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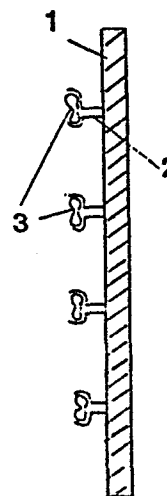
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54 A reflector structure for infrared radiation ovens.

57 The invention discloses a reflector structure for infrared radiation ovens intended for heat treatment of objects and incorporating an oven chamber through which objects to be treated are conveyed and which is provided with radiation sources constituted by infrared heating tubes (3) and having reflectors (1) provided behind said infrared tubes, at least the reflector surface thereby being manufactured by a ceramic fibrous material, adapted to reflect most of the radiation of the infrared heating tube (3), but to absorb a portion thereof in order to reach such an elevated temperature on the surfaces of the reflectors that any impurities on said reflector surfaces will be incinerated.

FIG 1



A REFLECTOR STRUCTURE FOR INFRARED RADIATION OVENSBackground of the invention

05 The present invention refers to a reflector structure for infrared radiation ovens, hereinafter referred to as IR-ovens, intended for heat treatment of objects and incorporating an oven chamber through which objects to be treated are conveyed and which is provided with radiation sources constituted by
10 infrared heating tubes, hereinafter referred to as IR-tubes, and having reflectors provided behind said infrared tubes.

IR-ovens of this kind are used for a plurality of different heat treatment purposes, such as drying of painted objects,
15 food preparation, hot treatment etcetera.

The overall efficiency of an IR-oven is dependent of the combination of IR-tubes and reflector. The oven chamber in which the IR-tubes are located is designed as a reflector
20 room, wherein the the secondary radiation from the IR-tubes hits the objects to be treated via the reflectors, and the objects are thus subjected to a maximum of radiation energy.

In order to give such a high efficiency as possible, the reflector room is generally built from a high reflecting
25 material such as gold coated or aluminized sheet steel or the like.

After operation during a period of time the reflector surface
30 of the oven chamber is coated by a burnt-in layer or impurity, the origin and composition of which can vary but which most often consists of dust, powder particles, grease and the like. This coating absorbs an ever bigger part of the radiation energy emitted from the IR-tubes and the efficiency of the
35 IR-oven becomes lower, whereby a large portion of the radiation energy from ther IR-tubes are instead used for heating the reflectors.

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Due to the gradually decreased efficiency of the oven the heat treatment result will also become uneven.

Cleaning of these contaminated surfaces is hardly possible with conventional methods and at least not when the reflector surface in its position in the oven. The hitherto most common method for increasing the efficiency again after operation of the oven for a period of time is that the oven is shut down, whereupon the contaminated sections are dismantled and substituted for new reflector surfaces. As it in particular are the reflector surfaces situated closest to the IR-tubes, i.e. the surfaces behind the IR-tubes, which are subjected to the impurities is this a time-wasting work as also the IR-tubes have to be dismounted for allowing the exchange of such reflector surfaces.

This means beside the work, that the oven must be put out of operation for some time rather often, which of course affects its possible ratio of production to capacity.

The purpose and most essential features of the invention

The purpose of the present invention is to provide a reflector structure for IR-ovens of the kind defined in the preamble, which entails that the reflector surfaces of the oven chamber are subjected to a continuous cleaning, whereby the efficiency of the IR-oven will be high and above all even, which will guarantee an even heat treatment result, and this has been achieved in that the reflector structure has been given features defined in the accompanying claims.

Brief description of the drawings

Figure 1 shows in cross-section a reflector structure according to the invention and incorporating a reflector disc and IR-tubes mounted thereon.

Figure 2 is a corresponding cross-section through a box-shaped combination of IR-tubes/reflector.

Figure 3 shows a planar view of the combination shown in Fig.

2.

Figure 4 shows in an end view an IR-oven equipped with the reflector structure according to the invention.

Figures 5 and 6 show schematically the directions of the radiation beams at the reflectors according to invention.

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Description of the preferred embodiments

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Figure 1 shows in cross-section a reflector disc 1 provided with retainers 2 for a number of IR-tubes 3 of any proper type.

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The reflector disc 1 is a self-supporting ceramic fibre plate, preferably based on alumina and which has the property of reflecting the bigger part of the radiation whereas a smaller part thereof is absorbed by the surface of the reflector material. The temperature of the reflector surface thereby will increase rapidly to high values, whereby organic impurities are burnt away from the reflector surface, and the reflector has hereby become a self-cleaning reflector 1.

