



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
01.08.2007 Bulletin 2007/31

(51) Int Cl.:
D06F 58/26 (2006.01)

(21) Application number: **06101040.1**

(22) Date of filing: **30.01.2006**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK YU

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(54) **Machine for washing and/or drying laundry**

(57) A machine for washing and/or drying laundry has a drying and/or condensation system (5) that comprises at least one air heating element (10). The heating element (10) comprises an inner support body (12) of insulating material for a plurality of electrical resistive elements, which is delimited in at least partial adherence

by at least one outer body (20) in sheet metal. The longitudinal extension of the heating element (10) is markedly greater than its width, forming a duct (18) developing in the direction of the flow of air to be heated, which duct is adapted to increase the time of permanence of air in the element, offering the advantage of markedly reducing the installed power.

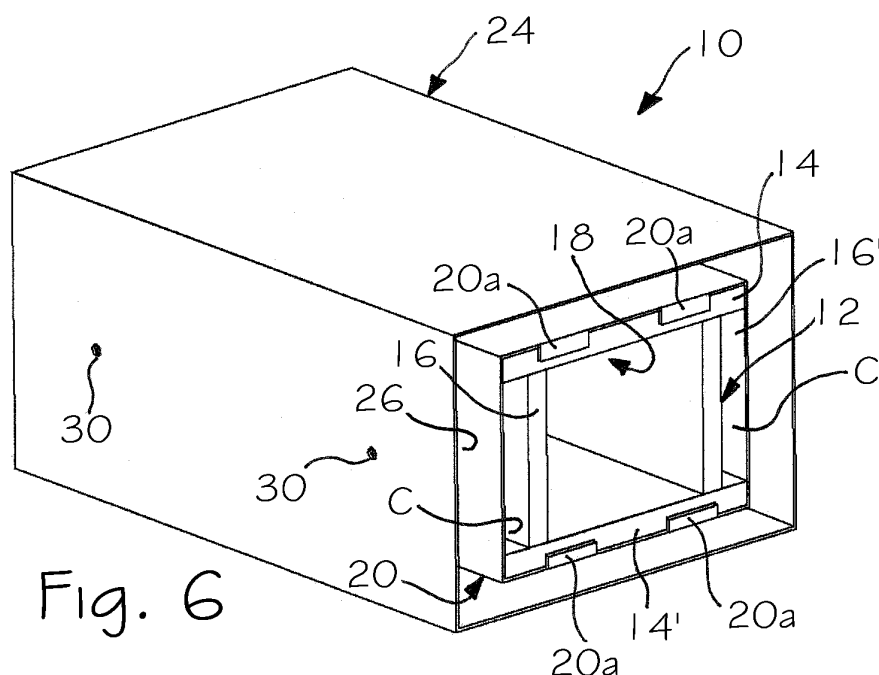


Fig. 6

Description

[0001] The present invention relates in general to electrical household appliances provided with a system for air heating or condensation that comprises at least one resistance or heating element. More in particular, the present invention has been developed with particular reference to an element for air heating suitable for use in machines for treating laundry.

[0002] It is known that machines for washing and drying laundry (the so-called washing-drying machines) are provided with heating elements whereby, at the end of the washing and spin-drying cycles, the laundry is dried. There also exist specific and independent drying machines, into which the washed laundry is transferred to be subjected to drying.

[0003] In both cases, the above machines comprise a drum -- which in the case of washing-drying machines is the same drum in which the laundry is placed for washing into which a flow of hot air is caused to enter by means of a fan; the air is typically heated by means of a heating element or resistance, through which the air passes before being delivered into the drum, the latter being appropriately caused to rotate to encourage uniform drying of the contents.

[0004] The known heating elements used in the appliances in question essentially consist of a body of prismatic shape, two opposing sides being open to provide for the entrance and exit of the forced air flow and, at least along two walls, provided with plate-shaped supports of insulating material; the resistive units, usually in the form of small aligned coils, are fixed to these supports. The remaining upper and lower walls of the element are defined by two plate-shaped bodies of sheet metal, which hold the whole together through screws or equivalent fixing means.

