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

(11) Publication number: **0 364 985 A2**

# (12) EUROPEAN PATENT APPLICATION

(21) Application number: **89119347.6**

(51) Int. Cl.5: **F25D 23/06 , B29C 67/22**

(22) Date of filing: **18.10.89**

(30) Priority: **20.10.88 IT 4576488**

(43) Date of publication of application:
**25.04.90 Bulletin 90/17**

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

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## (54) A method for producing a combined refrigerating and freezing apparatus.

(57) A method for producing a combined refrigerating and freezing apparatus, equipped with a refrigerating compartment and a freezing compartment and utilizing a conventional die and punch for foaming the polyurethane thermal insulation.

In the method the evaporators (11, 12) of the freezing compartment (7) and refrigerating compartment (8), respectively, are connected together beforehand and the evaporator (11) is then applied against the bottom wall (24) of the compartment (7), while the evaporator (12) is introduced into the compartment (8) through a side wall (27) dismountable from the latter, and is then put in position by fixing means (36, 37). The foaming of the polyurethane thermal insulation is then effected between the compartments and the outer cabinet (9) of the apparatus.

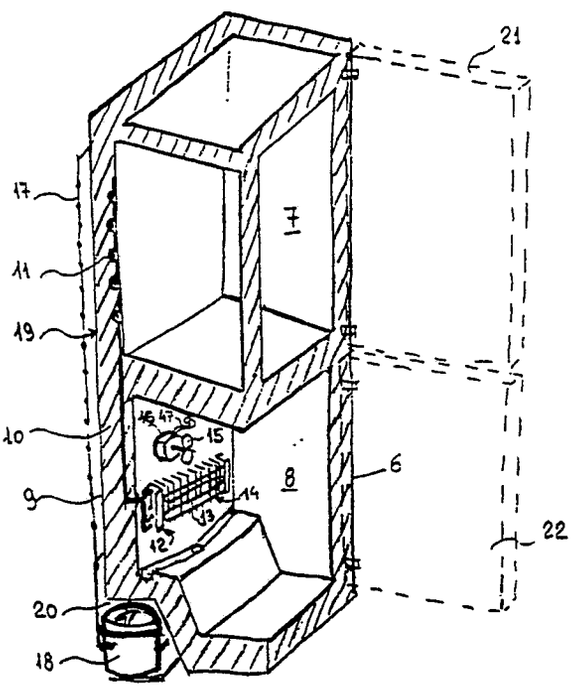


FIG 1

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# A method for producing a combined refrigerating and freezing apparatus

The present invention relates to a method for producing a combined refrigerating and freezing apparatus by which the apparatus are realized in a simple way and with fewer working steps.

Combined refrigerating and freezing apparatus for food, and in particular the "no-frost" type of apparatus, are known to comprise substantially two separate compartments one above the other, one for refrigeration and one for freezing, which are joined together during the phase of foaming the thermal insulation around said compartments, so as to obtain one cabinet extending vertically and having hinged thereto the doors for closing each compartment.

In particular, the freezing compartment of such an apparatus is normally provided with a battery evaporator connected to the refrigerating circuit of the apparatus, and with a fan for circulating the cooled air in a closed circuit within this compartment.

Such a battery evaporator, which is normally also equipped with a heating element for defrosting, is applied with known fixing means against the back wall of the freezing compartment after the latter has been combined with the refrigerating compartment, and the end capillaries of the battery evaporator are then inserted through appropriate openings passing through the back wall of the apparatus and then fixed, preferably by welding, with the corresponding terminal pipes of the refrigerating circuit of the apparatus.

Each apparatus of this type therefore requires further working phases to be performed after its production to mount it in position and connect the battery evaporator to the refrigerating circuit of the apparatus, which complicates and hampers the construction of such apparatus and also necessitates further operations for controlling the functionality of the refrigerating circuit after those operations normally required before connecting the battery evaporator to the circuit.

