flow of heat from the quartz lamps. Thereby, the potato pieces are heated quickly and safely to a temperature where the substances which the potato pieces consist of, undergo a number of chemical and physical processes which in e.g. a couple of minutes transform the potato pieces into ready-to-serve French fried potatoes.

25 At this point, the control (not shown) activates the swing mechanism (not shown) which thereby swings open the flaps 1, 16 so that the hot French fried potatoes via a chute 31 can glide down into a sleeve 33 on a table 32 under the chute 31. A portion of finished, hot French fried potatoes are now ready to be served, and the preparation of the next portion can begin.

The potato pieces have a content of, among other things, water, which have to be removed during preparation in order to obtain the desired consistence of the finished French fried potatoes. When the potato pieces are heated to an adequate

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temperature, a part of their contents of water, fat and other substances vaporise. The vapours spread into the chamber which quickly would be filled with saturated vapours to an extent which would stop or slow down the further course of the process if the vapours were not successively removed from the chamber.

During operation, the chamber is therefore supplied with fresh air for absorbing the vapours. Concurrently with the chamber being supplied with fresh air, vapour-containing air is sucked out of the chamber via an air shaft 34. The air is discharged into the open, but can, before this, advantageously be made to pass a filter device (not shown) in order to prevent that undesirable vapours and smells escape to the surrounding environment to the inconvenience of the persons who might be near by.

The content of oxygen in the air furthermore contributes to giving the French fried potatoes a crisp and delicious crust.

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The in fig. 1 and 2 shown structure is supplied with a ventilator (not shown) for sucking the vapour-containing air out of the air shaft 34. During this, the air can pass a subsequent filter device (not shown) and then be discharged into the open.

The sucking out forms a negative pressure which draws fresh air into the chamber 1 via the perforated swing flap 16 and the perforated wrapping 10 of the cylinder 3. As indicated in fig. 1, the fresh air, during this, advantageously passes the potato pieces at the bottom of the cylinder.

According to the invention, the axial-flow fan 28, which is driven by the motor 29, furthermore blows an air current into the cylinder 3 via the pipe 26 and the opening 21 of the cabinet. On the way, the air current passes the perforated

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plate 30 behind the quartz lamps 23. The air is therefore distributed evenly and uniformly across the total area of the quartz lamps. The perforated plate 30 is bright on the side facing the quartz lamps, and the plate therefore serves for reflecting the heat radiation down towards the potato pieces at the bottom of the cylinder.

As it can be seen, the air current has, through the swing flap 16 and the wrapping 10, direction mainly towards the opening 10 21 of the quartz lamp cabinet 20, while the air, which at the same time is flowing out of this opening, oppositely is directed towards the potato pieces tumbling around at the bottom of the cylinder 3.

15 The two air currents contribute considerably to, by means of convection, transmitting and distributing the heat to the potato pieces which thereby are ensured a uniform and precise treatment. This effect is optimised by, as mentioned, letting the two air currents blow towards each other so that a strong 20 turbulence is created in the treatment area.

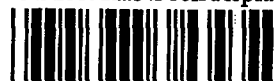
A cycle for preparing a portion of French fried potatoes will, for economical and practical reasons, necessarily have to be completed within a reasonably short timescale which typically 25 will be around a couple of minutes. The quartz lamps must therefore be able to act upon the potato pieces with an intense heat which however presupposes that the lamps operate with a relatively high surface temperature which for example can exceed 800° C.

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As mentioned earlier, there is a risk, at such high temperatures, that the substances of the vapours which the potato pieces give off when they are heated, will disintegrate at or on the quartz lamps and form malodorous and unhealthy 35 compounds.

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According to the invention, this is prevented by the fresh air which by means of an axial-flow fan 28 is blown into the cylinder 3 via the pipe 26 and the cabinet 20. The air acts as a shield which keeps the mentioned vapours at a distance of 5 the quartz lamps 23 and their immediate surroundings, for example the cabinet 20.

The air shield furthermore cools the quartz lamps and the cabinet. When the quartz lamps in this way are kept at a 10 predetermined low temperature, they are ensured a relatively long life. The cooling of the cabinet eliminates at the same time the risk of vapours, which might come in contact with the cabinet, disintegrating.

15 With reference to the drawing, the invention is described above on the assumption that the treatment chamber had a rotating cylinder, and sucking out vapour-containing air took place via a filter device.

20 Within the scope of the invention, the treatment chamber can however be designed in many other ways. In this way, the chamber can e.g. simply be in the nature of an oven with a built-in grid.

25 The essential is that an air shield is created around the heat source for cooling it and keeping vapours of e.g. fats at a distance so that they do no disintegrate.

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C l a i m s  
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1. Apparatus for a heat treatment of a particular food  
5 product with a content of evaporable substances, such as fat,  
in a treatment chamber in which the product is subjected to  
heat stress from a heat source, in the form of for example one  
or more quartz lamps, and the gasses, which the product gives  
off in the process, are sucked off by means of a ventilator in  
10 an air current, which via a filter device for removing the  
gasses from the air and an air connection between the filter  
device and the treatment chamber, are discharged into open  
air, whereby the air connection is constructed as a convector,  
characterized by the fact that the chamber comprises means for  
15 ventilating the heat source.

