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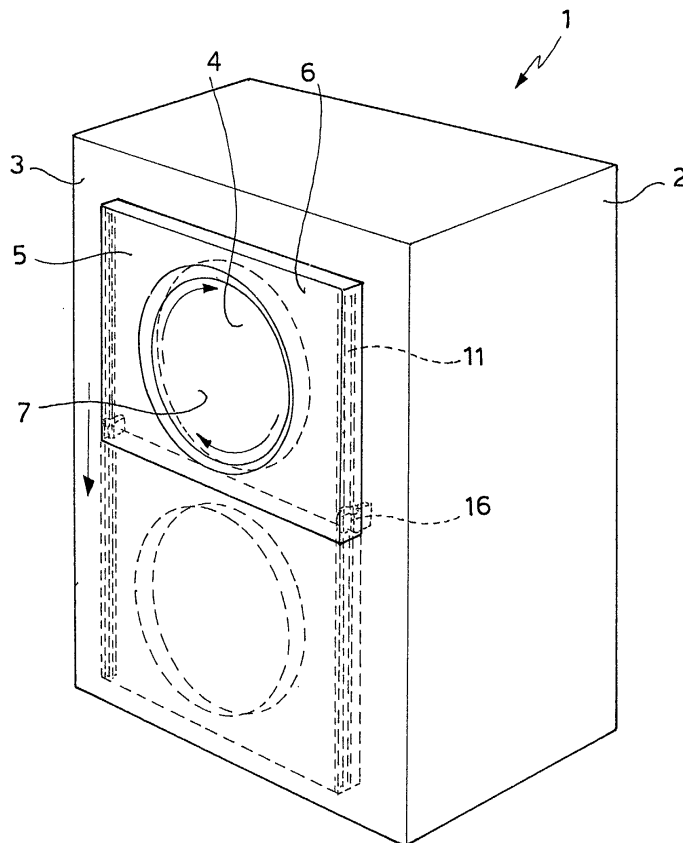
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**(54) Improved door for washing machines and/or dryers**

(57) Door (5) of a washing machine or dryer (1), of the type comprising a supporting and containing structure (2) provided with a loading aperture (4), in which the said door (5) comprises a frame (6) with connecting means (11, 16) for the movable connection of the door

(5) to the supporting structure (2), and a sealing portion (7) for interacting with the said loading aperture (4) to cover it, in which the sealing portion (7) is connected to the frame (6) in such a way that it can be adjusted by retraction and extension.



**FIG.1**

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## Description

**[0001]** The present invention relates to an improved door for washing machines and/or dryers, particularly those of the front-loading type.

**[0002]** There is a known type of door for washing machines and/or dryers, which comprises a rigid frame having movable connecting members, for example hinge sockets or corresponding pins, for the articulated connection of the door to the supporting and containing structure. The frame also acts as a mounting for an inspection window or porthole, allowing visual inspection of the progress of events inside the washing machine during its operation.

**[0003]** While the front face of the door of a washing machine forms part of the outer surface of the appliance, its rear face is designed to interact with the edges of the loading aperture of the washing machine in order to seal this aperture. The said rear face therefore usually has a sealing portion, formed in such a way that it adheres well to the surfaces of the edges of the loading aperture, which are commonly fitted with flexible seals.

**[0004]** To ensure a watertight contact between the sealing portion of the door and the edges of the loading aperture, the sealing portion usually has a convex or rounded truncated conical shape, such that it widens from its tip towards the base and therefore towards the frame of the door.

**[0005]** During the closing of the loading aperture of a washing machine, the sealing portion of the door is partially inserted into the loading aperture and, as a result of the gradual widening of its profile, it adheres with a specified radial pressure to the edges of the aperture or to the flexible seals, thus ensuring a watertight sealing of the washing machine.

**[0006]** However, the doors according to the prior art have certain drawbacks and disadvantages.

**[0007]** The dimensions of the sealing portion which are necessary in order to ensure a watertight sealing of the loading aperture cause the overall dimensions of the door, and consequently the washing machine itself, to be very large, particularly when the door is in the open position.

**[0008]** Furthermore, because of the asymmetry of the opening and closing movement of the door with respect to the loading aperture of the appliance, both the sealing portion and the edges and seals of the loading aperture are stressed in a non-uniform way, and become compressed and worn, causing a loss of watertightness and undesired leaks.

**[0009]** The object of the present invention is therefore to propose a door for an improved washing machine and/or dryer, having characteristics such that the problems mentioned with reference to the prior art can be overcome.

**[0010]** These and other objects are achieved by means of a door according to Claim 1, a washing machine and/or dryer according to Claim 13, and a method

of washing and/or drying according to Claim 17.

**[0011]** To enable the invention to be understood more clearly, a description of some embodiments of the invention is given below, by way of example and without restrictive intent, these embodiments being illustrated in the attached drawings, in which:

Figure 1 is a perspective view of a washing machine with a door according to the invention;

Figure 2 is a front view of an embodiment of the door of Figure 1, in a retracted configuration;

Figure 3 is a view of the door of Figure 2, seen in section along the line III-III;

Figure 4 is a front view of the door of Figure 1, in an extended configuration;

Figure 5 is a view of the door of Figure 4, seen in section along the line V-V;

Figure 6 is a side view of a detail of the door of Figure 4;

Figures 7 to 9 are sectional views of further embodiments of the door according to the invention;

Figure 10 shows, in a sectional side view, a front panel of a washing machine, fitted with a door according to the invention, in the closed configuration with the sealing portion extended and retracted;

Figure 11 shows, in a sectional side view, the front panel of Figure 10, in which the door is in the open configuration.