The invention is based on the problem of overcoming the above-mentioned shortcomings and limits using a method for producing a combined refrigerating and freezing apparatus so as to obtain the apparatus in a constructionally simple way and with fewer working steps. This production method is based substantially on the idea of connecting the battery evap orator to the refrigerating circuit of the apparatus before assembling the two compartments of the apparatus, and of then incorporating the battery evaporator within the freezing compartment directly during the operation of foaming the thermal insulation for both the compartments. The features of the production method are specified in the adjoined claims.

The invention will be understood better from the following description, which is intended only as a nonrestrictive example, with reference to the adjoined drawings in which

Fig. 1 shows schematically a cross-sectional perspective view of a combined refrigerating and freezing apparatus realized by the inventive production method,

Figs. 2, 3, 4 and 6 show the various production phases for the apparatus of Fig. 1 according to the present production method,

Fig. 5 shows an enlarged constructional detail of Fig. 4 in a lateral view partly cut along line A-A.

Referring to Fig. 1, one can see a combined apparatus 6 for refrigerating and freezing food, comprising substantially a refrigerating compartment 7 and a freezing compartment 8 which are separate, disposed one above the other, extend vertically and are contained in a parallelepiped metal cabinet 9 with a thermal insulation 10 interposed therebetween, such as e.g. expanded polyurethane or another suitable thermally insulating material.

Compartments 7 and 8 are in particular provided, respectively, with a conventional refrigerating evaporator 11 of the "vanishing" type, i.e. adapted to be applied against the back surface of the bottom wall of the compartment, in which it is incorporated within thermal insulation 10, and with a refrigerating evaporator 12 equipped with a battery and fins 13 for increasing the heat exchange surface, and also having an electrical heating element for defrosting 14 disposed in contact with the outer surface of the battery evaporator and connected electrically to the electrical system of the apparatus.

Freezing compartment 8 is furthermore provided with at least one fan 15 which is disposed in the compartment in the vicinity of battery evaporator 12 and set rotating by a traditional electrical motor 16 connected to the electrical system of the apparatus, in order to freeze the food disposed in the shelves of the compartment (which are not shown) by means of a current of cold air.

This apparatus is referred to as "no frost" thanks to the possibility of periodically defrosting the battery evaporator by means of heating element 14.

The present combined apparatus is finally provided with a condenser 17 and a refrigerating compressor 18 adapted to be applied respectively against the rear surface of back 19 of cabinet 9 and within a space 20 formed in the rear lower part

of the cabinet, the apparatus being further provided with two doors 21 and 22 for closing the front of corresponding compartments 7 and 8, the doors being hinged to the right (or left) side of the cabinet.

Referring now to Figs. 2, 3, 4, 5 and 6, one can see the various working phases required for assembling the above-described combined apparatus. In particular, Fig. 2 shows that during the first working phase of this apparatus, which involves refrigerating compartment 7 made of plastic preformed by working techniques known as such, the compartment is placed upside down and supported on a suitable fixed support 23 or on a conveyor belt (not shown) of the production line of the apparatus.

Thereafter, refrigerating evaporator 11 is applied against the outer surface of bottom wall 24 of compartment 7 by means of adhesives, adhesive bands or similar methods, the evaporator being preferably embodied by a pipe coil whose ends are connected beforehand, preferably by welding, to the corresponding ends of battery evaporator 12.

In its turn, the battery evaporator is provided with a return pipe 25 adapted to be connected to the corresponding intake pipe (not shown) of the refrigerating compressor (also not shown) during the assembly of the latter in the combined apparatus, at the same time as the condenser of the refrigerating circuit (the condenser not being shown either).

Thus, thanks to the two evaporators 11 and 12 being connected before the two compartments 7 and 8 of the combined apparatus are joined together, it is possible to check the hermetic seal of the refrigerating circuit consisting of the two evaporators with one control operation, effected during this working phase of the apparatus, thus eliminating the further control operations previously required for this check when the two evaporators are connected together, which used to be performed on the finished apparatus.

