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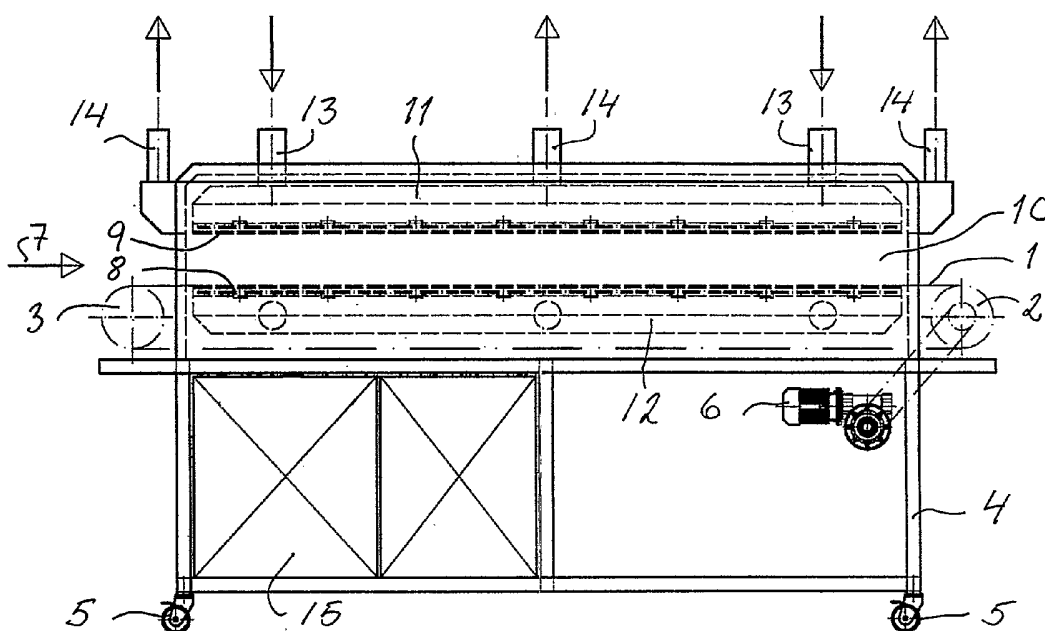
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(54) Title: A COOKING TUNNEL



(57) Abstract: A cooking tunnel comprises upper and lower heating means (8, 9) and a conveyor belt (1) for transferring a product to be cooked through the tunnel. Both the upper and lower heating means are IR panels (8, 9) protected under glass plates (26, 27) facing the product to be cooked. The conveyor belt (1) has at least a layer of PFTE for contact with the product and is supported by the lower glass plate (26).

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A COOKING TUNNEL

Technical Field

5 The present invention relates to a cooking tunnel, comprising upper and lower heating means and a conveyor belt for transferring a product to be cooked through the tunnel.

Background of the Invention

10 Cooking or frying to an industrial or semi-industrial scale (in food processing industries, fast-food restaurants and canteens) is often performed in a continuous fashion in a cooking or frying machine, in which the products to be processed (cooked or fried) are transferred through a
15 tunnel-shaped compartment on an endless conveyor belt.

 In certain such cooking tunnels, heating means are only provided below the product, which thus has to be reversed or flipped-over - often automatically in the tunnel - when a double-sided cooking is required.

20 It is, however, quite customary to provide heating means in the tunnel both below and above the tunnel in which the product to be processed is transferred, and the present invention relates to such a tunnel for double-sided cooking.

25 The most important problem to be solved in a cooking tunnel is to ensure a satisfactory and even cooking of the products, such as hamburger meat, chicken parts or the like, where the appearance is of certain significance. Other problems to be solved are energy consumption, machine
30 costs and hygiene. In the latter case it is important to protect certain elements against frying splashes and frying fumes. Another aspect is that the products shall have the possibility to leave the conveyor belt without manual action.

35 It is also of importance that the conveyor belt can withstand heat and has heat transfer capability.

The Invention

This is according to the invention attained in that both the upper and lower heating means are IR panels protected under glass plates facing the product to be
5 cooked and that the conveyor belt has at least a layer of PFTE for contact with the product and is supported by the lower glass plate.

Preferably, the conveyor belt is an endless belt made of Teflon®, preferably fabric reinforced Teflon®.

10 Each IR panel is preferably composed of a number of separate IR modules, which provides even heating and good control possibilities. These IR modules may be attached to a mounting plate, which also acts as a reflector.

