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(54) **Controlled-atmosphere furnace, particularly for preheating extrusion dies for aluminum and alloys thereof.**

(57) Controlled-atmosphere furnace, particularly for preheating dies for extruding aluminum and alloys thereof, including a supporting frame (1) which delimits, at a portion of a side wall, at least one chamber (2) which can be closed tight with respect to the outside environment, a chamber door (4) which can be opened outward and has a supporting frame (5) for a part to be preheated, and resistors (10) for heating the chamber.

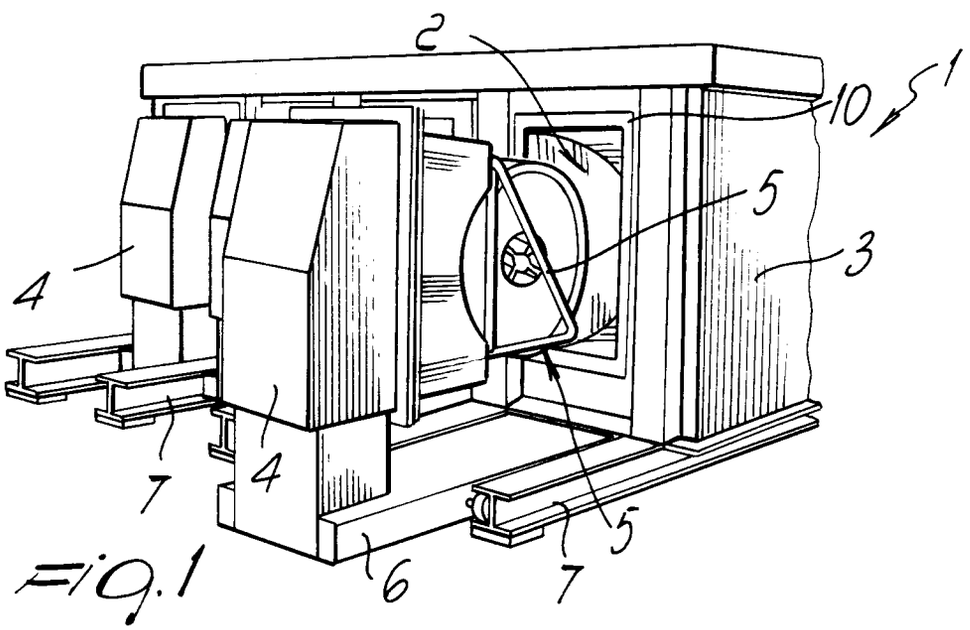

Fig.1

EP 0 529 198 A2

The present invention relates to a controlled-atmosphere furnace, particularly for preheating extrusion dies for aluminum and alloys thereof.

In the manufacture of aluminum extruded elements, such as profiles and the like, as is known, it is necessary to preheat the drawplates or die plates or extrusion dies, since the extruded profile flows uniformly through the opening or openings of said die, thereby correctly forming the required mechanical and possibly aesthetic characteristics, only when the die has reached an optimum thermal equilibrium.

Furnaces which delimit a substantially parallelepipedal horizontal chamber, usually provided with a single hinged upper lid, are currently used to perform the above described preheating. Said lid uncovers the entire top or ceiling of the furnace when the dies are loaded or removed at the required temperature.

The required preheating temperature, which is usually comprised between 420° and 480°, is measured and controlled by means of a simple pyrometric device, usually constituted by a thermocouple inserted in said chamber, and preheating uniformity is obtained by means of a forced circulation of air, for example by means of a fan. Said fan generally has a horizontal axis and is mounted on one of the sides of the furnace, i.e. of the chamber itself.

The lid furthermore does not maintain true tightness of the preheating chamber with respect to the external environment, so that there is a considerable replacement of the forced-circulation air inside said chamber, which is furthermore increased by the more or less frequent openings of said lid.