**[0012]** With reference to Figure 1, a washing machine is indicated as a whole by the number 1. The said washing machine 1 comprises a supporting and containing structure 2, whose front panel 3 is provided with a loading aperture 4 for loading and unloading the laundry to be washed.

**[0013]** In the detailed description of the invention, reference will be made to a door for a washing machine, but the invention is also applicable in an equally advantageous way to drying machines and washer-dryers.

**[0014]** The front panel 3 of the washing machine 1, or more generally the panel containing the said loading aperture 4, is provided with a door 5, comprising a frame 6 and a sealing portion 7, for interacting with the said loading aperture 4 in order to seal it. The door 5 is connectable to the supporting and containing structure 2, and particularly to the said panel containing the loading aperture 4, by movable connecting means, preferably hinge or sliding means.

**[0015]** In the embodiment shown in Figure 1, the movable connection between the door 5 and the front panel 3 is made in the form of sliding guides 11, provided in the vicinity of two opposite sides of the frame 6, on its side facing the washing machine 1, and corresponding fixed sliding means, for example rollers 16, located on the said front panel 3 and capable of making the door 5 slide in a direction essentially parallel to the front panel 3 from a closed position, in which the door 5 covers the loading aperture 4, to an open position, in which the

loading aperture 4 is completely free and accessible.

**[0016]** According to the invention, the sealing portion 7 of the door 5 is connected to the frame 6 in such a way that it can be adjusted by retraction and extension, advantageously, but not necessarily, in a direction essentially perpendicular to a plane defined by the frame 6.

**[0017]** In a preferred embodiment, the sealing portion 7 moves in a direction essentially perpendicular to the plane of the loading aperture 4, when the door 5 is in the closed position.

**[0018]** Advantageously, the sealing portion 7 is connected to the frame 6 by cam means or by threaded or bayonet means which hold the sealing portion 7 in the frame 6 and which also provide the said movement of extension and retraction of the sealing portion 7, for example by means of the rotation of the said sealing portion 7.

**[0019]** Figures 2 to 6 show an embodiment of the invention in which the frame 6 comprises at least one, but preferably two ramps 8, which form inclined surfaces with respect to the plane defined by the frame 6 and which preferably, but not necessarily, extend in the proximity of the outer circumference of the sealing portion 7, thus providing support and guide means for at least one, but preferably two, cams 9 fixed integrally to or, advantageously, made in one piece with the sealing portion 7 in opposing positions on its outer circumference.

**[0020]** The aforesaid ramps 8 and cams 9 form a connection between the frame 6 and the sealing portion 7, which permits the rotational and translational adjustment of the sealing portion 7, which can be carried out by actuating means which are preferably but not necessarily integral with the said sealing portion 7.

**[0021]** In the embodiment shown in Figure 2, the said actuating means comprise handle elements 10, positioned on the front face of the door 5 and operable manually by a user. In a further embodiment, the said actuating means comprise one or more cam elements located on the inner face of the door 5 and operable automatically, for example by additional cam elements of the washing machine 1.

**[0022]** Advantageously, the sealing portion 7 has an axially symmetrical shape with a double curvature, forming an outer surface essentially in the form of a rounded truncated cone, with a concave central area, as seen from the inner face of the door 5. This configuration of the sealing portion 7 is particularly suitable for ensuring a high degree of watertightness, while allowing the maximum space for laundry within the washing machine 1.

**[0023]** As shown, for example, in Figure 6, the cams 9, formed along the outer circumference of the sealing portion 7, have an inclination matching the inclination of the ramps 8, to ensure that they bear on them in a uniform way along the whole of their surfaces.

**[0024]** Figures 2 and 3 show the sealing portion 7 in the retracted configuration, and Figures 4 and 5 show the said sealing portion 7, after a rotation of approximately 90°, in the extended configuration.

**[0025]** Clearly, the arrangement of the ramps 8 and the cams 9 can be reversed. In particular, the ramps 8 can be formed along a circumference of the sealing portion 7, bearing on at least one, but preferably two or more, cams 9 of the frame 6. In a further embodiment, a single ramp 8 associated with the sealing portion 7 interacts with a single ramp associated with the frame 6, in which the ramp of the frame 6 replaces the said cams 9.

**[0026]** As shown in the figures, the sealing portion 7 is located in an essentially central aperture of the frame 6 and has at least one transparent area to form an inspection window. More advantageously, the whole sealing portion 7 can be made from a transparent material, for example glass or plastic, thus forming an inspection porthole.

**[0027]** Figure 7 shows a further embodiment of the door according to the invention, in which the frame 6 comprises a central aperture provided with a first internal thread 12, interacting with a second outer thread 13 of the sealing portion 7 to form the said connection which permits a movement of rotational and translational adjustment of the sealing portion 7 with respect to the frame 6, or more precisely a movement of the sealing portion 7 similar to that of a screw.

**[0028]** Figures 8 and 9 show a further development of the invention, in which an actuating element, more precisely a ring 14, is associated with the frame 6 by rotatable connecting means, for example circular sliding guides 15 or threads. In turn, the said actuating ring 14 has the aforesaid first thread 12 interacting with the second thread 13 of the sealing portion 7 to form a connection which enables the sealing portion 7 to be adjusted in a translational way without any rotation with respect to the frame 6, by means of a rotary movement of the actuating ring 14. Any rotation of the sealing portion 7 is prevented by suitable stop means, not shown in the figures, for example bearing surfaces formed both on the frame 6 and on the sealing portion 7. Clearly, the actuating ring 14 can be actuated manually by means of handle elements 10, or automatically, for example by means of cam elements, as described above.