[0005] It has been determined that this traditional embodiment of the resistances to heat the air suffers from significant drawbacks.

[0006] Indeed, in these known resistances, the air flow is not precisely channelled and heating of the air requires considerable installed power, generally between 2.2 and 2.5 kW; a conspicuous part of the heat, furthermore, is dissipated especially from the open sides of the element, overall causing considerable energy consumption.

[0007] The primary aim of the present invention is to resolve the drawbacks mentioned above.

[0008] In this sphere, a purpose of the invention is to produce a machine of the type indicated provided with an improved heating element in which the flow of air to be heated is precisely channelled and, in consequence, heat exchange comes about in an optimal fashion. Another purpose of the invention is to provide a machine of the type indicated equipped with a heating element in which heat loss is negligible.

[0009] A further purpose of the invention is to provide a machine of the type indicated fitted with a heating element of limited installed power, but nevertheless able to

bring the air to the temperature required by the operative standards of the machine.

[0010] A further purpose of the invention is to provide a machine of the type indicated fitted with a heating element able to ensure a high degree of efficiency and reliability over time, which is also such as to be easily and economically produced.

[0011] One or more of these purposes are achieved, according to the present invention, by a machine for washing and/or drying laundry having the characteristics related in the annexed claims. The claims constitute an integral part of the technical teaching provided here in regard to the invention.

[0012] The construction and functional characteristics of a machine according to the present invention may be better understood in the detailed description that follows, in which reference is made to the attached plates of drawings that represent a preferred embodiment with no limiting intent and in which:

- figure 1 represents schematically a machine for washing and drying laundry according to the invention;
- figure 2 represents schematically a perspective view with partial section of a heating element of the machine according to the invention;
- figure 3 represents schematically in perspective view, an inner body that supports the resistive elements or spiral resistances of the heating element in figure 2;
- figure 4 represents schematically in perspective view, an intermediate body of the heating element in figure 2;
- figure 5 represents schematically in perspective view, an outer cover or shell of the heating element in figure 2;
- figure 6 represents schematically in perspective view, the assembled heating element;
- figure 7 represents schematically in perspective view, a part of an intermediate body of the type represented in figure 2, in accordance with a possible variant.

[0013] Figure 1 represents, in a very schematic form, an electrical household appliance for treating laundry; for the purposes of the present intervention it is supposed that this appliance is a washing-drying machine, indicated with 1 as a whole, taking it however for granted that the invention is also applicable to drying machines.

[0014] The machine 1, which in the non-limiting example is of the top-loading type, comprises a casing 2 within which is supported in known fashion a tank 3; inside the tank 3 is rotatably mounted a drum 4 to contain the laundry, appropriately activated through an electric motor and the relative transmission and control means, likewise of known type. The machine 1 also comprises known means to take in and discharge the washing water and means to deliver the detergent, as well as a drying sys-

tem, indicated with 5 as a whole, that comprises means of ventilation, heating and condensation of the air. Such system 5 comprises an element to heat the air, or resistance, indicated with 10 as a whole.

[0015] With reference to figures 1 and 6, the heating element 10, that constitutes the specific subject of the invention, comprises a frame or inner body 12 to support resistive elements or spiral resistances, of known type.

[0016] The inner body 12, represented in figure 3, is formed by plates 14, 14', 16, 16' of electrically insulating material, disposed so as to form a box with substantially rectangular section, open at the two opposed longitudinal extremities. The said plates form a duct or tunnel, 18, for the passage of air, in which said spiral resistances are arranged, stabilised in appropriate recesses or seats practised on two or more of said plates; in the case given as an example seats or through openings are provided for this purpose, in substantially specular positions on plates 16 and 16', said openings only being represented in figure 2, where they are indicated as 16a; each spiral resistance only one of which is represented in diagram form and indicated as R, extends between two respective opposing openings 16a, respectively housing the two opposite regions of the spiral resistance; the various spiral resistances R, which thus extend transversely to the direction of the air flow in the tunnel 18, are connected electrically one to the other on the outer side of plates 16, 16'. Note in this connection that each of a series of spiral resistances R may consist of a respective coiled part of a single resistance wire.