According to the different production requirements, the dies are replaced according to preset times, which can vary within a range comprised between 30 minutes and 4 hours, thereby requiring openings of the chamber, in which seats are provided for a number of dies which is generally not smaller than twenty. However, some dies for the different types of work can remain within the chamber even for several hours consecutively, since they are not used immediately.

The prolonged permanence of a die inside the chamber for a considerable number of hours unavoidably causes its surface to oxidize, with more or less severe modifications of the openings of the die or of the active regions of the drawplates.

As is known, the phenomenon of oxidation of the surface layers of nitrided dies causes, in the course of time, severe damage to the dies and drawplates, with consequent productivity losses which cannot be immediately and correctly evaluated. Variability in the efficiency of the dies and early damage to the working surfaces of the drawplates are in fact often related to the degree of oxidation of the working surfaces of said dies.

Furthermore, from an eminently accident-prevention point of view, the upper opening of the chambers is particularly dangerous for the personnel assigned to the extraction of the dies from said chamber, since whoever physically removes extrusion dies from the chamber of the furnace may be struck by blasts of heat, with the possibility of suffering from extremely severe burns.

The aim of the present invention is to eliminate or substantially reduce the problems described above in known types of preheating furnaces for extrusion dies by providing a controlled-atmosphere furnace particularly for preheating dies for extruding aluminum and alloys thereof which substantially limits the dispersion of heat toward the external environment, eliminating the complete opening of the furnace during the extraction of a die.

Within the scope of the above aim, an object of the present invention is to provide a furnace in which the onerous phenomenon of the oxidation of the working surfaces of the dies is eliminated by allowing to work in environments having a controlled atmosphere.

Another object of the present invention is to provide a furnace which eliminates uncovering, i.e. the upward opening of the chamber, to thereby facilitate the operations for loading and removing dies and also to reduce the dispersion of heat into the external environment.

A further object of the present invention is to provide a furnace which allows a correct and precise control of its temperature, thus being able to rapidly adapt to the various contingent situations.

Not least object of the present invention is to provide a furnace which is relatively easy to manufacture and at competitive costs.

This aim, the objects mentioned and others which will become apparent hereinafter are achieved by a controlled-atmosphere furnace particularly for preheating dies for extruding aluminum and alloys thereof according to the invention, characterized in that it comprises a supporting frame which delimits, at a portion of a side wall, at least one chamber which can be closed tight with respect to the outside environment, a door which can open outward being provided at said at least one chamber, said door having means for supporting a part to be preheated, and means for heating said at least one chamber.

Further characteristics and advantages of the invention will become apparent from the description of a preferred but not exclusive embodiment of a controlled-atmosphere furnace particularly for preheating dies for extruding aluminum and alloys thereof according to the invention, illustrated only by way of non-limitative example in the accom-

panying drawings, wherein:

figure 1 is a schematic perspective view of a furnace according to the invention;

figure 2 is a perspective view of a door for sealingly closing a chamber and of the supporting means which can be applied to said door;

figure 3 is a front view of a furnace without one of the closure doors;

figure 4 is a sectional lateral elevation view of a chamber, taken along the plane IV-IV of figure 3;

figure 5 is a sectional plan view of a chamber of the furnace, taken along the plane V-V of figure 3;

figure 6 is a sectional front elevation view of a chamber, taken along the plane VI-VI of figure 4; and

figure 7 is a sectional lateral elevation view of a chamber with the respective door open, taken along the plane VII-VII of figure 5.

With reference to the above figures, a controlled-atmosphere furnace particularly for preheating dies for extruding aluminum and alloys thereof according to the invention comprises a supporting frame, generally designated by the reference numeral 1, which delimits, inside it and at a portion of a lateral wall which is preferably but not necessarily a front one, at least one chamber 2 which can be closed with a tight seal with respect to the outside environment.