**[0029]** The door 5 shown in the figures has a frame 6 of essentially rectangular shape. This advantageously enables the movable connecting means, for example the sliding guides for connection between the door and the supporting and containing structure, to be covered. Clearly, the overall shape of the door 5, and therefore of the frame 6, can be varied according to the requirements for its use, and according to the external shape of the appliance on which it is fitted. For example, the frame 6 can have an essentially circular shape in front view, so that, if the sealing portion is circular, the frame 6 can be made in the form of a ring with an essentially constant thickness.

**[0030]** With reference to Figures 10 and 11, the door 5 is fitted, with the use of sliding means, on the supporting structure 2, and in particular on the front panel 3, of

the washing machine 1. Advantageously, the said sliding means comprise rollers 16 associated with the supporting structure 2 in fixed positions and slidable within sliding guides 11 of the door 5, or more precisely of the frame 6. This enables the door 5 to slide in a direction essentially parallel to the front panel 3 between a closed position (Fig. 10), in which the door covers the loading aperture 4, and an open position (Fig. 11), in which the loading aperture 4 is completely free and accessible.

**[0031]** The operation of the door 5 according to the invention will now be described.

**[0032]** When the door 5 is in the closed position, the sealing portion 7 can be extended, by manual or automatic actuation, to seal the loading aperture 4 in a watertight way, for example by adhering to a flexible seal 18.

**[0033]** In relation to the above, it should be noted that the extension and retraction movement of the sealing portion 7 can be adjusted manually or automatically, thus making it possible to adjust both the radial pressure on the seal 18 and the depth of insertion of the sealing portion 7 into the laundry compartment, in order to vary for example its volume and internal surface.

**[0034]** After or during the execution of a washing or drying programme, the sealing portion 7 can be retracted to allow the aeration of the laundry and to increase the volume of the laundry compartment, while the door itself remains closed.

**[0035]** In order to open the door 5, the sealing portion 7 is fully retracted, thus releasing the loading aperture 4 and reducing the overall dimensions of the door 5 in the direction of the supporting structure 2, and in particular in the direction of the front panel 3, to a sufficient extent to enable the door 5 to be moved to its open position without any initial movement away from the loading aperture 4. The door 5 is closed in a similar way, without any auxiliary movement towards the aperture 4.

**[0036]** In a particularly advantageous embodiment, the sealing portion is adjusted automatically by the use of the actuating means described above. The said actuating means are advantageously controlled by a control unit, in accordance with the specified washing and/or drying programme and other parameters which can be selected by the user.

**[0037]** Stop means can advantageously be provided to set the ends of the sliding travel of the door 5 and the movement of the sealing portion 7, these means including elastic locking or stop means, advantageously of the snap type, which hold the sealing portion 7 and/or the door 5 by snap-locking in specified positions.

**[0038]** As an alternative to the sliding system for the door 5 described herein, it is also possible to provide systems of the telescopic or lever type or combined systems, as described for example in patent application EP02425058.1, filed on 05.02.2002, and in EP02425324.7, filed on 22.05.2002, the content of which is to be considered as incorporated herein.

**[0039]** The door 5 according to the invention also pro-

vides considerable improvements in the methods of washing and/or drying laundry by means of a washing machine, dryer or washer-dryer.

**[0040]** This is because the door 5 enables washing procedures of the following types to be carried out automatically or by manual intervention:

- inserting the laundry to be washed and/or dried through the loading aperture 4 into the drum or containing compartment of the washing machine or dryer;
- covering the loading aperture 4 with the door 5;
- extending the sealing portion 7 of the door 5 to provide a watertight closure of the loading aperture 4;
- executing a programme for washing and/or drying laundry;
- retracting the sealing portion 7 of the door 5 to open the loading aperture 4 and aerate the laundry, while the door 5 remains closed;
- continuing the programme for washing and/or drying the laundry if necessary;
- adjusting the position of the sealing portion 7 of the closed door 5 to vary the volume of the laundry compartment.

**[0041]** A door according to the invention has numerous advantages.

**[0042]** The door, and consequently the appliance to which it is fitted, have smaller overall dimensions, regardless of the position of the door, and are therefore particularly suitable for domestic use.

**[0043]** The door according to the invention provides a sealing movement which is absolutely symmetrical with respect to the loading aperture, thus minimizing the compression and wear of the seals while increasing the watertightness of the sealing of the loading aperture.

**[0044]** Since it is possible to retract the sealing portion from the loading aperture, while the door itself remains in the closed position, the door according to the invention enables the internal space of a washing machine and/or dryer to be aerated in safe conditions while maintaining a more pleasing appearance.

**[0045]** The door according to the invention is also perfectly suited to the requirements for its use. During closing, the sealing portion is extended from the door to seal the loading aperture. During opening, on the other hand, the said sealing portion is retracted so that it does not impede in any way the opening movement of the door. This advantageously enables sliding door closing systems to be used without auxiliary movements of the door towards or away from the loading aperture.

**[0046]** The door according to the invention is suitable both for use as a conventional door, in other words one hinged to the front panel of the appliance, and as a sliding door.

**[0047]** A washing machine with a sliding door according to the invention has numerous advantages.

**[0048]** In the first place, hot, sharp or wet structural

parts are never exposed, and therefore the risk of accidents is minimized.

**[0049]** Hot surfaces and those wetted by washing liquids are never exposed, but always face the appliance itself and are therefore practically inaccessible to the user and to others, for example children.