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Such a ceramic fibre plate, which is available on the market under the trade name TRITON KAOWOOL, as an insulating plate, has unexpectedly proven itself to give the desired effect as a self-cleaning reflector disc, whereby it at the same time has an insulating effect against its side turned away from the reflector.

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The material which contains 43 - 47 % Al_2O_3 and 57 - 53 % SiO_2 has the ability of withstanding temperatures up till $1400^{\circ}C$, i.e. temperatures which are more than sufficient in order to allow contaminations such as dust, paint particles or grease to be incinerated. the reflector disc 1 of this material reflects about 85% of the infrared radiation whereas 15% is absorbed and thereby is used for keeping the reflector clean.

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It is to be understood that also other similar materials can be used for the same purpose.

Figure 2 shows in cross-section corresponding to Fig. 1, a

box-shaped unit 4 incorporating an insulating reflector disc 1 with retainers 2 which project from one side surface thereof and carry IR-tubes 3, whereas on the opposite side of the disc is fitted a sheet metal housing, consisting of a sheet metal frame 5 and a covering sheet 6. The housing can contain a not shown discharge blower and it is for this purpose provided with a connecting socket 7.

From figure 3, which shows the box-shaped unit according to Fig. 2 in planar view from the side surface thereof provided with the IR-tubes 3, it can be seen how the retainers 2, which carry the IR-tubes are located one adjacent each end of the different IR-tubes. The unit is also provided with mounting holes 8 for mounting of the unit into an IR-oven. At each end connection for the IR-tubes there are perforations 9 intended to introduce cooling air from the sheet metal housing to these connections.

The self-supporting reflector disc according to Fig. 1 can be adapted after the current requirements and it can be mounted in existing oven chambers without the necessity of changing the oven shell in appreciable content.

With the unit according to Figs. 2 and 3 is it possible to make a mounting in an oven chamber having an arbitrary design, and if neither of the designs shown in Figs. 1 or 2,3 is suitable is it possible to adapt the combination IR-tubes/reflector to any type of oven.

Fig.4 shows as an example an application of the invention at a powder heat treating oven for melting and setting of plastic material layers applied on objects, e.g. by means of electrostatic coating.

The IR-oven incorporates i.a. an oven chamber in two hingedly connected halves 10,11 which are articulated about a shaft arranged to extend in the longitudinal direction of the oven. Each one of the halves being connected to actuators 12 by means of which the oven can be opened such as intimated in dash lines. The oven may alternatively be provided with a

laterally hinged openable doors.

In closed position (continuous lines) the two oven halves 10, 11 form an oven space 13 through which objects to be treated are conveyed. The oven space 13 is provided with an internal wall confinement, which in the sloping roof and bottom regions 14 and 15 resp. have through-holes or perforations. The inner vertical walls 16, however, have no perforations, but they are at their walls facing the center of the oven chamber designed as reflectors, which carry a number of IR-tubes 17. Also the sloping roof and bottom regions 14, 15 can of course be designed as reflectors. The reflector surfaces 16 are designed in the manner described hereabove in connection to Figs. 1, 2 and 3. Also the surfaces 14, 15 may, if they are formed as reflectors, be made from ceramic fibre material, but the self-cleaning effect can hardly be obtained on these surfaces as the reflector must be arranged rather close to the IR-tube for reaching a sufficiently high temperature.

In the roof of each oven half there is arranged radial blowers 19 for circulation of the oven atmosphere through the perforations in the inner roof 14 of the oven and via ducts 18 between the reflectors 16 and the outer, insulated, vertical oven wall to the bottom of the oven, where the atmosphere again is introduced into the oven chamber through the perforations in the bottom regions 15.

The cross-section of the oven chamber is hexagonal, and only the vertical walls are used for supporting the IR-tubes, in order not to risk the tubes being damaged by falling objects. The IR-tubes can alternatively be mounted separately on a supporting structure freestanding from the walls 16, but anyhow adjacent these.

The IR-oven may however have any desired shape and it can be adapted for hanging objects or horizontally conveyed objects.

In figure 5 is schematically shown an IR-unit 5 having a

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reflector disc 1 fitted to one of its sides and IR-tubes
 3 applied thereto, which tubes emit infrared radiation. The
 figure also shows a schematically intimated work piece or
 object 20, which shall be subjected to some kind of heat
 treatment. The object 20 as seen is subjected to direct
 15 radiation 21 as well as secondary radiation 22, which is
 reflected from the reflector disc 1.

Figur 6 is a corresponding view of a reflector disc 1 with an
 IR-tube whereby the radiation is illustrated as direct
 10 radiation 21 against a not shown object, direct radiation 23
 against the reflector disc 1, and secondary radiation 22,
 reflected from the reflection disc 1.