The frame 1 is preferably but not necessarily constituted by an iron lattice which defines the frame on which panels 3 of thermally insulating closing material are applied; said panels define walls of said furnace. According to its capabilities, the furnace comprises a plurality of chambers 2 which are arranged mutually side by side and are divided by the thermally insulating panels 3. The number of chambers 2 depends exclusively on the capabilities of said furnace.

A door 4 which can open outward is provided for each chamber 2 at side walls of the furnace, preferably but not necessarily at a front wall. Each door 4 is provided with removable means for supporting a part to be preheated, and heating means are provided within each chamber 2. Each door 4 is preferably but not necessarily made of stainless steel, is thermally insulated by means of appropriate panels and is provided with engagement means for the removable supporting means.

The supporting means are constituted by a framework 5 which can be removably applied to the inside of each door 4, as more clearly illustrated in figure 2, and has a configuration which corresponds to the shape of a part to be supported and preheated. Said framework 5, which can be made for example of metallic tubular elements, has various dimensions and shapes according to the physical dimensions and geometric shapes of the dies.

Each door 4 is supported by a carriage 6 which can slide drawer-like with respect to guides which are constituted by a pair of members 7 for each chamber 2 which are arranged below each chamber, as more clearly illustrated in figure 1. In this manner, the carriage 4 is mounted so as to be able to slide within the respective guides, like a drawer, allowing to extract the door 4 and to extract the preheated part or die from the respective chamber without resorting to dangerous maneuvers such as those described above and also acting as protection for the personnel assigned to this operation.

Each door 4 furthermore has, at a flanged edge 8, a sealing gasket 9 which is arranged at a heat exchanger, constituted for example by a copper coil 10, which prevents the heating of the edge 8 and door 4.

The heating means advantageously comprise a plurality of resistors 10 which are preferably but not necessarily arranged on lateral walls and on the bottom of each of the chamber 2 and are easily and rapidly replaceable. The space between each resistor 10 and the walls of the respective chamber 2 is furthermore reduced to a minimum in order to advantageously allow a more rapid heating of said chamber.

Mutually independent pyrometric control means are furthermore provided in each of the chambers 2 and are constituted by pyrometers 11 which penetrate into each chamber. The pyrometers 11 are furthermore connected independently to temperature control means, of a perse known type, which are in turn connected to the heating means in order to independently control the temperature of the various chambers according to the different preheating temperatures of the dies, depending on the different productions in which they are used.

Each chamber 2 is furthermore provided with a duct 12 which leads into it and can be selectively connected to a source of vacuum, such as for example a pump, and to a unit for introducing a controlled inert atmosphere, which is constituted for example by a tank of treatment gas.

In practical operation, the removal of the air contained in each individual chamber 2 requires approximately 10 minutes. Once emptying has ended, while the door 4 is closed and with a die to be preheated inserted within a framework 5, an electric valve connects the duct 12 to the tank of the treatment gas, which is usually of the inert type and thus contains no oxygen or water vapor and thus prevents the oxidation of the working surfaces of the openings of the die.

Furthermore, in order to remove a die or insert it in the furnace it is advantageously necessary to open only one of the chambers 2, without thereby

altering the thermal condition of the other chambers, in which the preheating process can continue without interruption.

Furthermore, the absence of oxidizing gases such as oxygen conveniently allows the permanence of the dies in the respective chambers even for very long times without thereby leading to the forming of oxide on its working surfaces.

Finally, the drawer-like opening of the door 4 considerably reduces heat dispersion toward the outside environment, furthermore allowing the assigned personnel to rapidly engage the die supported in the framework 5, thus reducing the time for which said chamber is open and consequently reducing the dangers of exposure of the personnel to blasts of heat arriving from the chambers.

It has been observed that the invention achieves the intended aim and objects, constituting a valid alternative to the furnaces used so far. Advantageously, the furnace according to the invention furthermore allows a precise and controlled adjustment of the temperature of each individual preheating chamber, allowing a better choice of the preheating temperature for each die.

