(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 270 984**
A2

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **87117762.2**

(51) Int. Cl.4: **F24C 15/08** , F24C 15/34

(22) Date of filing: **01.12.87**

(30) Priority: **11.12.86 IT 4575786**

(43) Date of publication of application:
15.06.88 Bulletin 88/24

(84) Designated Contracting States:
CH DE ES FR GB IT LI SE

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(54) Method for manufacturing cooking ovens.

(57) A method for the manufacture of gas-burning or electrically powered ovens for cooking foods, in which the insulating structure of the casing and the bottom is made of evacuated anorganic powders.

The method permits a cooking oven integrally provided with all of the respective functional components to be manufactured in an automatized process.

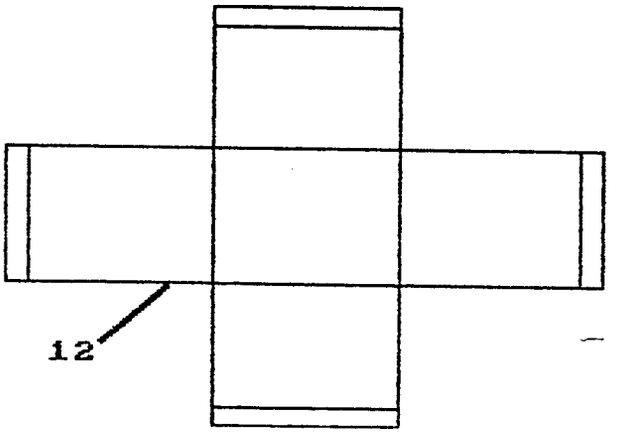

Fig.1

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Method for Manufacturing Cooking Ovens

The present invention relates to a method for the manufacture of appliances for cooking foods of any nature in an insulated enclosure (kitchen ovens, individually or in combination with a cooktop), the casing of such appliances being composed of walls, a bottom, and a door and provided with an adequate thermal insulation.

The thermal insulation of such ovens is usually accomplished by the formation of an insulating lining of glass wool. This insulation system requires walls of considerable thickness, because the conductivity of the insulating material cannot be reduced below certain values (0.028 -0.030 Kcal/m h °C).

These values increase considerably in response to rising temperatures: for example, at 200 °C the conductivity of glass wool is practically twice the value indicated above.

In addition, the employ of glass wool panels requires a number of manual operations for moving, handling, and often also assembling the applicance, so that it is practically inavoidable that the operator comes into contact with the material which is notoriously harmful for man.

A provision for limiting the danger of contaminating the workplace environment with glass fibres consists in the application of a bonding agent to the fibres to thereby achieve a higher degree of compaction.

The presence of such bonding agent becomes apparent during the initial operating time of the applicances when the more volatile components are released by the effect of temperature.

Described in US 2,164,143 is an alternative insulating structure, in particular for refrigerating appliances, obtained by the introduction of fine powders, such as metal oxides and Kieselguhr (diatomaceous earth) into a space formed between two flexible metal sheets by hermetically welding them to one another, and from which the air is subsequently evacuated.

The thus obtained insulation has to be enclosed, however, in an air-tight envelope formed by an inner casing and an outer casing joined to one another with the interposition therebetween of a wooden framework and rubber gaskets.

This provision is necessary for protecting the insulating panel, and particularly the respective weld seams, during further processing.

The casing obtained according to the method of US 2,164,143 does not either permit the integration of functional components of the respective appliances (in the case considered by the present invention, resistance heaters, burners, a thermostat, a grill, a fan and the like).

The Italian Patent Application no. 45745-A/86 filed by the present applicant on September 18, 1986, proposes a manufacturing method permitting a refrigerating appliance to be obtained with all of the respective functional components in an automatized process. The insulating structure of the casing is composed of evacuated anorganic powders filling the space between the outer walls and the interior compartment of the casing.

The feasibility and technical-economical convenience of applying the same method also to the manufacture of oven casing, particularly of the domestic type, has been experimentally verified.

It has in fact been shown that an insulation formed of evacuated anorganic powders is also capable of withstanding the high temperatures generated within the oven chamber, offering better thermal insulation characteristics than glass wool and permitting the manufacturing process to be completely automatized.

A main object of the invention is thus the provision of an applicance for cooking foods, provided with an insulating structure on the base of evacuated anorganic powders of high efficiency and obtainable by an automatized process.

The invention thus provides a method for the manufacture of cooking ovens, particularly of the domestic type, comprising a casing the metal sheet walls of which contain a thermal insulation formed of a mass of evacuated anorganic powders and are provided with a plurality of functional components such as burners, electric resistance heaters, a thermostat, a fan and the like.

According to the invention this method is characterized by comprising a first step of cutting and drilling two planar sheets having the developed shapes respectively of the complete internal and external walls of the oven, and of mounting the respective functional components on said sheets, a second step of bending and welding said sheets to form two component-equipped box-shaped elements having one open side, a third step of inserting the box-shaped elements into one another and welding them along their edges to form an empty space therebetween, and finally a fourth step of completely filling said empty space with an anorganic powder, and evacuating and hermetically sealing said space.