Of the primary, direct radiation 23, which hits the reflector
 disc, with a reflector material of the type described above,
 15 about 15 % of the radiation to be absorbed by the reflector
 disc. This energy incinerates the contaminations on the
 reflector disc 1 and a clean reflector is obtained, which
 emits about 85% af the energy from the primary radiation 23 as
 secondary radiation.

20 The invention is not limited to the embodiments shown in the
 accompanying drawings and described with reference thereto but
 modifications are possible within the scope of the
 accompanying claims.

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C L A I M S

1. A reflector structure for infrared radiation ovens intended for heat treatment of objects and incorporating an oven chamber (13) through which objects to be treated are conveyed and which is provided with radiation sources constituted by infrared heating tubes (3,17) and having reflectors (1,14,15,16) provided behind said infrared tubes, characterized in,

that at least the reflector surface (1,16) is a ceramic fibrous material, adapted to reflect most of the radiation of the infrared heating tube, but to absorb a portion thereof in order to reach such an elevated temperature on the surfaces of the reflectors that any impurities on said reflector surfaces will be incinerated.

2. A reflector structure as claimed in claim 1, characterized in, that the reflector material incorporates Al_2O_3 .

3. A reflector structure as claimed in claim 1 or 2, characterized in, that the reflector material consists of 43 - 47 % Al_2O_3 and 57 - 53 % SiO_2 .

4. A reflector structure for an infrared radiation oven as claimed in anyone of claims 1 to 3, characterized in, that it is designed as a self-supporting reflector disc (1), having retainers (2) for supporting infrared heating tubes (3), without intermediate shields between the infrared tubes and the reflector surface.

5. A reflector structure for an infrared radiation oven as claimed in anyone of claims 1 to 3, characterized in, that it is designed as a box-shaped unit provided with a reflector disc (1) which on one of its flat side surfaces

carries unshielded retainers (2) projecting therefrom and supporting infrared heating tubes (3) and a having a housing (5,6) connected to the opposite side of the reflector disc and adapted to incorporate mounting members (8) and to be able to enclose cooling and/or ventilation means.