**[0050]** Because of the absence of auxiliary movements of the door away from the loading aperture, the door sliding mechanism is very simple, robust, and reliable, and can be actuated by automatic actuators, for example electric motors, controlled by a control unit in accordance with the set washing and/or drying programme.

**[0051]** Clearly, a person skilled in the art can, in order to meet contingent and specific requirements, make further modifications to and variations of the door and the washing machine or dryer according to the invention, all such modifications and variations being included in the scope of protection of the invention as defined in the following claims.

## Claims

1. Door (5) of a washing machine and/or dryer (1), comprising a frame (6) with connecting means (11, 16) for movable connection to a supporting and containing structure (2) of the said machine (1), together with a sealing portion (7) for interacting with a loading aperture (4) provided in the said supporting and containing structure (2), **characterized in that** the sealing portion (7) is connected to the frame (6) of the door (5) in such a way that it can be adjusted by retraction and extension for the adjustment of its position with respect to the said aperture (4).
2. Door (5) according to Claim 1, comprising cam means (8, 9) or threaded means (12, 13) or bayonet means for forming the said connection for the adjustment of the sealing portion (7) by retraction or extension.
3. Door (5) according to Claim 1 or 2, in which the frame (6) comprises at least one or more ramps (8) which form inclined surfaces with respect to a plane defined by the frame (6), thus forming support and guide means for one or more cams (9) of the sealing portion (7) to permit a movement of the sealing portion (7) similar to that of a screw.
4. Door (5) according to Claim 2, in which the frame (6) comprises first threaded means (12), interacting with second threaded means (13) of the sealing portion (7) to permit a movement of the sealing portion (7) similar to that of a screw.
5. Door according to Claim 1 or 2, comprising an actuating ring (14), associated with the frame (6) by sliding connecting means (15) and having first threaded means (12) interacting with second threaded means (13) of the sealing portion (7) which is prevented from rotating, to enable the sealing portion (7) to be adjusted in a translational way by the rotation of the actuating ring (14).
6. Door (5) according to any one of the preceding claims, in which the frame (6) has an essentially central aperture and the sealing portion (7) is located in the said central aperture.
7. Door (5) according to any one of the preceding claims, in which the sealing portion (7) has a transparent area to form an inspection window.
8. Door (5) according to Claim 6, in which the sealing portion (7) is made from a transparent material, preferably glass or plastic.
9. Door (5) according to any one of the preceding claims, in which the frame (6) has an essentially rectangular shape in front view.
10. Door (5) according to any one of Claims 1 to 8, in which the frame (6) has an essentially circular shape in front view.
11. Door (5) according to any one of the preceding claims, in which the sealing portion (7) has an essentially circular shape in front view.
12. Door (5) according to any one of the preceding claims, in which the connecting means for the movable connection of the door (5) to the supporting structure (2) comprise hinge means.
13. Door (5) according to any one of the preceding claims, in which the connecting means for the movable connection of the door (5) to the supporting structure (2) comprise sliding means (11, 16).
14. Washing machine (1) or dryer, comprising a supporting and containing structure (2) provided with a loading aperture (4), **characterized in that** it comprises a door (5) according to any one of the preceding claims.
15. Machine according to Claim 14, comprising actuating means for actuating the adjustment of the position of the sealing portion (7) of the door (5), when the door (5) is in the closed position, to provide the said extending sealing movement and retracting opening movement of the sealing portion (7).
16. Machine according to Claim 15, in which the said actuating means are controlled by a control unit in accordance with the washing and/or drying pro-

gramme.

17. Method of washing and/or drying laundry by means of a machine according to one of Claims 14 to 16, comprising the following steps:

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- inserting the laundry to be washed and/or dried through the loading aperture (4) into a containing compartment of the washing machine and/or dryer (1);
- covering the loading aperture (4) with the door (5);
- extending the sealing portion (7) of the door (5) to provide a watertight closure of the loading aperture (4);
- executing a programme for washing and/or drying the laundry,

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**characterized in that** it comprises a step of retracting the sealing portion (7) of the door (5) to open the loading aperture (4) and aerate the laundry, while the door (5) remains closed.

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18. Method according to Claim 17, comprising the step of adjusting the position of the sealing portion (7) of the door (5) to vary the volume of the laundry compartment.