2. Apparatus according to claim 1, characterized by the fact  
that the means for ventilating the heat source comprise an air  
shaft which, possibly via a filter device, connects the  
20 chamber to the open, an open cabinet for mounting the heat  
source, which is placed in the chamber above the grid, an  
inlet duct which connects the cabinet to the open, and at  
least one ventilator for sending an air current into the  
cabinet via the inlet duct.

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3. Apparatus according to claim 1 or 2, characterized by the  
fact that the opening of the cabinet faces the grid, that the  
heat source is extending along the opening, and that the air  
duct ends behind the heat source.

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4. Apparatus according to claim 1, 2 or 3, characterized by  
the fact that a perforated air distributor plate is put in  
between the mouth of the inlet duct in the cabinet and the  
heat source.

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5. Apparatus according to claim 4, characterized by the fact that the perforated air distributor plate is bright at least on the side facing the heat source.

5 6. Apparatus according to each of the claims 1 - 5, where the product is to be oxidised, and vapours generated during the process are to be removed from the chamber, characterized by the fact that the volume of fresh air necessary for the mentioned purpose is supplied to the chamber via the inlet  
10 duct.

7. Apparatus according to each of the claims 1 - 5, where the product is to be oxidised, and vapours generated during the process are to be removed from the chamber, characterized  
15 by the fact that the volume of fresh air necessary for the mentioned purpose is supplied to the chamber partly in a first air current which passes the inlet duct, partly in a second air current which passes the grid.

20 8. Apparatus according to claim 7, characterized in that the two air currents have primarily opposite directions.

9. Apparatus according to each of the claims 1 - 8, characterized in that the grid, in combination, is formed in a  
25 lower part of the cabinet wall and in a rotating cylinder which with journals is journaled in bearings which are mounted on the chamber wall, that at least one of the journals has a through axial hole, and that the inlet duct is extending through this hole.

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10. Apparatus according to claim 9, characterized in that the inlet duct is formed in a pipe which is extending in through the axial hole and is attached to the cabinet, and that at least one of the ventilators for sending an air current into  
35 the cabinet is mounted in or at the end of this pipe.



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## AMENDED CLAIMS

[received by the International Bureau on 09 October 1998 (09.10.98);  
original claims 1-10 replaced by amended claims 1-9 (2 pages)]

1. Apparatus for a heat treatment of a particular food product  
5 (11) with a content of evaporable substances, such as fat, in  
a treatment chamber (1) in which the product is subjected to  
heat stress from a heat source, in the form of for example one  
or more quartz lamps (23), and the gasses, which the product  
(11) gives off in the process, are sucked off by means of a  
10 ventilator (28) in an air flow, which via a filter device for  
removing the gasses from the air and an air connection between  
the filter device and the treatment chamber (1), are  
discharged into open air, whereby the air connection is  
constructed as a convector, and whereby the chamber (1)  
15 comprises means for ventilating the heat source, characterized  
in that the means for ventilating the heat source comprises an  
exhaust channel (34) which, possibly via a filter device,  
connects the chamber to the open, an open cabinet (20) for  
mounting the heat source, which is placed in the chamber (1)  
20 above the grid, an inlet duct (26) which connects the cabinet  
(20) to open air, and at least one ventilator (28) for sending  
an air flow into the cabinet (20) via the inlet duct (26).

2. Apparatus according to claim 1, characterized in that the  
25 opening (21) of the cabinet (20) faces the grid, that the heat  
source is extending along the opening (21), and that the air  
duct (26) ends behind the heat source.

3. Apparatus according to claim 1 or 2, characterized in that  
30 a perforated air distributor plate is put in between the mouth  
of the inlet duct (26) in the cabinet (20) and the heat  
source.

4. Apparatus according to claim 3, characterized in that the  
35 perforated air distributor plate is bright at least on the  
side facing the heat source.



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AMENDED SHEET (ARTICLE 19)

5. Apparatus according to each of the claims 1 - 4, where the product (11) is to be oxidised, and vapours generated during the process are to be removed from the chamber (1),  
5 characterized in that the volume of fresh air necessary for the mentioned purpose is supplied to the chamber (1) via the inlet duct (26).

6. Apparatus according to each of the claims 1 - 4, where the  
10 product (11) is to be oxidised, and vapours generated during the process are to be removed from the chamber (1),  
characterized in that the volume of fresh air necessary for the mentioned purpose is supplied to the chamber (1) partly in  
a first air flow which passes the inlet duct (26), partly in a  
15 second air flow which passes the grid.

7. Apparatus according to claim 6, characterized in that the two air currents have primarily opposite directions.

20 8. Apparatus according to each of the claims 1 - 7,  
characterized in that the grid, in combination, is formed in a lower part of the cabinet wall and in a rotating cylinder (3)  
which with journals (4,5) is journaled in bearings (6,7) which are mounted on the chamber wall, that at least one of the  
25 journals has a through axial hole, and that the inlet duct (26) is extending through this hole.

9. Apparatus according to claim 8, characterized in that the inlet duct (26) is formed in a pipe (26) which is extending  
30 through the axial hole and is attached to the cabinet (20),  
and that at least one of the ventilators (28) for sending an air flow into the cabinet (20) is mounted in or at the end of this pipe (26).

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AMENDED SHEET (ARTICLE 19)

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