The fact that each chamber is sealed tight with respect to the outside and that it is thus possible to advantageously provide a precise and constant control of the atmosphere in which the die or part being preheated is immersed, eliminating a severe productive risk factor such as oxidation of the working surfaces of each individual extrusion die, is furthermore fundamentally important.

The invention thus conceived is susceptible to numerous modifications and variations, all of which are within the scope of the inventive concept. All the details may furthermore be replaced with other technically equivalent elements.

In practice, the materials employed, as well as the dimensions, may be any according to the requirements.

Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the scope of each element identified by way of example by such reference signs.

Claims

1. Controlled-atmosphere furnace, particularly for preheating dies for extruding aluminum and alloys thereof, characterized in that it comprises a supporting frame (1) which delimits at least one chamber (2) which can be closed tight with respect to the outside environment, a door (4) which can open outward being provided at said at least one chamber (2), said door having removable means for supporting (5) a part to be preheated, and means for heating (10) said at least one chamber (2).

2. Furnace according to claim 1, characterized in that it comprises a plurality of said chambers (2) arranged mutually side by side and mutually separated by insulating panels (3).

3. Furnace according to the preceding claims, characterized in that each of said chambers comprises pyrometric temperature control means (11) which are mutually independently connected to said means for heating (10).

4. Furnace according to one or more of the preceding claims, characterized in that each chamber (2) is provided with a duct (12) which leads therein and can be selectively connected to a source of vacuum and to a unit for introducing a controlled inert atmosphere.

5. Furnace according to one or more of the preceding claims, characterized in that each door (4) has, at a flanged edge (8) thereof, a sealing gasket (9) which is arranged at a heat exchanger (10) and which is suitable for preventing the heating of said door (4).

6. Furnace according to one or more of the preceding claims, characterized in that a copper coil constitutes said heat exchanger (10).

7. Furnace according to one or more of the preceding claims, characterized in that each door (4) is supported by a carriage (6) which can slide drawer-like with respect to guides (7) provided below within said supporting frame (1).

8. Furnace according to one or more of the preceding claims, characterized in that said removable supporting means are constituted by a framework (5) which can be removably applied to said door (4) and has a configuration which corresponds to the shape of a part to be supported.

9. Furnace according to one or more of the preceding claims, characterized in that said heating means comprise a plurality of resistors (10) which are arranged on side walls and on the bottom of each one of said chambers (2).