Examining now Figs. 3 and 4, one can see the second working phase of the combined apparatus, which involves freezing compartment 8 made of preformed metal sheet with working techniques known as such, the compartment being disposed upside down and supported on another fixed support 26 or on the above-mentioned conveyor belt.

This compartment is disposed adjacent the other compartment (not shown) and spaced therefrom so as to allow for the mutual assembly of the compartments during the operation of foaming the polyurethane thermal insulation of the apparatus.

This compartment is furthermore realized with a side wall 27 which is dismountable therefrom to allow for introduction of battery evaporator 12 inside the compartment during this working phase of the apparatus.

For this purpose, side wall 27 is dimensioned to fit against the corresponding peripheral edge of compartment 8 and, after the introduction of battery evaporator 12 inside the compartment, said wall is fixed with working methods known as such against the lateral edge of the compartment. This side wall is furthermore provided with a through hole 28 in correspondence with the above-mentioned peripheral edge, said edge having inserted therein a packing 29 provided to prevent the penetration of the thermal insulation inside compartment 8 during the foaming phase, and said packing having holes for the passage of pipes 30 and 31 for interconnecting evaporators 11 and 12.

In the course of this working phase, furthermore, electrical heating element 34 adapted to effect the periodic defrosting is applied by gluing, taping or similar methods against the outer surface of conveyor 32 for collecting water during the periodic defrosting of battery evaporator 12, the conveyor being disposed below the evaporator and connected with a pipe 33 for discharging the water to the outside.

In its turn, battery evaporator 12 is applied against bottom wall 35 of compartment 8, as can be seen in Fig. 5, by means of screws 36 to be screwed into and out of corresponding threaded sockets 37 to be inserted through corresponding holes 38 through the bottom wall and equipped with appropriately bent rigid arms 39 adapted to form a stop against the corresponding surface of the bottom wall in order to hold sockets 37 in position before they are countersunk in thermal insulation 10, during the following phase of foaming the latter around both compartments 7 and 8, performed in the way described below.

Thanks to this manner of applying battery evaporator 12, it is thus possible to dismount and remount it easily with respect to compartment 8 when this is necessary for operations of repair and maintenance and always keeping the evaporator connected to the other evaporator 11, screwing screws 36 into and out of corresponding sockets 37. Further more, when battery evaporator 12 is defective, it is possible to dismount it from the compartment, disconnecting it beforehand from the other evaporator 11, and replacing it by a new battery evaporator which is then connected to evaporator 11 by the same simple operations as described above. Finally, referring to Fig. 6, one can see the third working phase of the combined apparatus, which involves the foaming of polyurethane thermal insulation 10 around both compartments 7 and 8 of the apparatus, an operation which is performed utilizing a traditional pressing tool consisting of a die 41 and a punch 42.

As can be seen, die 41 is provided with two

separate protruding portions 43 and 44 dimensioned to fit perfectly inside corresponding refrigerating and freezing compartments 7 and 8, while punch 42 is in turn provided with a flat plate 45 dimensioned to fit the outer profile of compartments 7 and 8, being spaced from the profile to allow for formation of thermal insulation 10.

Furthermore, protruding portion 44 of die 42 is also provided with a through hole 46 formed in correspondence with the position of battery evaporator 12 inside freezing compartment 8 and dimensioned to allow for a perfect fit of the battery evaporator through the hole during the introduction of aforesaid protruding portions 43 and 44 into corresponding compartments 7 and 8.