Each IR module is preferably molded in ceramic
15 material so as to be splinter-protected and easy to clean.

The IR modules of both the lower and the upper IR panels are sealingly enclosed in a compartment formed by the mounting plate, the glass plate, and a circumferential collar connecting said plates.

20 Means are preferably provided for supplying cooling air to the back side of the IR panels and further for supplying air heated by the IR panels to the tunnel.

Brief Description of the Drawings

The invention will be described in further detail
25 below under reference to the accompanying drawings, in which Fig 1 is a partly sectional side view of a cooking tunnel according to the invention, Fig 2 is a top view of the same tunnel, and Fig 3 is a transverse sectional view to a larger scale of important portions of the tunnel.

30 Detailed Description of a Preferred Embodiment

An endless conveyor belt 1 is laid over end pulleys 2 and 3, journaled in relation to a framework 4, which may be provided with wheels 5. The framework 4 is preferably made of stainless steel for hygienic reasons (which is true
35 also for other relevant parts of the cooking tunnel). The

pulley 2 to the right may be driven by an electric motor 6, supported by the framework 4, for transferring the belt 1 in the direction of an arrow 7, i.e. to the right. The pulley 3 to the left may be provided with a belt tensioning device. (The terms "left" and "right" generally refer to Figs 1 and 2 throughout the specification.)

The conveyor belt 1 has the double task of conveying a product to be processed (cooked or fried) through the cooking tunnel and of transferring heat from below to this product. It is preferably made of PFTE, like Teflon®, which is hygienic, easy to clean and has good heat transfer properties.

A lower heating means in the form of an IR panel 8 is mounted under the upper part of the conveyor belt 1 (and over its lower part). An upper heating means in the form of an IR panel 9 is mounted a certain distance above the belt 1. This distance is chosen so as to suit the products to be cooked in the cooking tunnel and may be adjustable.

Longitudinal sidewalls 10 are arranged at either sides of the conveyor belt 1, the lower IR panel 8, and the upper IR panel 9 for defining a tunnel. These sidewalls 10 may be insulated, double-mantled plates of stainless steel.

As will appear more clearly below, the two IR panels 8 and 9 are contained in an upper casing 11 and a lower casing 12, respectively. Cooling air for the IR panels 8 and 9 may be supplied to these casings, as is indicated by inlets 13 to the upper casing 11, and removed for example through outlets 14. The thus heated air as well as possibly steam may be supplied to the tunnel for the products to be cooked in order to improve the efficiency of the process and the quality of the products.

Electric equipment for energizing and controlling the cooking tunnel is contained in a cabinet 15 in the framework 4. Modern electronics will provide the possibility for full automation.

Products are supplied to the conveyor belt 1 to the left and are transferred through the tunnel hereby. They are cooked or fried by IR induced heat both from below and from above. The cooking capacity is determined by the length and width of the tunnel. The parameters of belt speed and IR heat are controlled in such a way that the products are cooked to the desired extent at discharge from the right hand end of the tunnel.

The construction of the lower IR panel 8 and the upper IR panel 9 will now be described with reference to Fig 3, which shows relevant portions of the cooking tunnel in a section transverse to Figs 1 and 2.

Lower IR modules 20 are attached to a lower mounting plate 21 and upper IR modules 22 to an upper mounting plate 23. These mounting plates 21 and 23 also serve as reflectors for the IR light created by the modules 20 and 22. The number of IR modules 20 and 22 in the transverse direction may as shown be four and in the longitudinal direction eight (see Fig 2), but the number may of course differ depending on the circumstances, for example the desired capacity.

In a practical case, each IR module 20 and 22 may have a capacity of 1000 W and be molded in ceramic material, which means that it will be splinter-protected and easy to clean.

The lower IR modules 20 are surrounded by a lower plate collar 24, to which the lower mounting plate 21 is attached, and the upper IR modules 22 are surrounded by an upper plate collar 25, to which the upper mounting plate 23 is attached. A lower tempered glass plate 26 (quartz glass) is sealingly mounted in the lower collar 24 and an upper tempered glass plate 27 (quartz glass) in the upper collar 25. Hereby, the IR modules 20 and 22 are encased in a closed compartment.