[0017] The plates 14, 14', 16, 16', of substantially rectangular form, are made of any insulating material, preferably such as steatite, magnesite or, preferably, ceramic; along the longitudinal edges of the plates 16, 16' projections may be provided that are adapted to engage in respective recesses or seats formed in the plates 14, 14'.

[0018] According to the embodiment brought as an example and without limiting intent as in the figures, the two opposing plates 14 and 14' oriented horizontally in figure 3, substantially parallel, are of width greater than the distance between the two plates 16 and 16' oriented vertically, they too opposing and substantially parallel. In this way, therefore, plates 14, 14' project laterally with regard to the two plates 16, 16', along the entire longitudinal extension of the inner body 12.

[0019] The inner body 12 that contains and supports the spiral resistances R, constituted of said plates of insulating material, is delimited by a metal housing or intermediate containing body 20, illustrated in schematic form in figure 4, made of sheet metal or any other appropriate material, for example galvanised iron.

[0020] The intermediate body 20, of essentially hollow parallelepiped form, delimits and precisely compacts the inner body 12, adhering to it along the opposing upper and lower faces, defined by plates 14 and 14', as well as along the lateral edges of these same plates, that project from the remaining plates 16 and 16' oriented vertically. Note that in this way two longitudinal cavities C (see fig-

ures 1 and 6) are delimited between the plates 16, 16' of the inner body 12 and the walls of the intermediate body 20 facing them; the means for electrical connection between the various coils run in these cavities C, and if necessary parts of the relative power-supply cable or cables, without any risk of contact with the body 20.

[0021] In the example given in figure 4, the front and rear edges of the upper and lower walls of the body 20 are provided with cantilever projections, indicated with 20a; these projections 20a are destined to be folded substantially at right angles inwards regarding the body 20, so as to maintain the inner body 12 in the correct operative and assembly position, as is shown for example in figures 1 and 6.

[0022] To advantage, the metal housing or intermediate body 20 is provided, along the lateral surface, with a plurality of projections or reliefs 22, of any form and development, projecting outwards from the body, having the function specified below; such reliefs 22, obtained for example through a drawing process on the sheet metal forming the body 20, are of preference situated on at least two opposing faces of the body.

[0023] The assembly formed by the inner body 12 of insulating material and the metal body 20 that encompasses it is in its turn inserted within an outer shell 24, schematically represented in figure 5, equally made of sheet metal or other suitable material. The outer shell 24 defines a rectangular section whose dimensions are such as to encompass the body 20 without adhering to it, excepting locally in correspondence with the reliefs 22, that is maintaining a distance of for example between 5 and 20 mm around it. This distance is determined advantageously by the extent of projection of the reliefs 22 practised on the intermediate body 20, and gives rise to the creation between the latter and the outer shell 24 of an insulating chamber, indicated with 26 in figures 1 and 6, of perimetral development, wherein ambient air is distributed.

[0024] The outer shell 24 is stabilised with regard to the intermediate body 20 through screws, rivets or equivalent means of fixture, destined to be fixed into the exposed extremities of the reliefs 22. For this purpose, these latter may present, as in the example illustrated, a truncated cone development, with through hole 28 on the lesser base or exposed front. In parallel, the outer shell 24 is provided with through holes 30, destined to align with those 28 of the reliefs 22.

[0025] Note that the spacer means between the body 20 and the outer shell 24 might, rather than reliefs 22, be obtained by flaps made through shearing, in correspondence with the front and rear edges of the lateral walls of the body 20, similarly to the case of the projections 20a; these flaps -- one of which is represented in diagram form in figure 7, where it is indicated with 22a -- are then folded to an L shape inwards versus the body 20; in this way, a portion of the extremity of the flap 22a is substantially parallel to and adjacent to the opposing lateral wall of the outer shell 24, in such portion being provided with at least

one hole 28, having a similar function to that of the knobs 22.