In this way, after the two aforesaid compartments and metal cabinet 9 are disposed between die 41 and punch 42 and after the latter are closed against the compartments and the cabinet, the expanded polyurethane can be injected inside the pressing tool, thereby forming the combined apparatus whose evaporator 11 is countersunk in thermal insulation 10 and whose battery evaporator 12 with its defrosting heating element 14 is put directly in position inside freezing compartment 8. Then, after the pressing tool is opened and the combined apparatus thus produced is removed, fan 15 with its driving motor 16 is introduced inside compartment 8, the fan being put in position by being screwed against corresponding sockets (not shown) countersunk in the thermal insulation of the apparatus, together with the sockets for the passage of cable 47 for supplying power to the motor and to the heating element for defrosting 14 (see Fig. 1). Furthermore, condenser 17 and compressor 18 are then disposed in their respective positions against the back walls of the apparatus and connected in the known way to the refrigerating circuit of the apparatus.

## Claims

1. A method for producing a combined refrigerating and freezing apparatus, comprising a refrigerating compartment and a freezing compartment which are separated, disposed one above the other and provided with a first and a second refrigerating evaporator, respectively, the freezing compartment being also provided with at least one motorized fan and an electrical heating element adapted to effect a current of cold air through the compartment and periodic defrosting of the second evaporator, respectively, said method providing for the use of at least one die and punch of the conventional type for foaming the polyurethane thermal insulation in the compressed space between the refrigerating and freezing compartments and the outer metal cabinet of the apparatus, and being characterized by a first phase in which the first evaporator (11) previously connected hermetically with the second evaporator (12) is applied with known means against the bottom wall (24) of the refrigerating compartment (7); by a second phase in which the second evaporator (12) with the heating element (14) are initially introduced into the freezing compartment (8) through a dismountable side wall (27) of the compartment and the second evaporator (12) is then put in position in the freezing compartment (8) by fixing means (36, 37); and by a third phase in which the polyurethane thermal insulation is foamed through the space, thus having countersunk therein the first evaporator (11) and the fixing means (36, 37) of the second evaporator (12), and in which the motorized fan (15) is applied in the freezing compartment (8) and connected electrically, together with the heating element (14), with conductor means (47) of the apparatus.

2. The production method of claim 1, characterized in that the fixing means comprise a plurality of screws (36) to be engaged in corresponding threaded sockets (37) to be inserted through holes (38) in the bottom wall (35) of the freezing compartment (8), said threaded sockets (37) being equipped with rigid arms (39) adapted to form a stop against the bottom wall (35) for holding the second evaporator (12) in position.