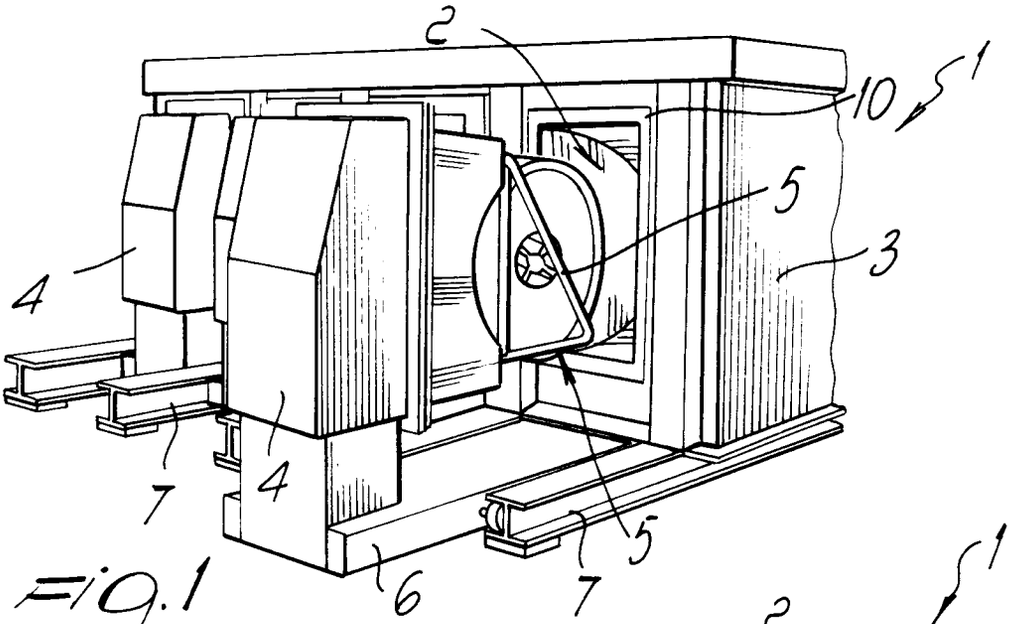

Fig.1

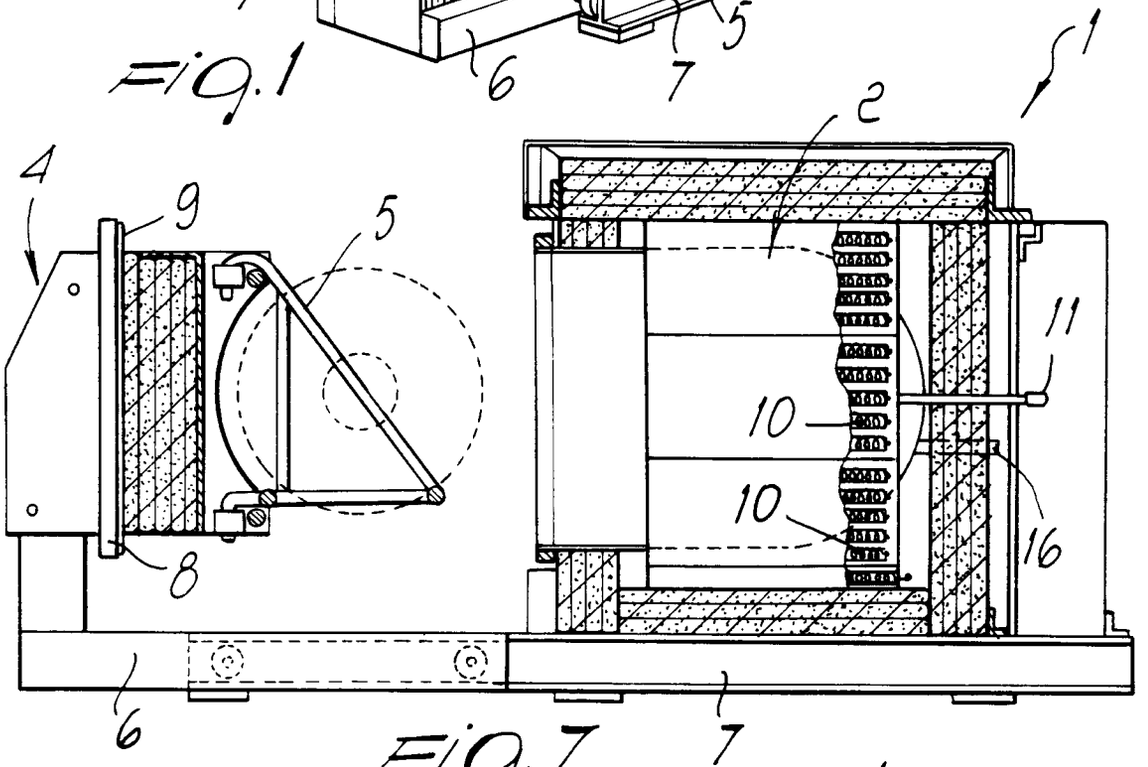

Fig.7