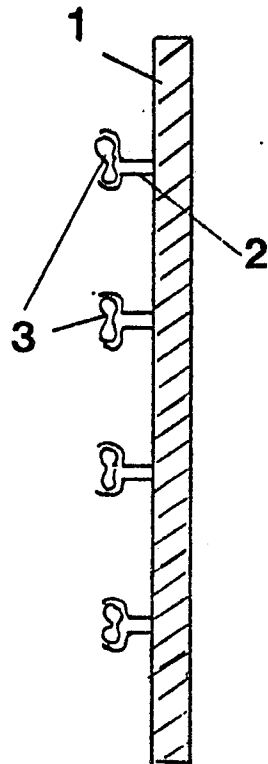
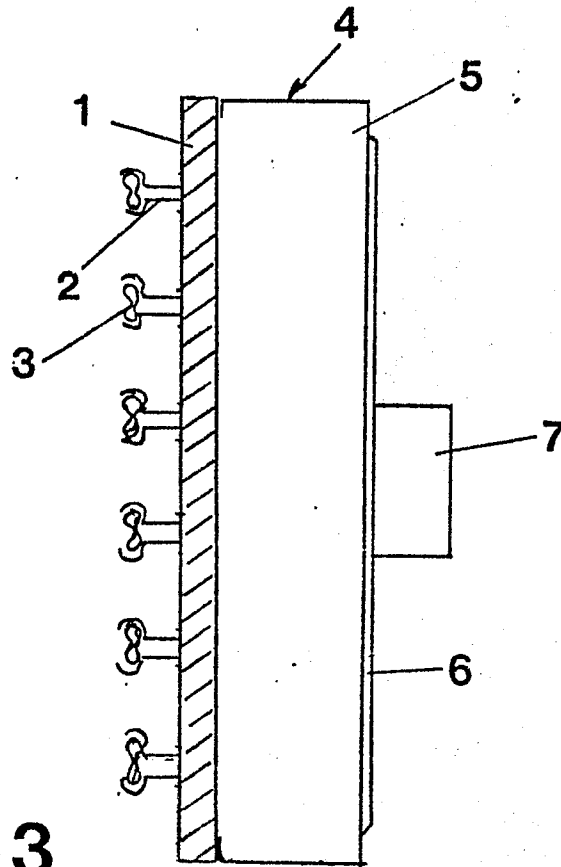
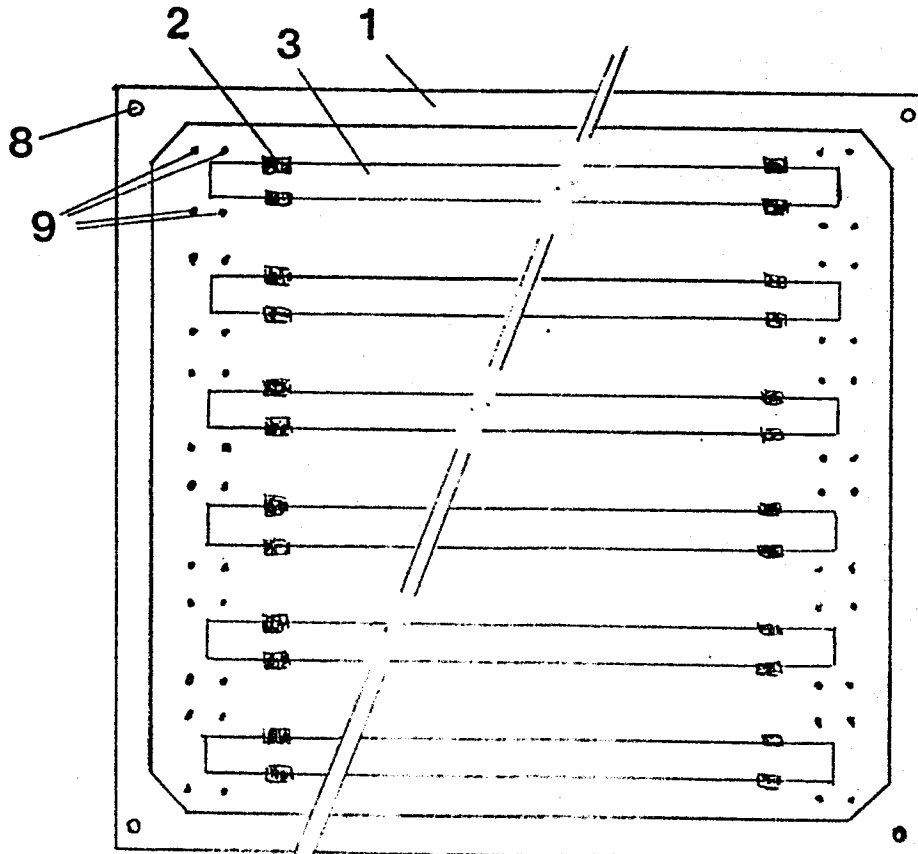
FIG 1**FIG 2****FIG 3**