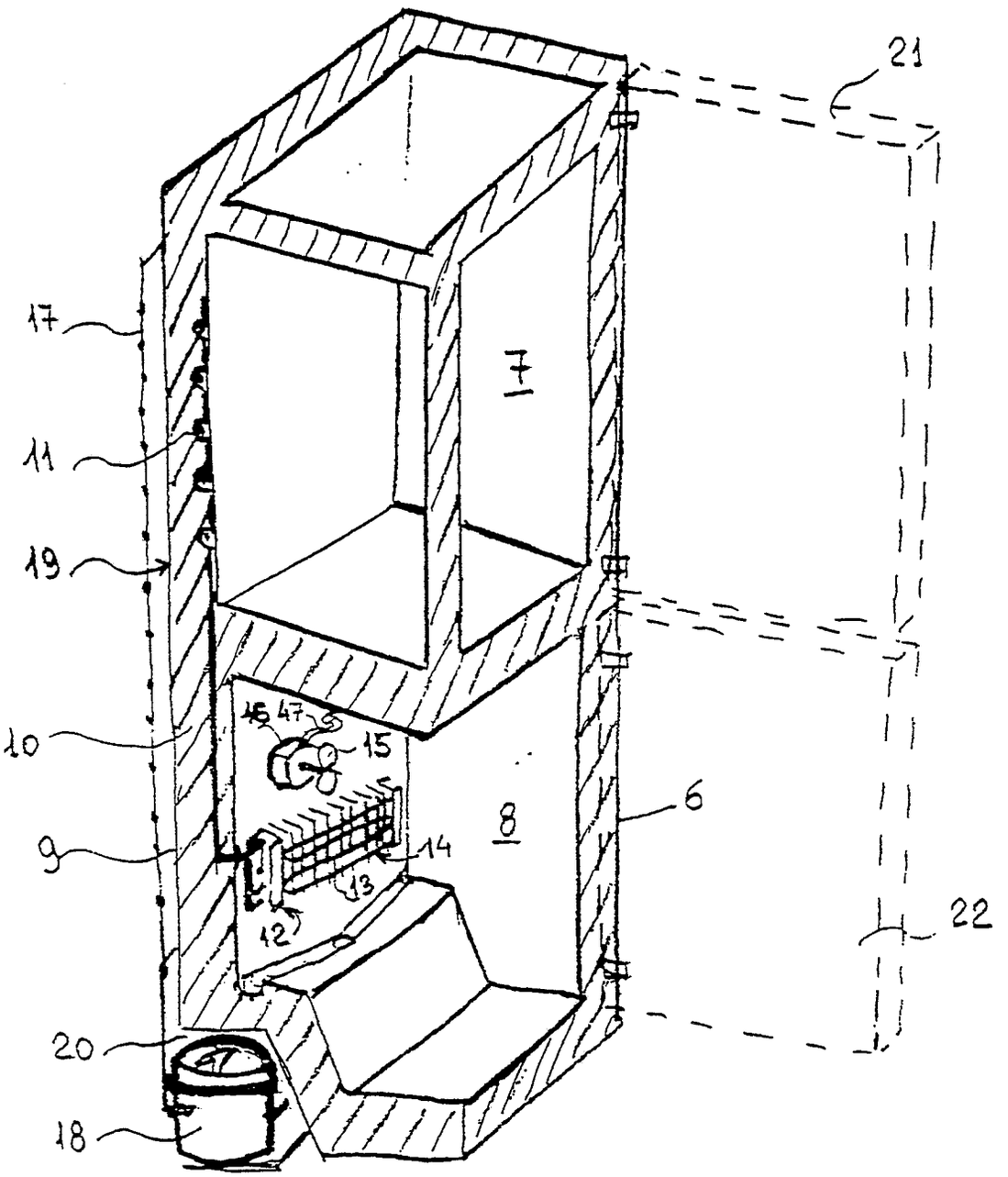


FIG 1