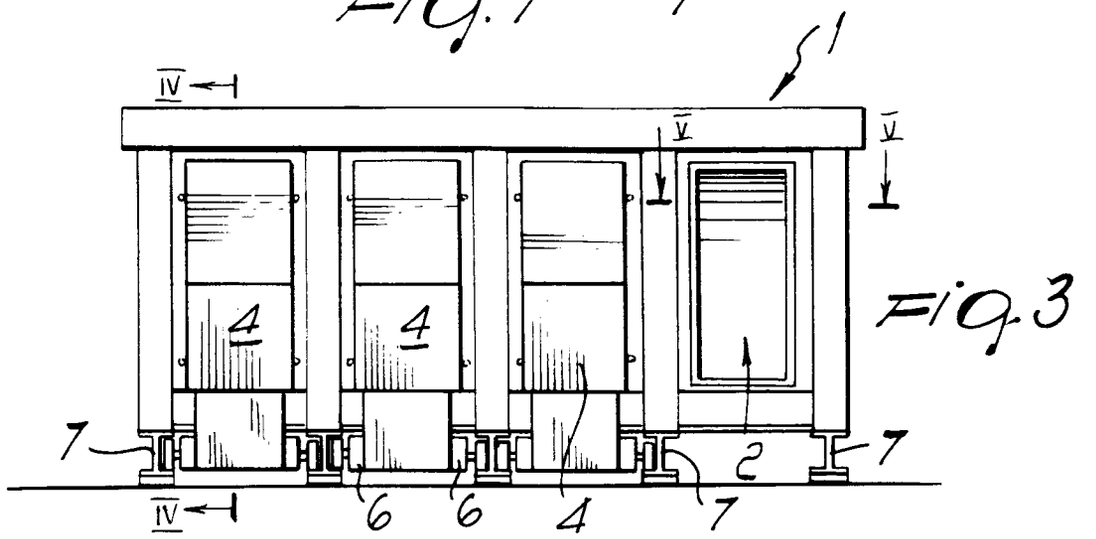

Fig.3

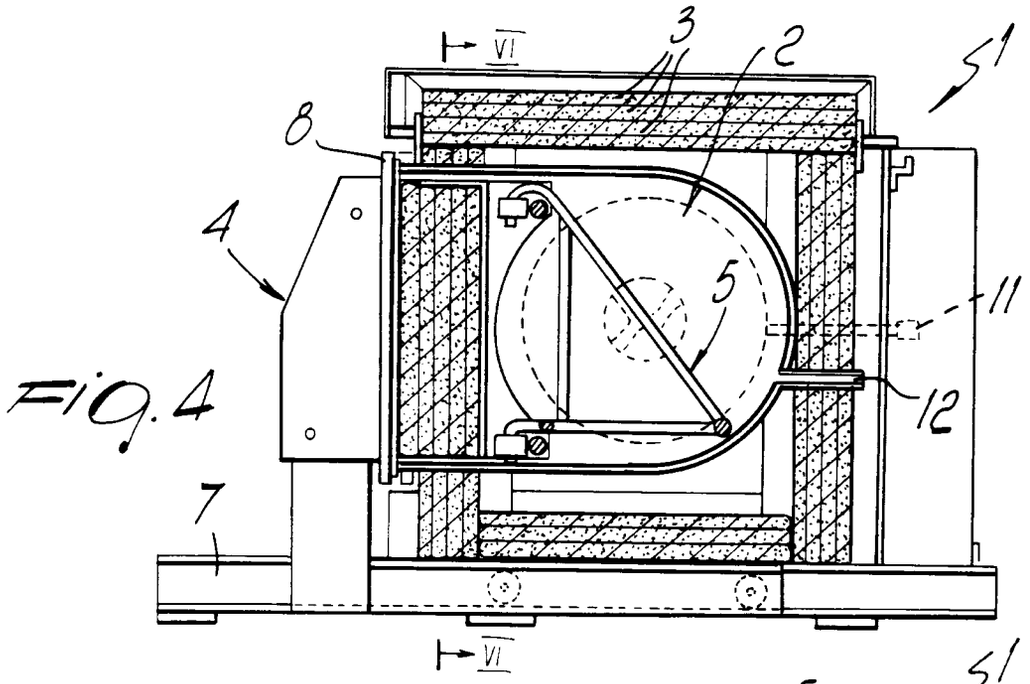

Fig. 4

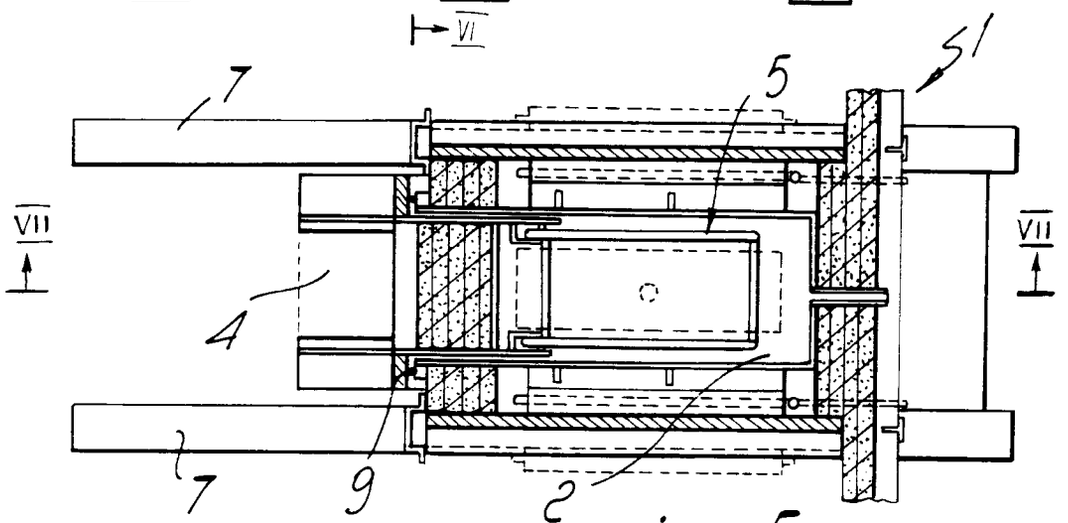