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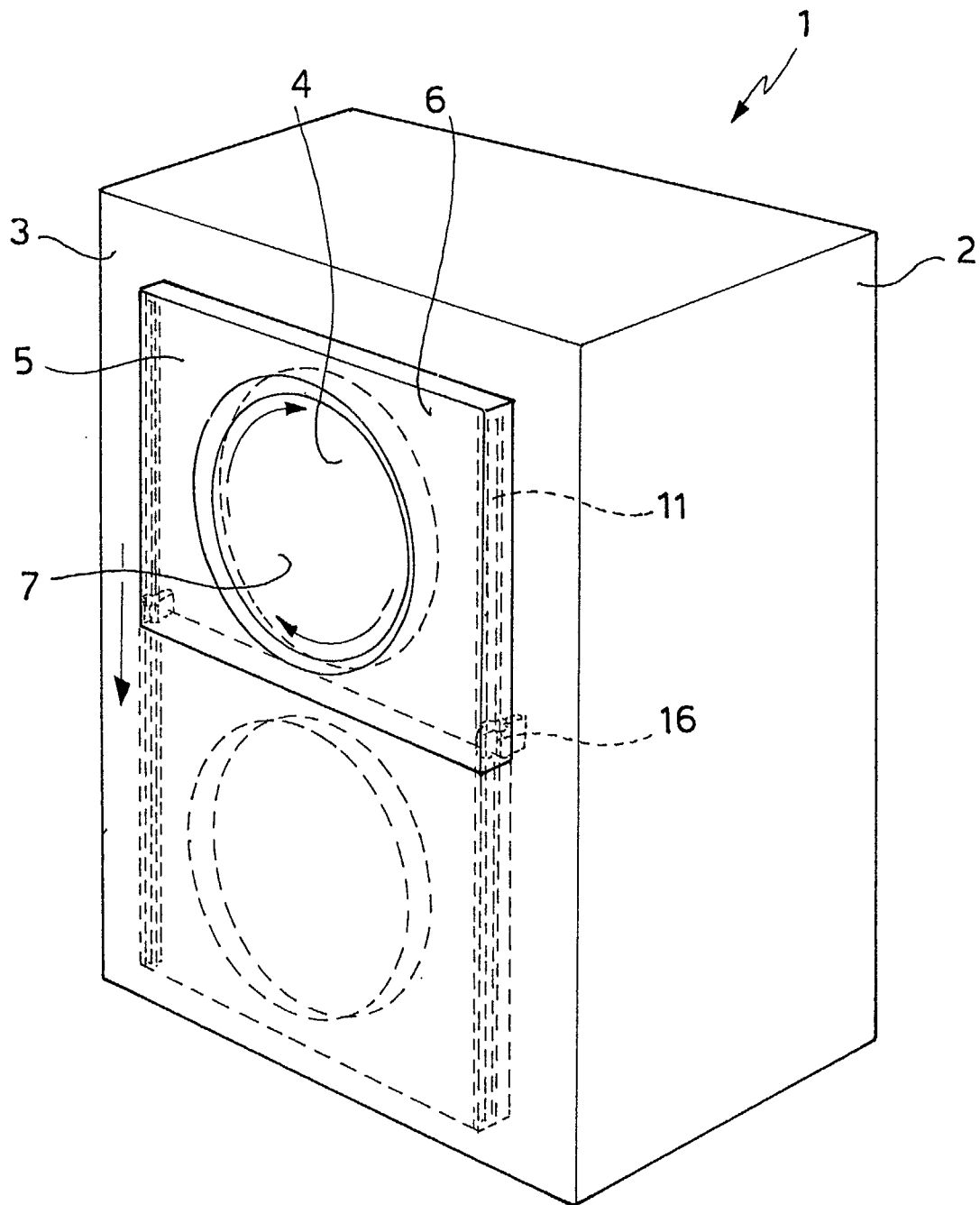
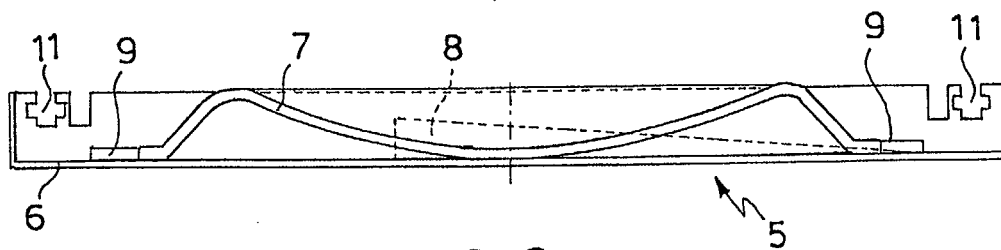
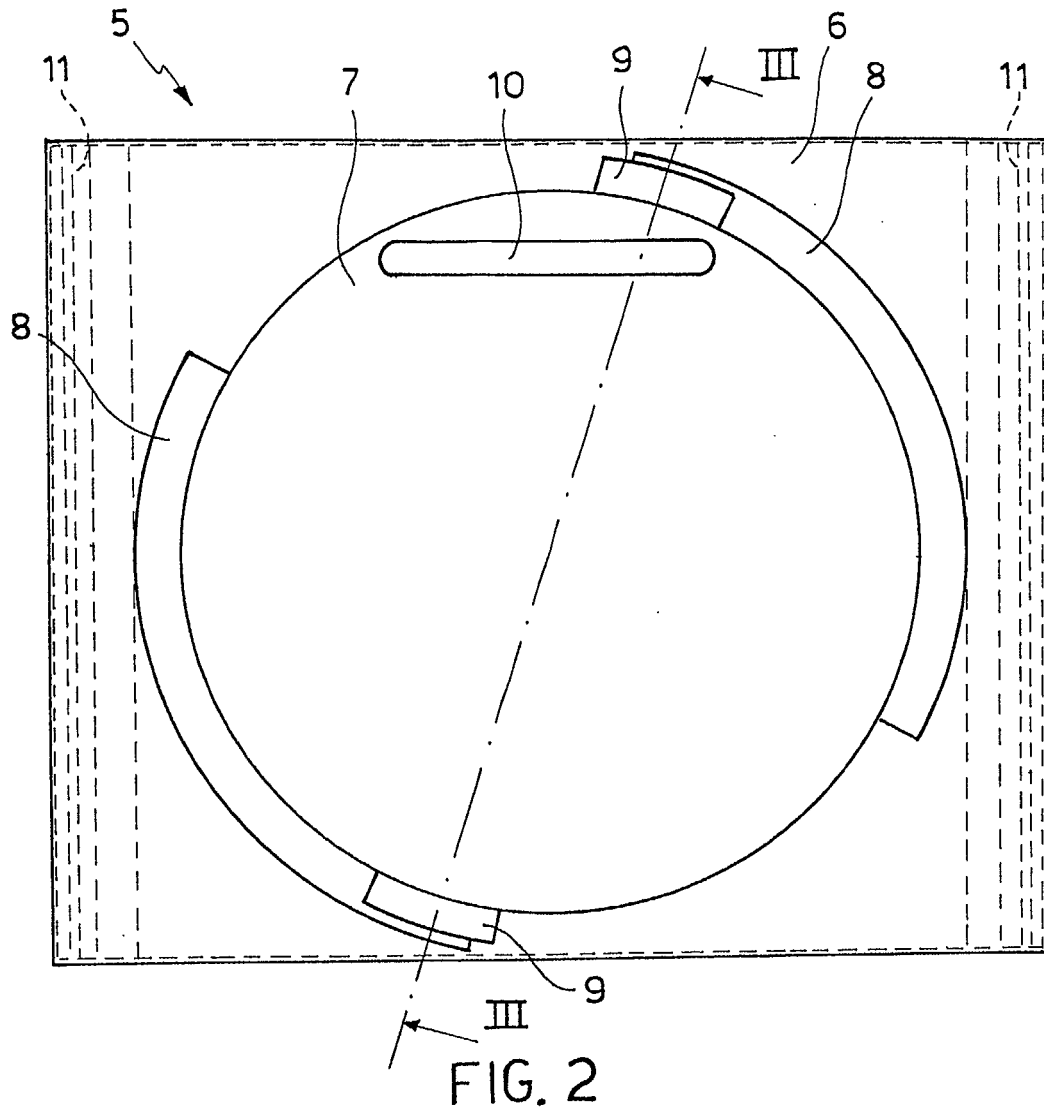