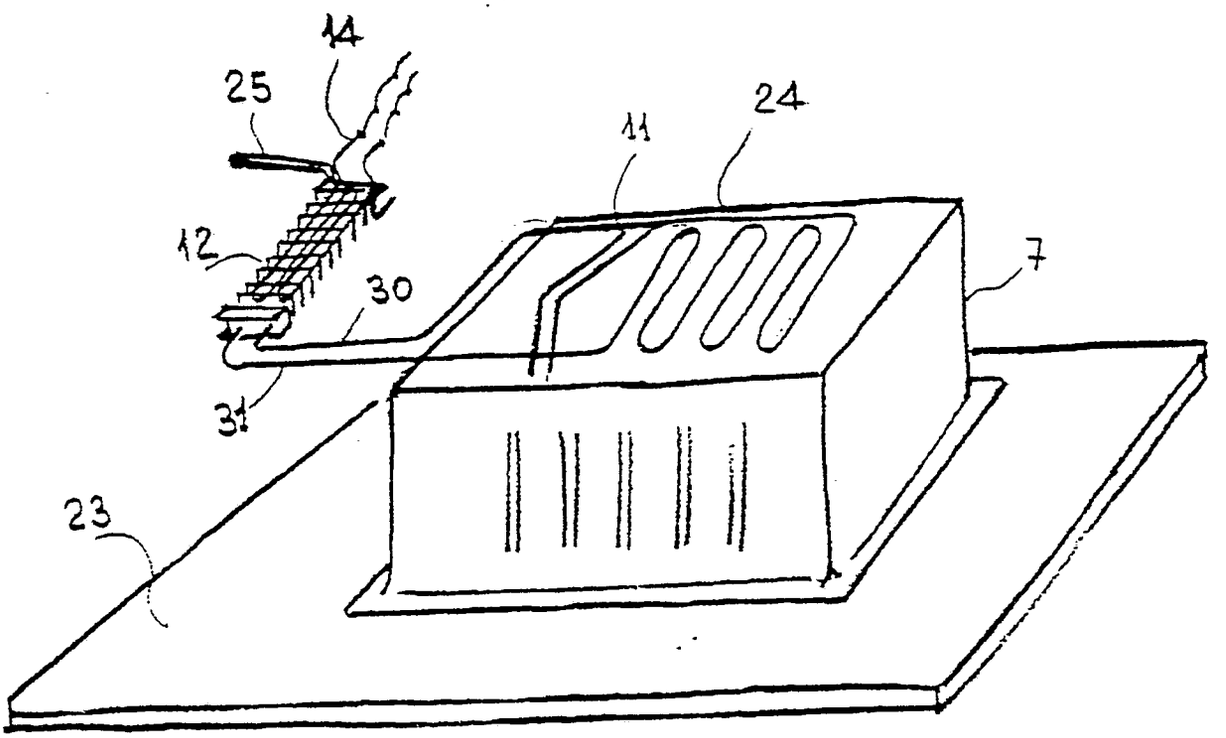


FIG 2

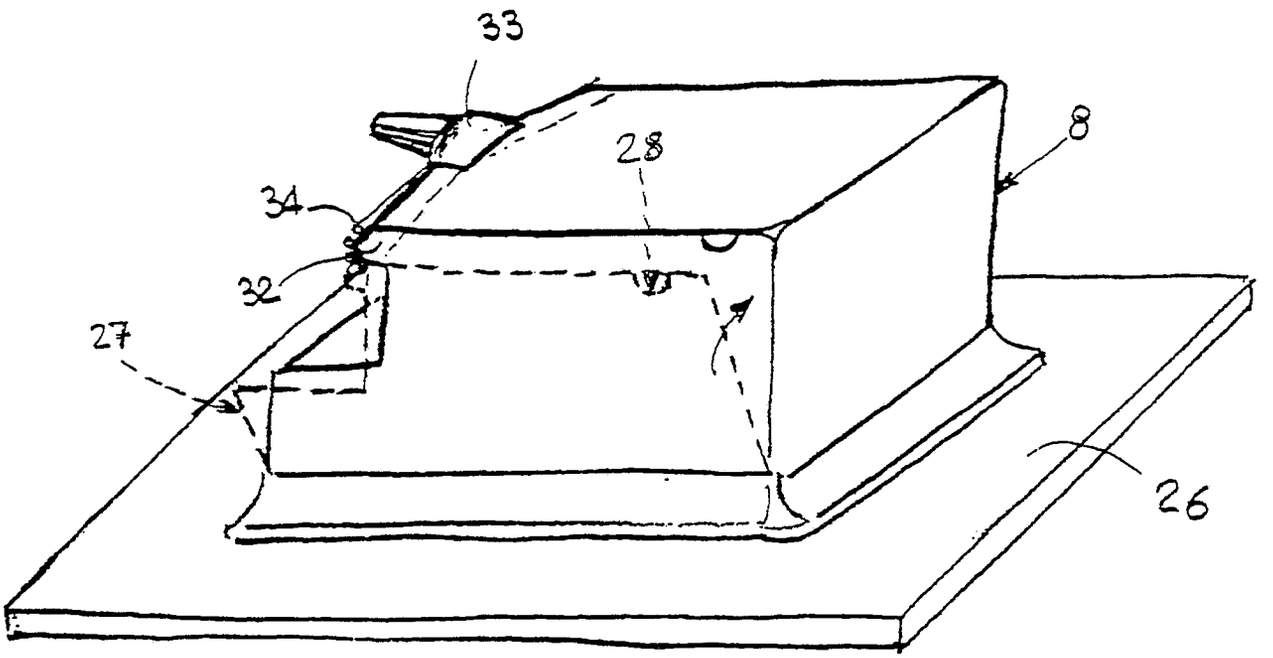