[0026] According to an important characteristic of the invention, the longitudinal extension of the heating element or resistance 10 is markedly greater than its width, so as to facilitate heat exchange between the forced air, coming from a conventional fan which is part of the drying system 5, and the resistive elements R situated in the support or inner body 12 of insulating material, powered electrically in known fashion. The flow of forced air to be heated is channelled precisely into the tunnel 18 of the resistance 10, in which it remains for an appreciable time-span, since the resistance has greater development in length. As a simple indication, the longitudinal extension of the heating element 10 may be equal to approximately double that of a typical heating element for drying machines (at least 12 cm against 6 cm). As may be seen in the figures, the three components 12, 20 and 24 of the heating element 10 have essentially equal longitudinal extension.

[0027] From the above the advantages that the invention are clear. The heating element 10 of the machine according to the invention enables the flow of forced air to be channelled with precision to the spiral resistances, achieving optimal heat exchange with the air not least as a function of the considerable longitudinal development of the tunnel 18; this latter, developed in the direction of the airflow, thus increases the time that the air spends within it. The installed power, in consequence, may be appreciably reduced compared to traditional resistances for analogous use, nevertheless guaranteeing the same degree of heating of the air. Experimental tests conducted by the applicant have shown that such power may be reduced at least by 40 or 50% compared to that installed on conventional resistances of equivalent use (approximately 1100 kW in the case of the invention and 2000-2500 kW in the case of a known drying machine).

[0028] Heat loss, furthermore, is minimised thanks to the insulation obtained through the intermediate body 20, the outer shell 24 and the air space 26 created between them, this latter being open at both its longitudinal extremities.

[0029] The improved heating element 10, as detailed above, is particularly indicated for use in washing-drying machines, drying machines, or machines with condensation circuits, but it is clear that it could also be used in electric household appliances of other types, in which it is necessary to heat a flow of air.

[0030] Although the invention is described above with particular reference to one embodiment, given as a pure example and without limiting intent, numerous modifications and variations appear clear to the technician in the light of the description given above. Thus the present invention intends to embrace all modifications and variants that lie within the spirit and sphere of protection of the following claims.

Claims

1. Machine for washing and/or drying laundry (1) having a drying and/or condensation system (5) that comprises at least one air heating element (10), **characterised in that** said heating element (10) comprises an inner body (12) of insulating material that supports a plurality of electrical resistive elements (R), which is arranged within at least one respective container body (20), particularly in sheet metal or similar, said support body (12) being at least partially adherent to said container body (20), the longitudinal extension of said heating element (10) being markedly greater than its width.
2. Machine according to claim 1, wherein said support body (12) is formed of four plates (14, 14', 16, 16') orientated in a substantially orthogonal fashion to define a longitudinally extended duct (18), where two first opposing plates (14, 14') project laterally with regard to two second likewise opposing plates (16, 16').
3. Machine according to claim 2, wherein each of the two opposing longitudinal edges of each of said first plates (14, 14') is adjacent to a respective first lateral wall of said container body (20), a longitudinally extended cavity (C) extending between each of said second plates (16, 16') and a respective said first lateral wall, said resistive elements (R) preferably extending transversely with regard to the longitudinal extension of said duct (18).
4. Machine according to at least one of the preceding claims, wherein the heating element (10) also comprises an outer shell (24), particularly in sheet metal or similar, that encompasses said container body (20), a peripheral chamber (26) being formed between the container body (20) and the outer shell (24).
5. Machine according to claim 4, wherein said container body (20) and said outer shell (24) are locally connected one to another by means of spacer means (22), preferably made in a single piece with one of said container body (20) and said outer shell (24), said spacer means extending at least in part into said peripheral chamber (26).
6. Machine according to claim 5, wherein said spacers comprise at least one of
 - one or more reliefs or projections (22), each formed in an intermediate region of a respective face of the said container body (20), and
 - one or more folded flaps (22a), each formed in correspondence with the front and/or rear edge of a respective wall of said container body (20).