The characteristics of the invention will become more clearly evident from the following description, given by way of example with reference to the accompanying drawings, wherein figs. 1 to 4 show diagrammatical representations of successive steps of the method for the manufacture of a casing for a cooking oven according to the invention.

The insulating materials employed according to the invention are preferably expanded perlite or diatomaceous earth.

The thermal conductivity of these materials, already low at atmospheric pressure (about 0.04 Kcal/m h °C) is known to decrease still further under vacuum conditions: at 0.01 mm Hg the conductivity has decreased to about one tenth.

The thermal insulation obtainable with these conductivity values is conducive to a considerable improvement of the performance of the oven when the thickness of the insulat ing walls remains the same as at present, or to an increase of the available free volume when the thickness of the walls is reduced to dimensions for obtaining the same performance as in a conventional oven. In any case there results a noticable energy saving effect.

A further advantage obtained by the employ of perlite or diatomaceous earth derives from the fact that the insulation remains constant over long time: there is no degradation of the insulating material by the action of high temperatures, and thus no change in the insulating capacity.

On the other hand, the influence of temperature on the thermal conductivity is less then in the case of glass wool: as a matter of fact, the thermal conductivity is much less responsive to rising temperatures and is not noticeably increased thereby.

The sealing of the powders between two metallic walls also ensures impermeability to external agents (air), so that it is not necessary to introduce absorbent substances (getters) for the prevention of a gradual rising of the internal pressure with the resultant degradation of the performance of the applicance.

This provision may be necessary, however, when the powders are introduced in flexible containers (films).

The conventional process for the manufacture of an oven usually involves the formation of the interior walls and the bottom by suitably stamping metal sheets. These two components are formed with perforations for the introduction8 of the necessary functional components into the oven chamber, and welded together to form a unitary body. After this body has been enamelled, the glass wool is applied to the outer surfaces of the assembled casing.

In contrast therewith, the method according to the invention comprises a first step in which an integral piece 12 having the developed shape of the complete outer walls of the overn (fig. 1) and another integral piece 13 having the developed shape of the complete inner walls of the oven (fig. 2) are cut from a metal sheet.

The dimensions of piece 12 have to be suitably greater than those of piece 13, because the two box-shaped elements to be formed of these pieces are to be interconnected in a manner leaving an empty space therebetween to be subsequently filled with insulating powders as will become evident as the description proceeds.

In an automatic processing step preceeding a bending operation each of the two pieces is provided with necessary perforations 14-16 for mounting the functional components (e.g. resistance heater, thermostat etc.) of the appliance (fig.2).

The perforations formed in the external and internal walls are interconnected by connecting pipes welded thereto at their ends to thereby ensure the hermetical sealing of the vacuum to be subsequently created in the intervening space.

The lateral walls of the inner casing are additionally formed with elongate projections 17 to act as rails for supporting grids and shelves within the oven (fig. 3).

The method according to the invention includes the further step of bending the two metal sheet pieces and of welding them along abutting edges to thereby form two box-shaped elements 18, 19 each having an open side (fig.4).

The element having the smaller dimensions is then inserted into the other one so as to create an empty space between the two elements.

During the same processing phase the two elements are welded together along their respective edges. These edges should be formed with zones of different mechanical strength for compensating the shrinkage of the powders during the evacuation of the intervening space between the two elements in the subsequent processing phase. The welding step is preferably carried out in a continuous laser welding operation. The oven may if need be also be subjected to an enamelling process. In a further step of the method, the intervening empty space is then filled with anorganic powders and subsequently evacuated. To this purpose the outer casing is provided with passages which are subsequently closed by electric welding after the introduction of the powders and the evacuation of the intervening space. The compaction of the powders within the intervening space is ensured by vibrating the casing with the aid of a vibrating table whereon it is placed.

The described method for making the oven is also applied to the manufacture of the door, which also consists of an inner and an outer sheet metal wall sealingly welded together and filled with an evacuated powder.

This method is thus substantially analogous to that of the Italian Patent Application no. 45745-A/86 already quoted above.

In summary, the proposed method offers the following advantages:

-an improvement of the insulating performance relative to that of glass wool for the same wall thick-

ness, or a corresponding reduction of the wall thickness, and thus of the overall dimensions, for the same insulating performance;
-substantially constant thermal conductivity of the insulation with rising temperatures;
-complete impermeability of the walls, whereby the employ of absorbent substances is rendered unnecessary and the thermal insulating characteristics are maintained over an extended period of time;
-a major degree of automatization of the manufacturing process, resulting in greater reliability and reduced physical contact with operating personnel; the manufacturing process is thereby rendered less noxious to the environment of the workplace.