The tempered quartz glass plates 26 and 27 act as contact protection for the IR modules 20 and 22 and shield against frying splashes and frying fumes. The lower quartz glass plate 26 has the further important function of acting
5 as support for the conveyor belt 1.

This conveyor belt 1 is preferably made of fabric reinforced PFTE (Teflon®), which provides release properties in relation to the food products. It is alternatively possible to make use of a Teflon®-coated
10 steel belt. The belt 1 shall withstand heat and have heat transfer capability.

Also shown in Fig 3 are the upper casing 11 with a cooling air inlet 13 as well as the lower casing 12. It appears that the collar 24 or 25, the mounting plate 21 or
15 23, and the casing 12 or 11 can be jointly connected.

The heat transfer to the food products occurs both by heat transfer (especially from below) and by radiation. The control of the lower and upper IR panels 8 and 9 is performed in relation to the desired cooking temperature.
20 The cooling air to the IR panels can, when heated, be utilized in the cooking process.

The use of IR panels, quartz glass plates and a conveyor belt of PFTE makes the process energy-conserving. The use of IR-heating makes the frying or cooking effective
25 without unnecessary heat losses. The IR radiation has a certain penetration capability, which reduces the cooking time and accordingly the energy consumption in relation to conventional contact cooking machines.

CLAIMS

1. A cooking tunnel, comprising upper and lower heating means (8, 9) and a conveyor belt (1) for transferring a product to be cooked through the tunnel,
5 c h a r a c t e r i z e d in that both the upper and lower heating means are IR panels (8, 9) protected under glass plates (26, 27) facing the product to be cooked and that the conveyor belt (1) has at least a layer of PFTE for contact with the product and is supported by the lower
10 glass plate (26).

2. A cooking tunnel according to claim 1, wherein the conveyor belt (1) is an endless belt made of Teflon®, preferably fabric reinforced Teflon®.

3. A cooking tunnel according to claim 1, wherein
15 each IR panel (8, 9) is composed of a number of separate IR modules (20, 22) attached to a mounting plate (21, 23).

4. A cooking tunnel according to claim 3, wherein each IR module (20, 22) is molded in ceramic material.

5. A cooking tunnel according to claim 3, wherein the
20 IR modules (20, 22) are sealingly enclosed in a compartment formed by the mounting plate (21, 23), the glass plate (26, 27), and a circumferential collar (24, 25) connecting said plates.

6. A cooking tunnel according to claim 1, wherein
25 means are provided for supplying cooling air to the back side of the IR panels (8, 9).

7. A cooking tunnel according to claim 6, wherein means are provided for supplying air heated by the IR panels (8, 9) to the tunnel.
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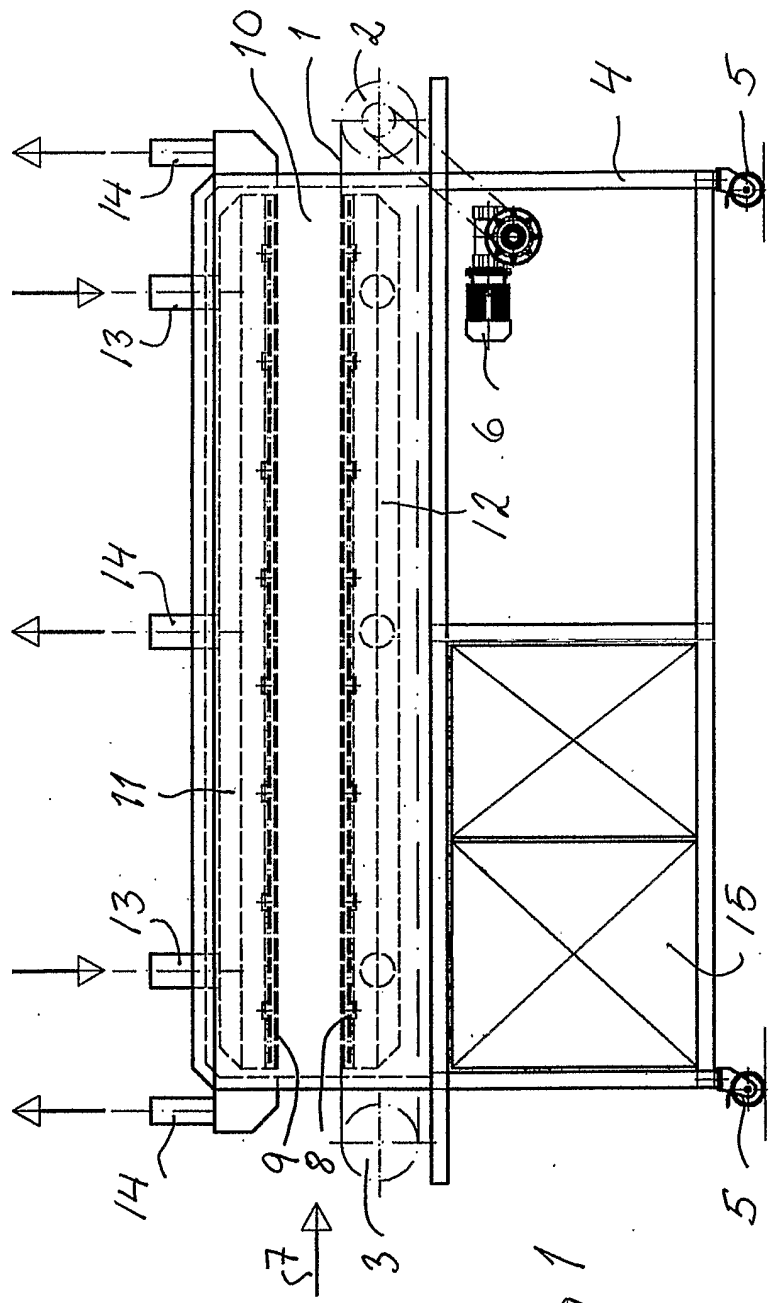