FIG 3

FIG.5

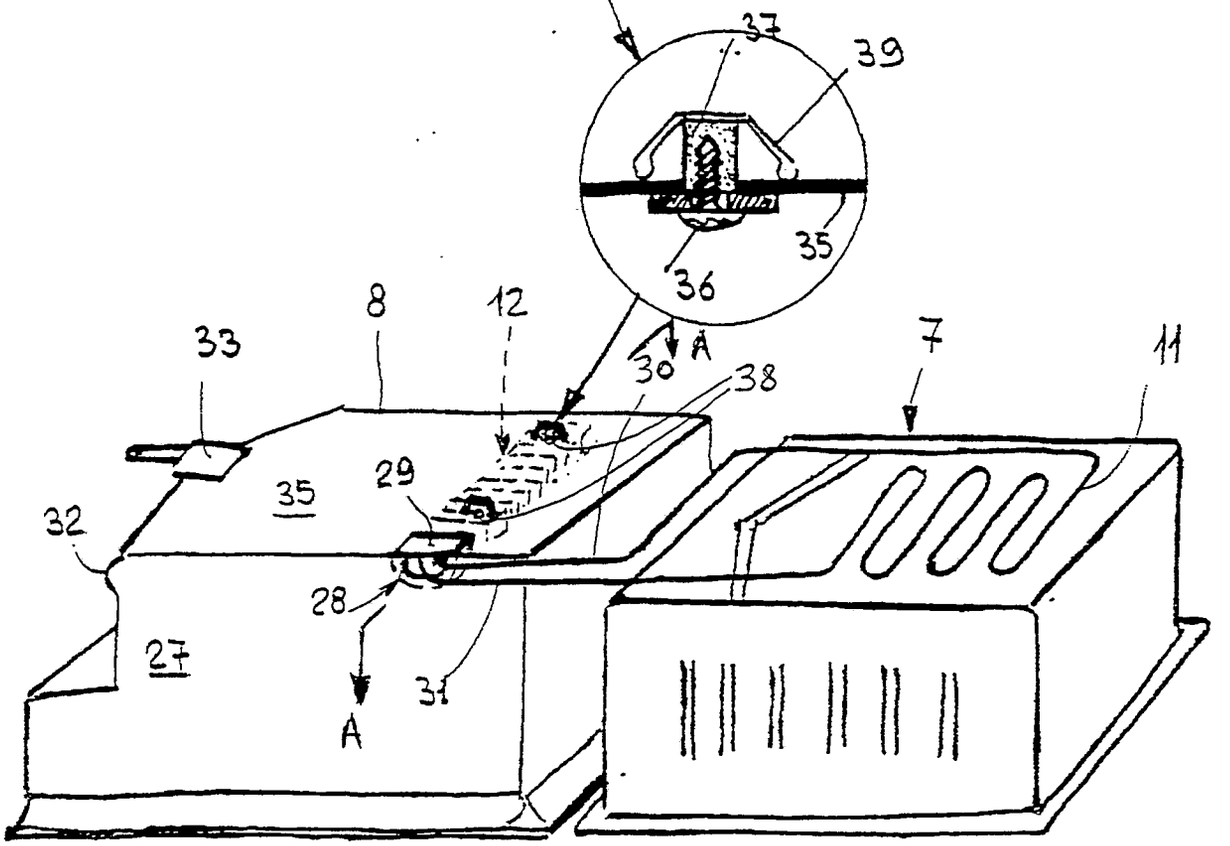