7. Machine according to claim 5 and/or 6, wherein said spacer means (22) are located in correspondence with at least two opposing faces of said container body (20) and have at least in part a substantially truncated cone development, with the smaller base outwards and provided with a through hole (28). 5
8. Machine according to claim 5 and/or 6, wherein said outer shell (24) is provided, on one or more faces, with through holes (30) destined to align with holes (28) of said spacer means (22), to receive screws, rivets or equivalent means of fixation. 10
9. Machine according to claim 1, wherein said container body (20) includes one or more projections (20a) formed in correspondence with the front edge and/or the rear edge of a respective wall of said body, said projections 20 being folded so as to maintain said supporting body (12) in position. 15 20
10. An air heating element for an electrical household appliance, such as a machine for washing and/or drying laundry, according to one or more of claims from 1 to 9. 25

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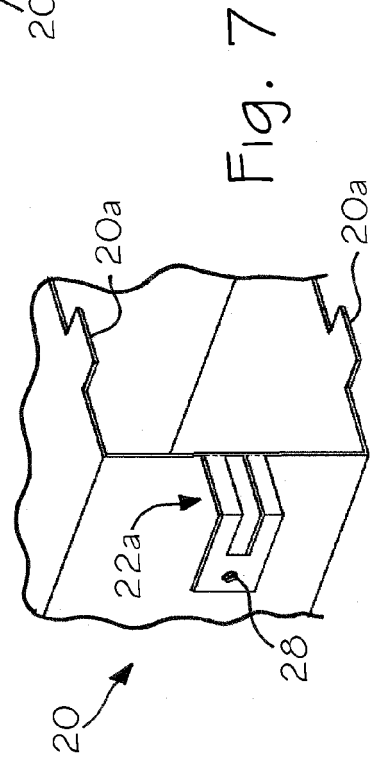
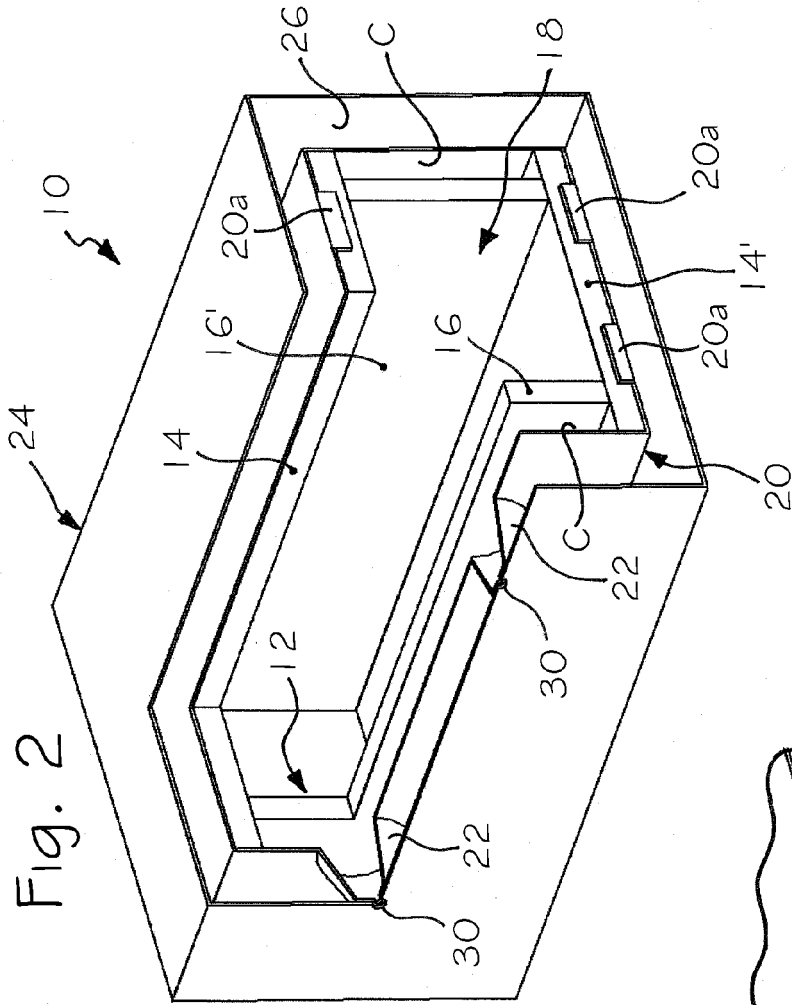
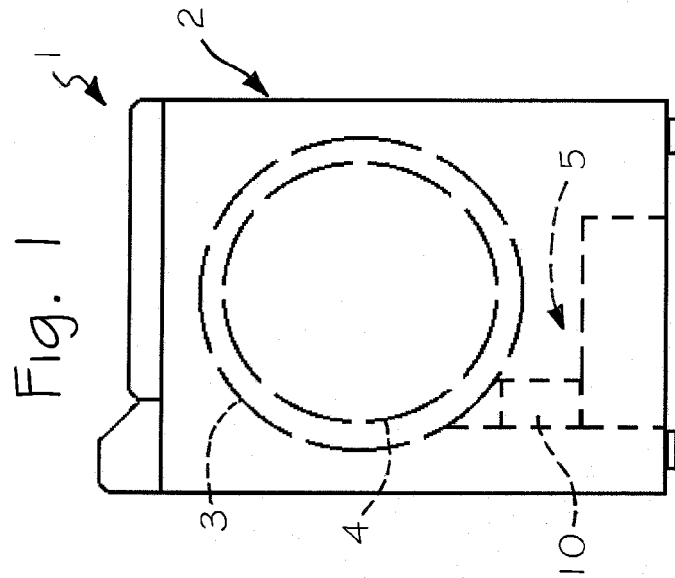