Fig. 5

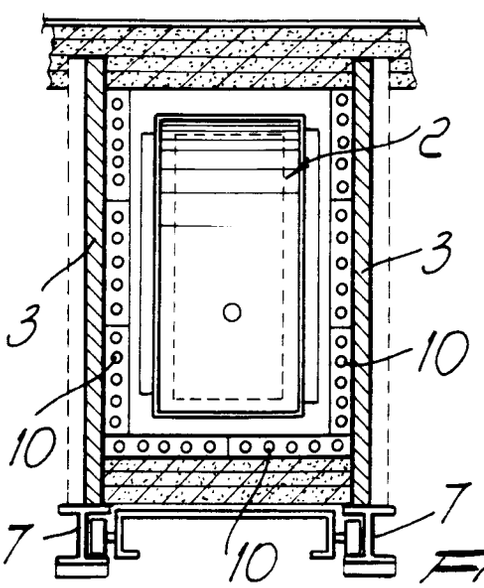

Fig. 6

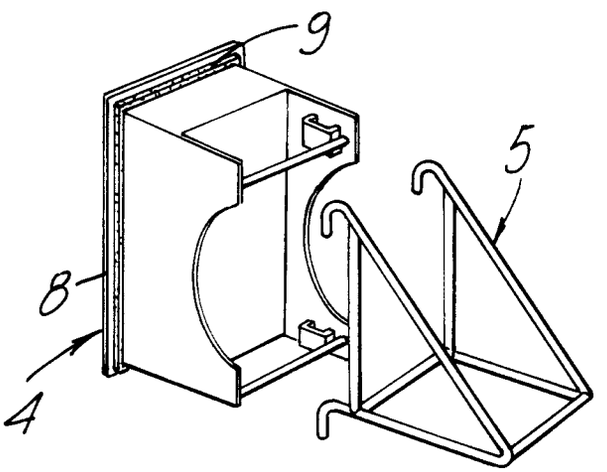

Fig. 2