FIG.1





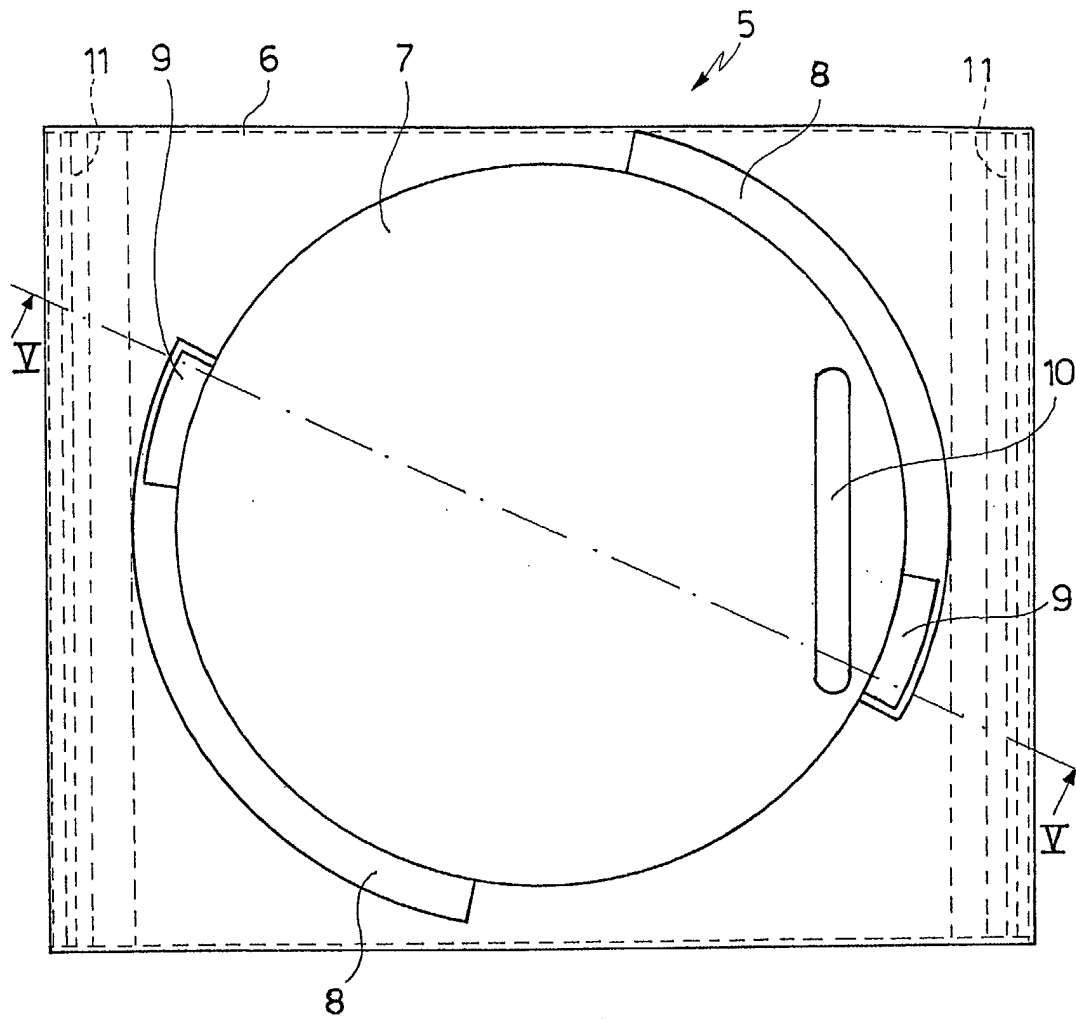


FIG. 4

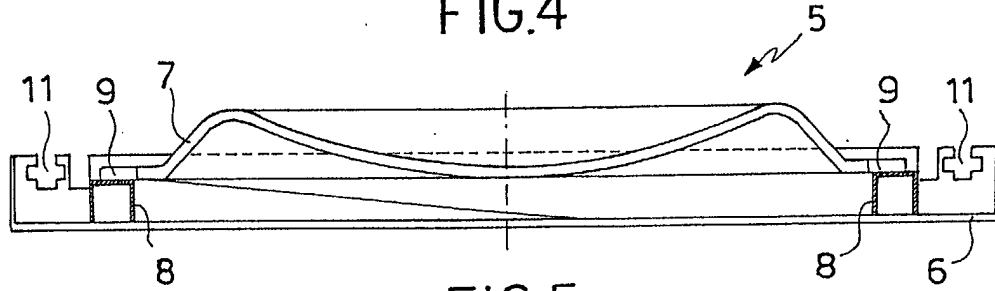


FIG. 5

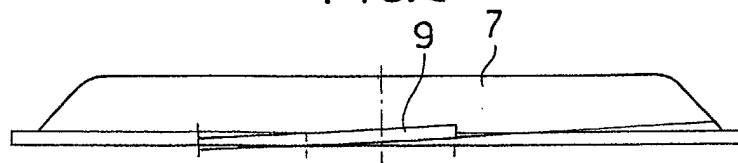


FIG. 6

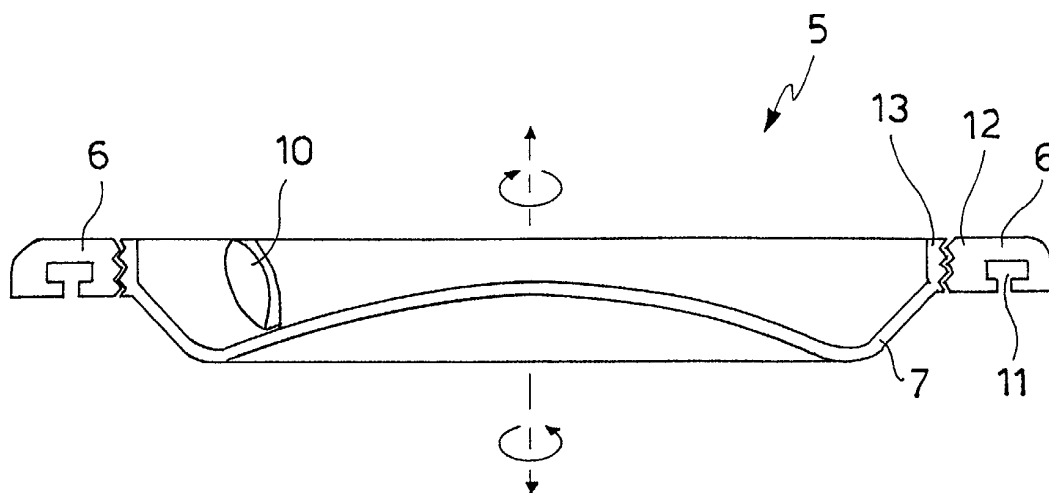


FIG. 7

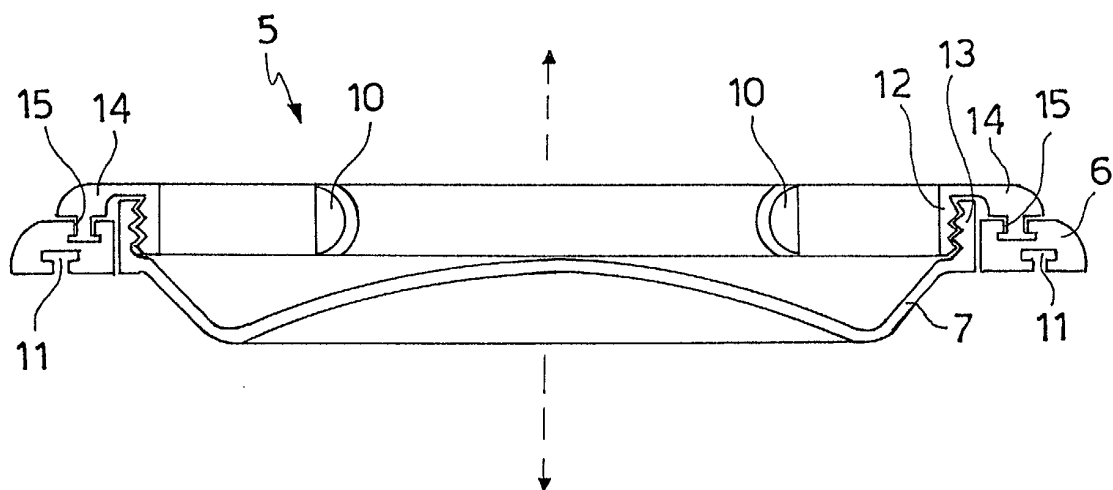


FIG. 8

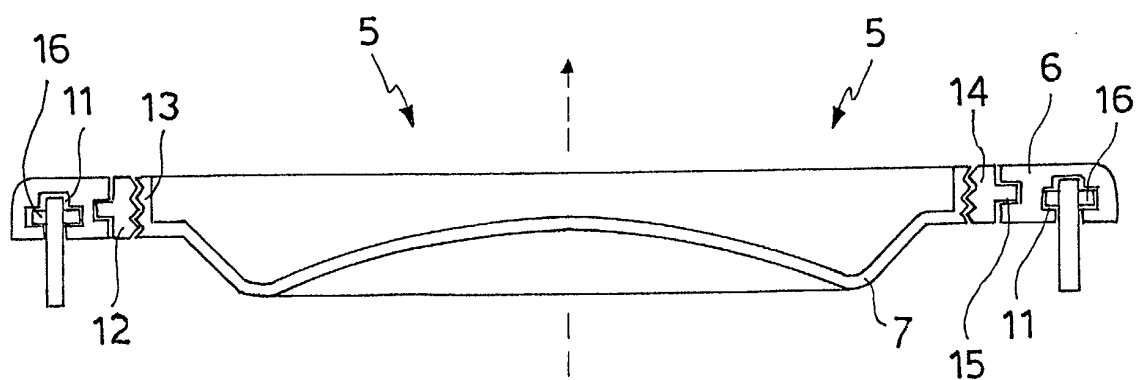


FIG. 9

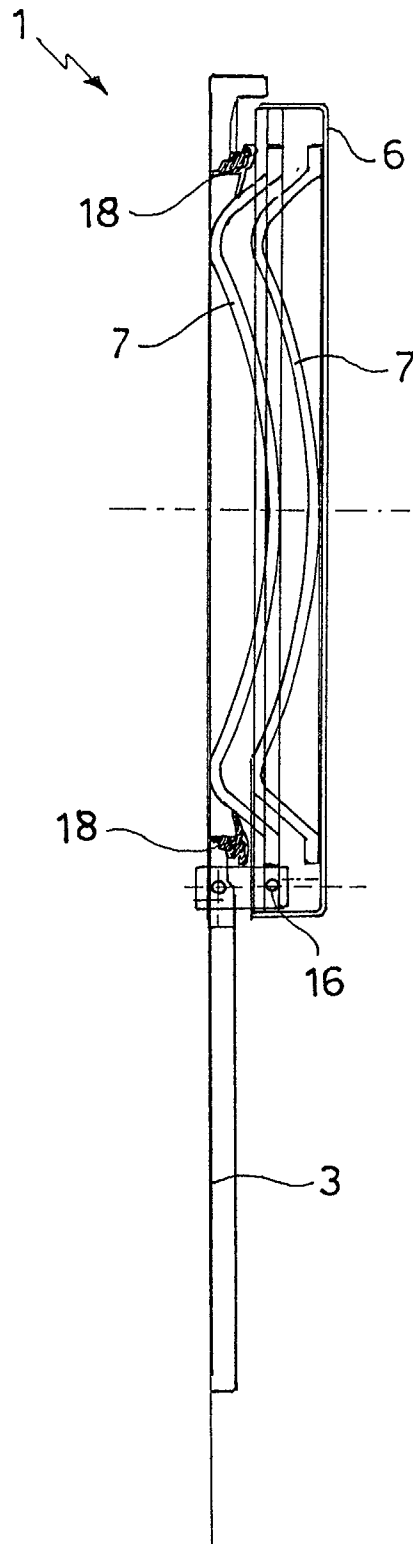


FIG. 10

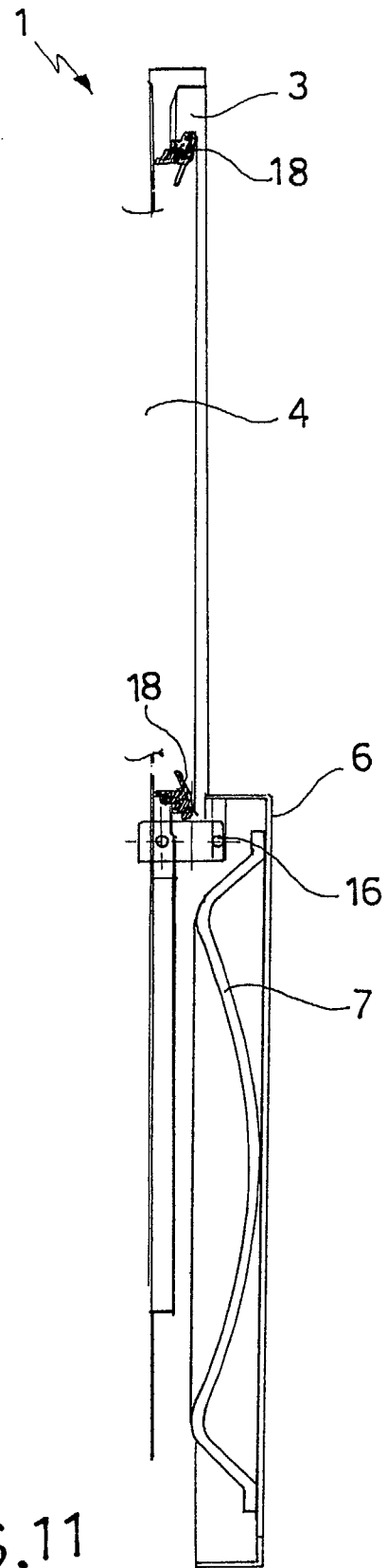


FIG. 11



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| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                      |                                                            |                                                     |
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| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                      |                                                            |                                                     |
| Place of search<br><b>THE HAGUE</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                      | Date of completion of the search<br><b>29 October 2002</b> | Examiner<br><b>Norman, P</b>                        |
| <p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone<br/>Y : particularly relevant if combined with another document of the same category<br/>A : technological background<br/>O : non-written disclosure<br/>P : intermediate document</p> <p>T : theory or principle underlying the invention<br/>E : earlier patent document, but published on, or after the filing date<br/>D : document cited in the application<br/>L : document cited for other reasons<br/>&amp; : member of the same patent family, corresponding document</p> |                                                                                                                                                                                                                      |                                                            |                                                     |

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**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. The members are as contained in the European Patent Office EDP file on  
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