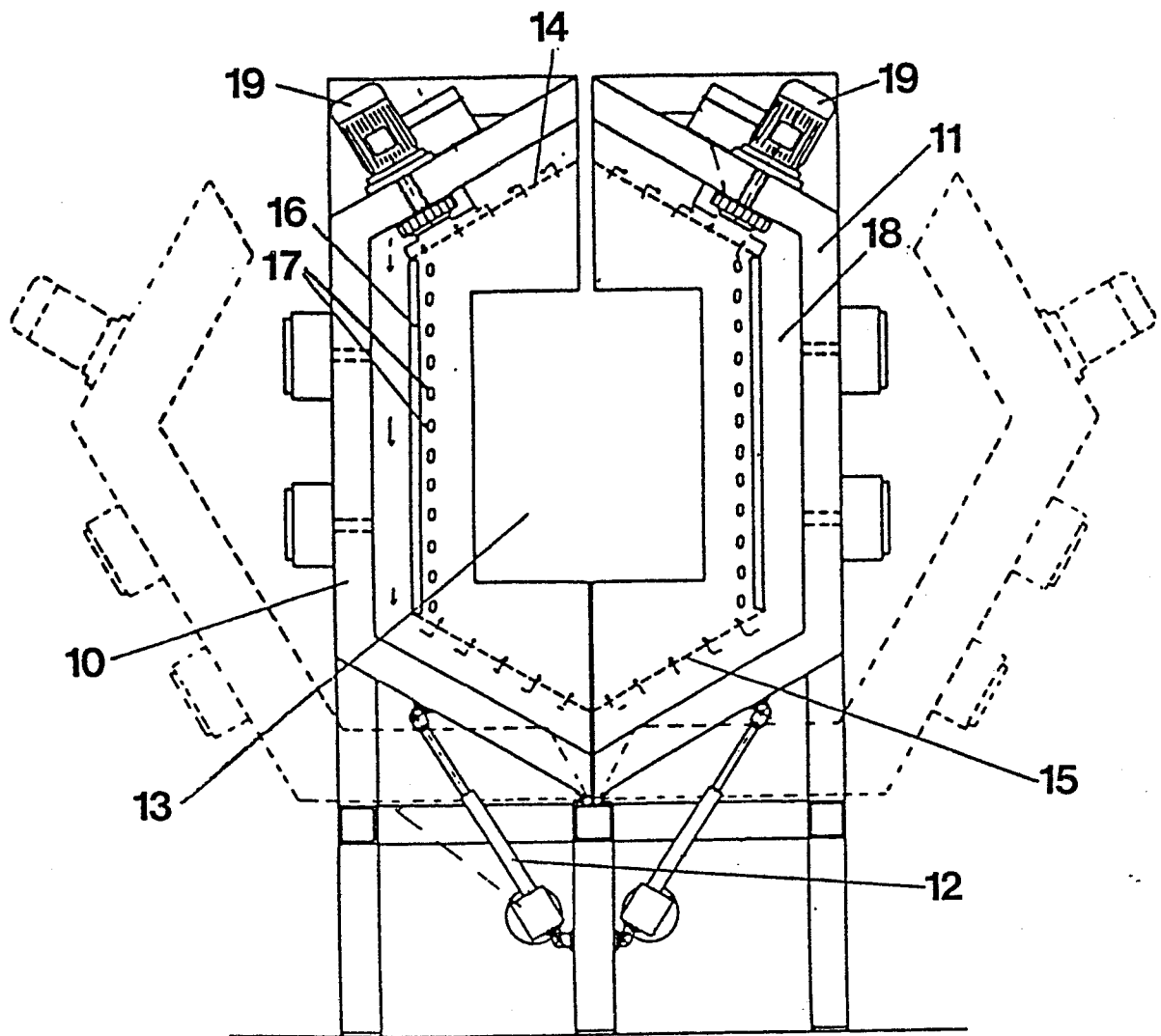
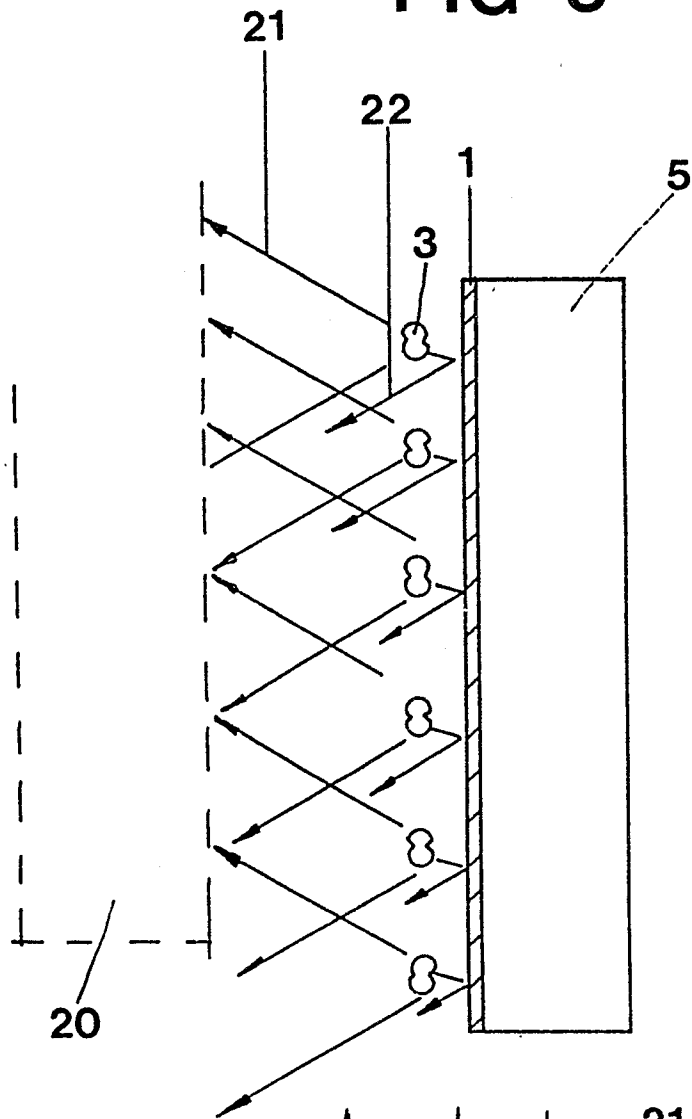
FIG 4

FIG 5**FIG 6**