Claims

1. A method for the manufacture of cooking ovens, particularly of the domestic type, comprising a casing closed by at least one door, the metal sheet walls of said casing containing a thermal insulation formed of a mass of evacuated anorganic powders, and being provided with a plurality of functional components such as burners, electric resistance heaters, a thermostat, a fan and the like, said method being characterized by comprising a first step of cutting and drilling two planar sheets (12,13) having the developed shapes respectively of the complete internal and external walls of the oven, and of mounting the respective functional components (14-16) on said sheets, a second step of bending and welding said sheets (12,13) to form two component-equipped box-shaped elements (17,18) having one open side, a third step of inserting the box-shaped elements (17,18) into one another and welding them along their edges (19) to form an empty space therebetween, and finally a fourth step of completely filling said empty space with anorganic powder, and evacuating and hermetically sealing said empty space.

2. A method according to claim 1, characterized in that the edges of the sheets to be welded are formed with zones of different mechanical strength to thereby compensate the shrinkage of the thermally insulating powder when creating the vacuum in the space between said box-shaped elements.

3. A method according to claim 1, characterized in that the welding of the edges of the sheets for joining the box-shaped elements is carried out by a continuous laser welding operation.

4. A method according to claim 1, characterized in that said casing is subjected to vibrations when said space is filled with said insulating powder.

5. A method according to claim 1, characterized in that the same manufacturing steps are also carried out for the separate manufacture of said door, said first step including the step of mounting conventional elements for containing and supporting foods on the inner wall thereof.

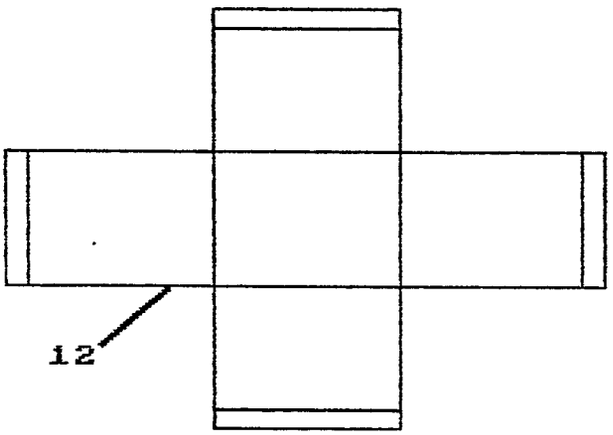

Fig.1

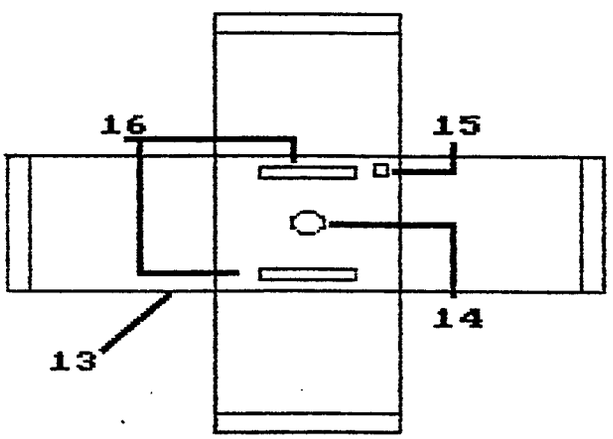

Fig.2

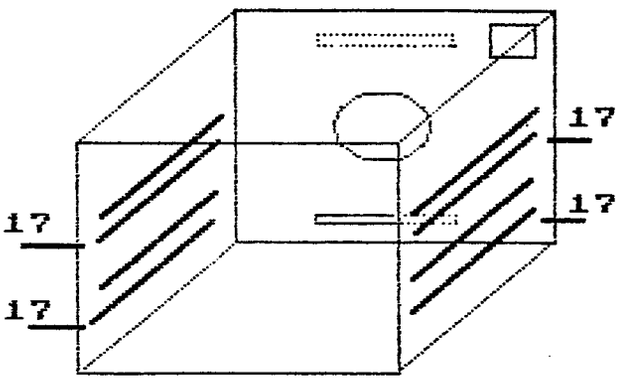

Fig.3

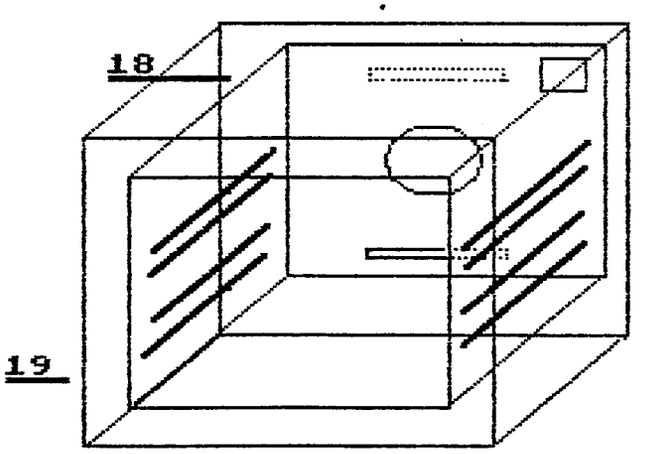

Fig. 4