Fig 1

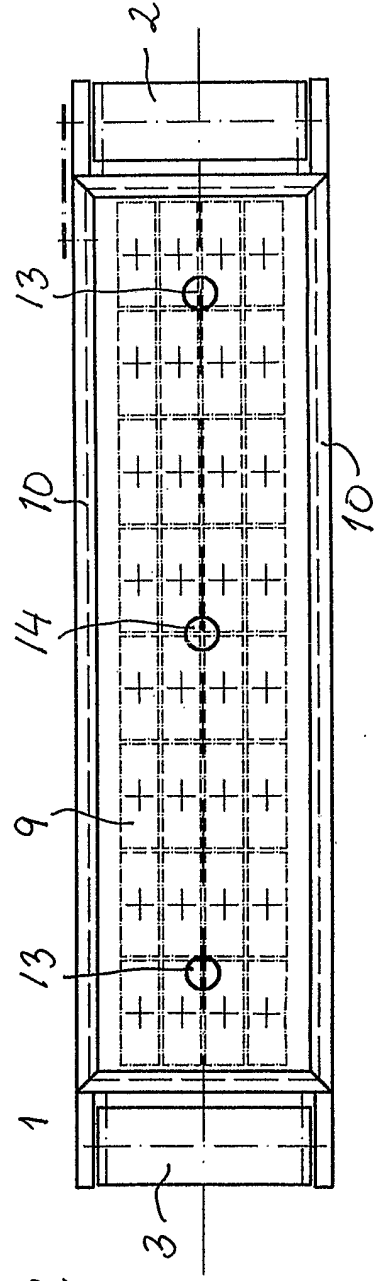


Fig 2

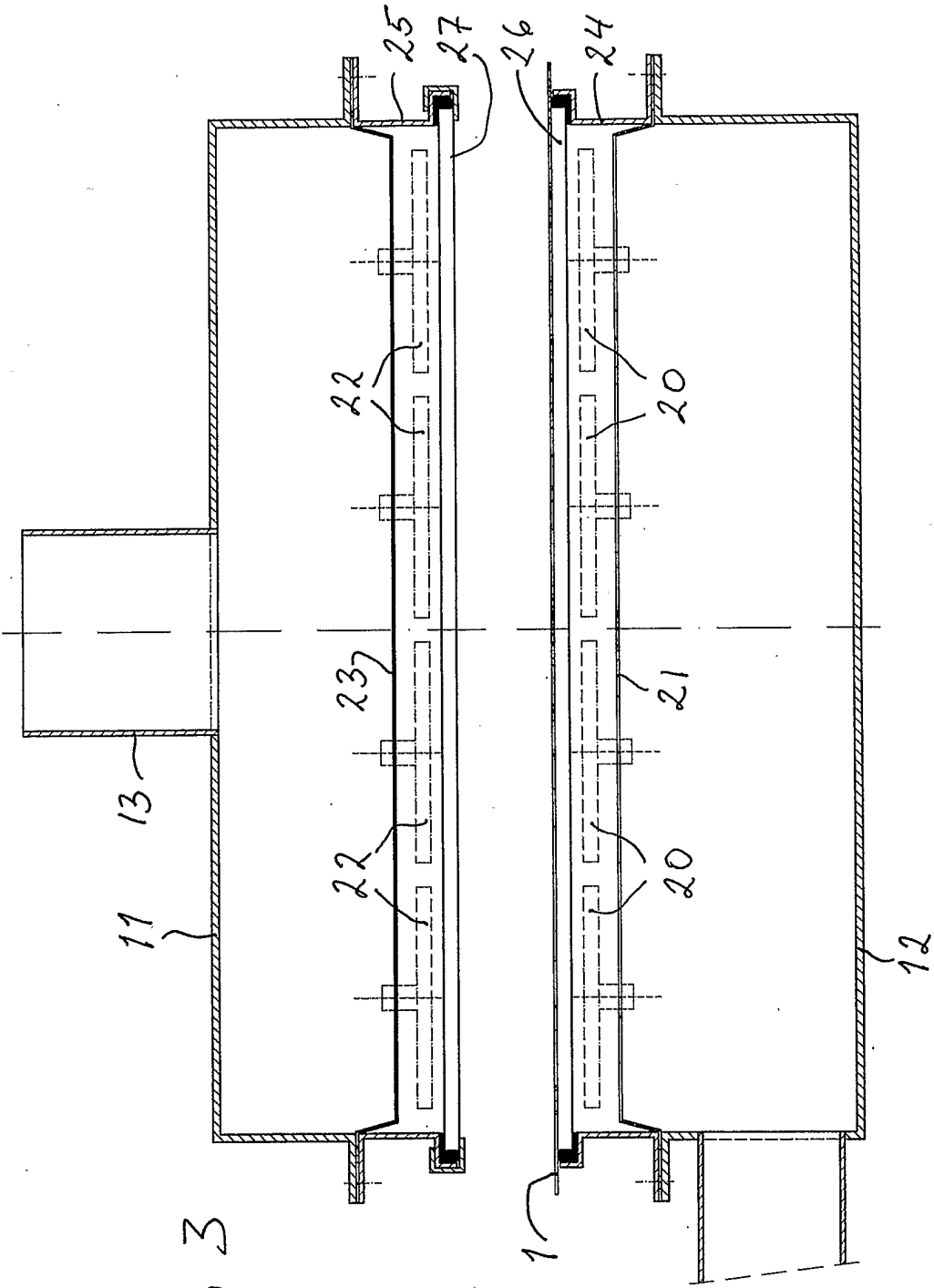


Fig 3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE2006/000255

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: A47J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4572061 A (MASTERS), 25 February 1986 (25.02.1986), column 2, line 59 - line 67, figures 1-9, abstract --	1-7
A	WO 2005006866 A1 (INTER IKEA SYSTEMS B.V), 27 January 2005 (27.01.2005), figure 1, abstract --	1-7
A	US 3736860 A (VISCHER, JR), 5 June 1973 (05.06.1973), figure 1, claim 1, abstract --	1-7
A	US 2504110 A (JOHN G DAVIS ET AL), 18 April 1950 (18.04.1950), figures 1-2, claim 1 --	1-7

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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Cited literature, if any, will be enclosed in paper form.

INTERNATIONAL SEARCH REPORT

Information on patent family members

04/03/2006

International application No.

PCT/SE2006/000255

US	4572061	A	25/02/1986	EP	0165348 A,B	27/12/1985
				GB	2131287 A,B	20/06/1984
				GB	8332957 D	00/00/0000

WO	2005006866	A1	27/01/2005	AU	2003294197 A	21/07/2005
				CA	2532559 A	27/01/2005
				SE	526553 C	04/10/2005
				SE	0302102 A	19/01/2005
				WO	2005064747 A	14/07/2005
				WO	2005064748 A	14/07/2005

US	3736860	A	05/06/1973	AU	466674 B	11/10/1973
				AU	4084772 A	11/10/1973
				CA	993717 A	27/07/1976
				DE	2216361 A	19/10/1972
				FR	2132439 A,B	17/11/1972
				GB	1383560 A	12/02/1974

US	2504110	A	18/04/1950	NONE		
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