FIG. 4

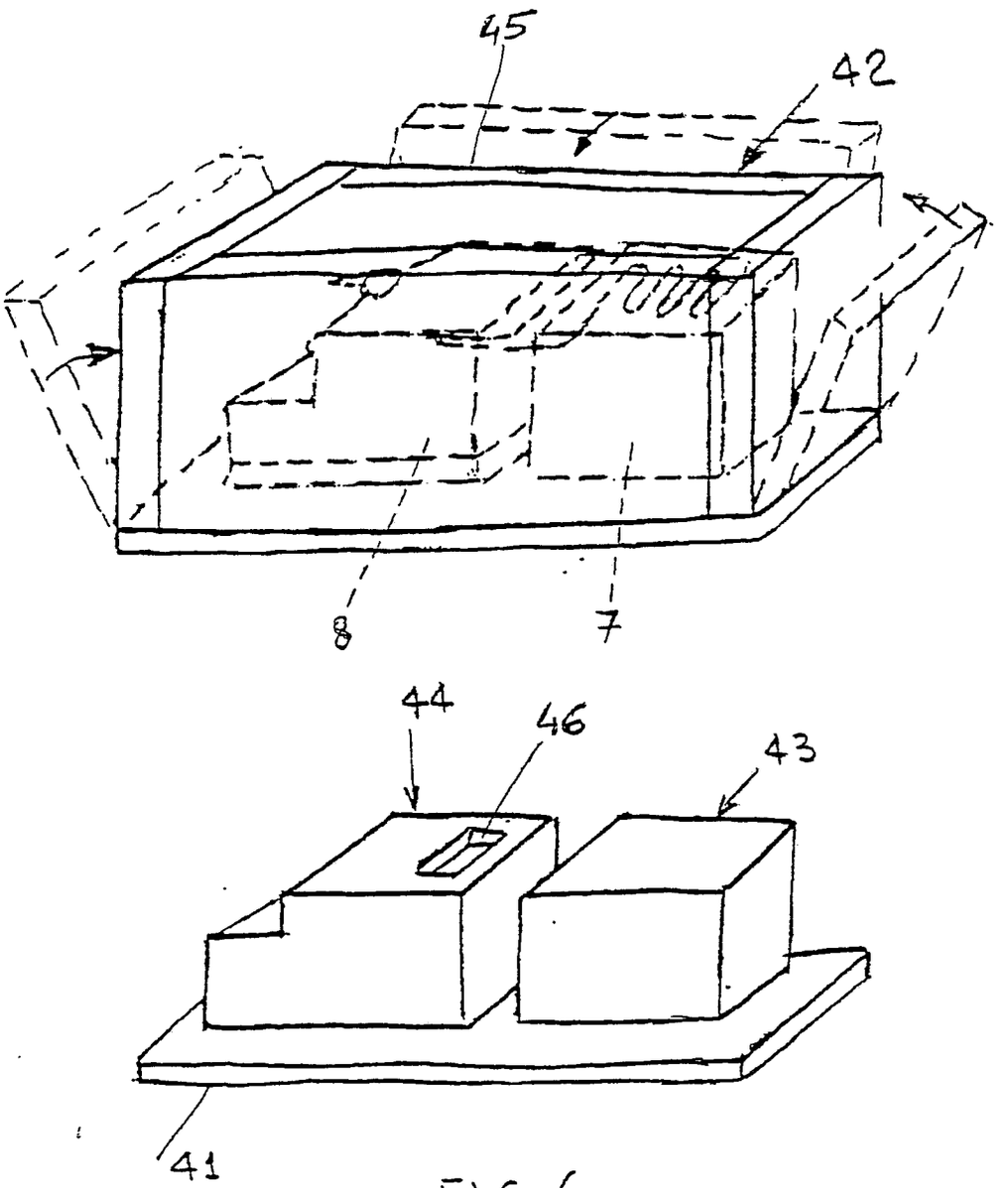


FIG.6