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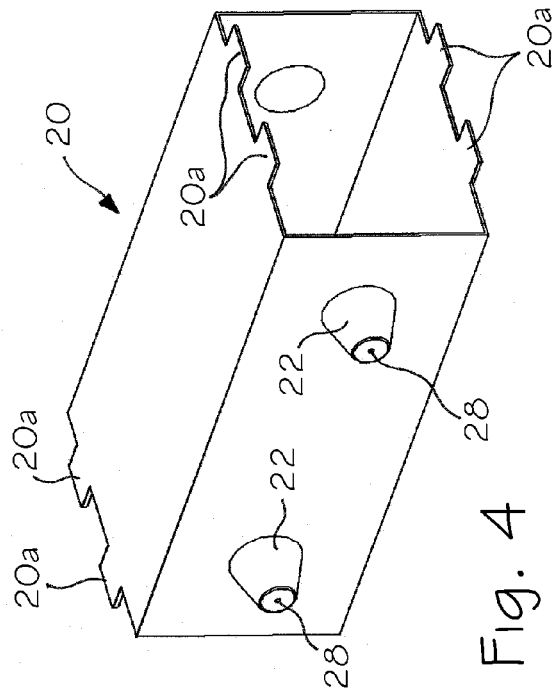
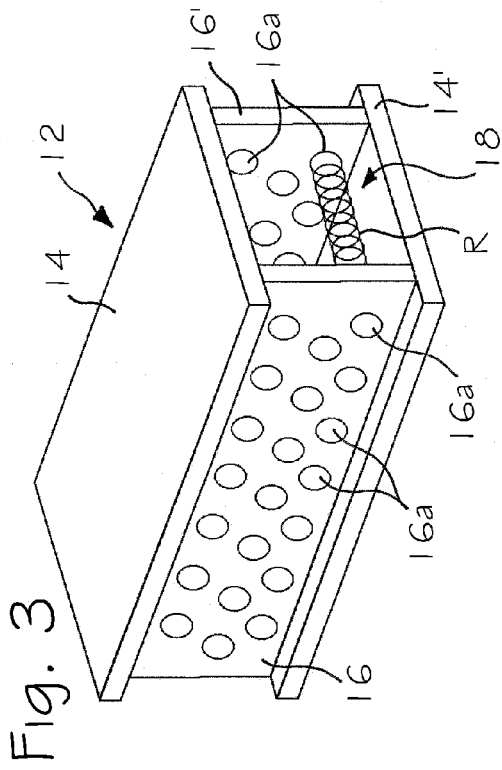
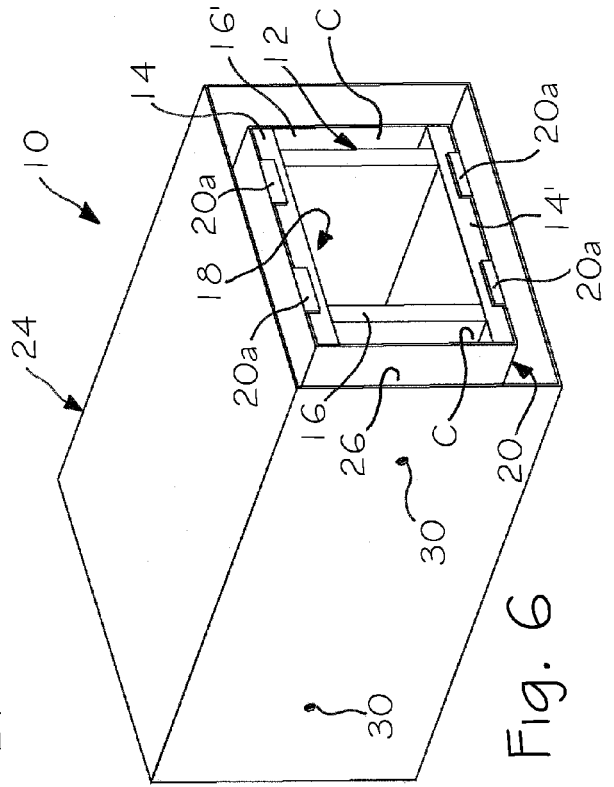
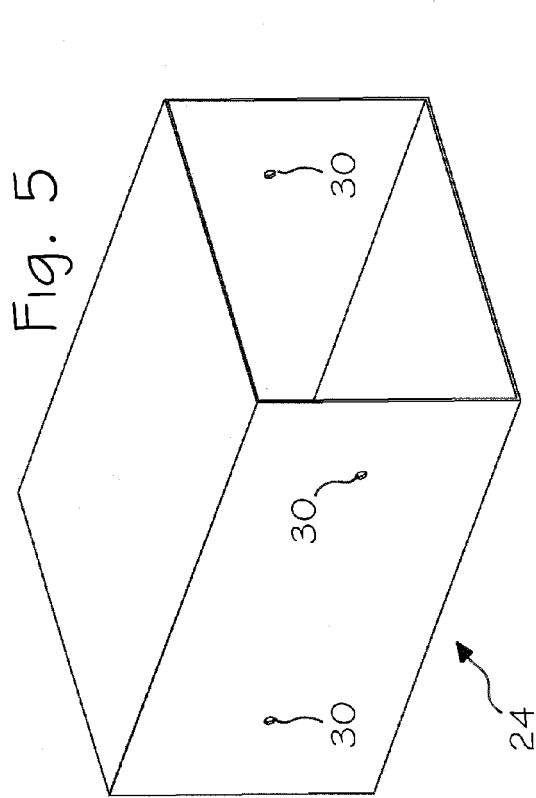
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EUROPEAN SEARCH REPORT

Application Number
EP 06 10 1040

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 3 July 2006	Examiner Weinberg, E
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03 82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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