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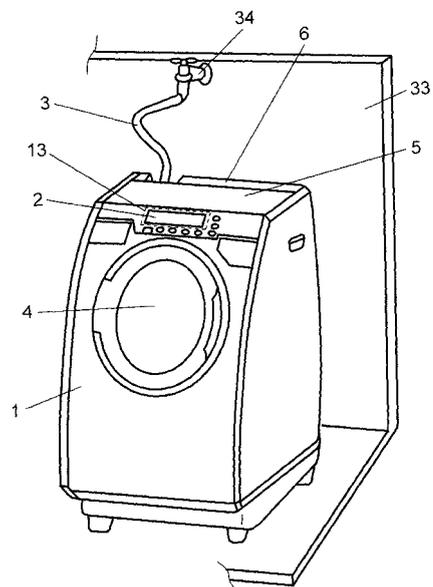
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(54) **Washing Machine**

(57) A washing machine includes a controller for controlling at least the steps of washing, rinsing, and dehydrating, a speaker (25) for receiving an audio signal supplied from the controller (13) and sounding a voice, an external frame of the washing machine, a front panel placed in the external frame (1) at front and having small openings; and a top plate (5) for covering a top section of the external frame (1). The front panel includes therein: a case (30), whose sectional view shows like a letter "L", having a top opening and a lateral opening on both its ends, and a diaphragm of the speaker (25) mounted at the top opening with its face orienting downward, a speaker mounting case for covering the speaker, and a slit cover held between the lateral opening and the front panel. The lateral opening is placed directing toward the small openings (9).

FIG. 1



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## Description

### FIELD OF THE INVENTION

[0001] The present invention relates to a washing machine announcing an operational guide or a warning to a user with voice.

### BACKGROUND OF THE INVENTION

[0002] A washing machine that is capable of announcing an operation guide or a warning to a user with voice has been proposed years ago. This kind of conventional washing machine includes a speaker in a side-panel compartment which is formed of a side panel mounted to and covering a lateral face of a laundry loading inlet formed on a top plate of the washing machine. The top plate covers the top section of an external frame of the washing machine. This structure is detailed hereinafter with reference to Fig. 6 - Fig. 9.

[0003] Fig. 6 shows a partially cut-away perspective view of a conventional washing machine disclosed in Unexamined Japanese Patent Publication No. 2002 - 11274. Top plate 9 having lid 20 is mounted to external frame 1 at the top of the washing machine. Top plate 9 includes operating section 11 at front and resonating box 35 rigidly mounted in side-panel compartment 37 at the left side. Resonating box 35 includes a speaker therein.

[0004] Fig. 7 shows a perspective view of the top plate with the side panel decomposed for illustrating how the speaker is mounted in the side panel. Resonating box 35 having a speaker built therein is mounted to a top face of left lateral face 5 of top plate 9 such that resonating box 35 can be accommodated in side-panel compartment 37. Brim 35e of resonating box 35 is screwed down to a mounting seat of top plate 9, whereby box 35 is mounted to top plate 9.

[0005] Fig. 8 shows a perspective view enlarging the side panel of the conventional washing machine. A vertical lateral face of side panel 36 has a hook engaging hole 36a to which a draining hose is hooked. Grille 35a of resonating box 35 is placed as close as possible to hook engaging hole 36a in order to produce a greater sound of the voice from speaker 25.

[0006] Fig. 9 shows an exploded perspective view of the speaker and the resonating box of the conventional washing machine. Box 35 includes a grille at front so that the grille confronts a diaphragm of the speaker, and is formed of front enclosure 35b open back and rear enclosure 35d open front. Rear enclosure 35d includes speaker retainer 35c standing inward on its rear wall.

[0007] Speaker 25 is built in resonating box 35 as shown in Fig. 9, and placed inside side-panel box 37 as shown in Fig. 7. Box 37 is formed inside side-panel 36 which is mounted such that it covers a lateral face of laundry loading inlet 5a formed on top plate 9.

[0008] As discussed above, speaker 25 is protected from humidity and water by resonating box 35, and yet,

sounds the voice efficiently through hook-engaging hole 36a, formed on side-panel 36, to the outside of the washing machine.

[0009] However, the voice announcing mechanism discussed above of the conventional washing machine needs to place hook-engaging hole 36a and grille 35a on a line as straight as possible, and also as close as possible to each other, or to enlarge the size of hook-engaging hole 36a in order to sound the voice to the outside as efficiently as possible. On the other hand, when a user cleans off the exterior of the washing machine with a wet towel, water sometimes enters into the interior of the washing machine through hook-engaging hole 36a. In such a case, a placement of speaker grille 35a and hook-engaging hole 36a on a line more alike the straight line and the placement thereof closer to each other will incur grater adverse effect to the electronic component, i.e. speaker 25, in terms of water-proof and humidity-proof characteristics. The structure discussed above thus makes the reliability of the conventional washing machine yet insufficient.

[0010] Such a small hole as the hook-engaging hole tempts a user to insert his/her finger or a small stick thereto, which sometimes damages speaker 25 through grille 35a.

### SUMMARY OF THE INVENTION

[0011] A washing machine of the present invention comprises the following elements:

- a controller for controlling at least the steps of washing, rinsing, and dehydrating;
- a speaker to which an audio signal is supplied from the controller;
- an external frame of the washing machine;
- a front panel disposed at the front of the external frame and including a small opening; and
- a top plate for covering a top section of the external frame.

A case, whose sectional view shows like letter "L", is mounted inside the front panel. This case includes a top opening and a lateral opening on its both ends. A diaphragm of the speaker is mounted to this top opening with its face orienting downward. A speaker mounting case for covering the speaker is mounted also to this top opening. A cover having slits (slit cover) is held between the lateral opening and the front panel, so that the lateral opening is placed directing toward the small openings.

[0012] According to the foregoing structure, the speaker and its diaphragm are covered with the case, whose sectional view shows like a letter "L", and the speaker mounting case, so that the speaker and its diaphragm never touch water directly. The structure also allows the diaphragm (cone paper), which sounds a voice, not to face directly toward the outside of the washing machine, so that the diaphragm never invites damages from the

outside. As a result, the speaker can be free from adversary effects to the humidity proof or the water proof characteristics, so that a reliable washing machine free from damages from the outside is obtainable.

## BRIEF DESCRIPTION OF THE DRAWING

### [0013]

Fig. 1 shows an external perspective view of a washing machine in accordance with an embodiment of the present invention.

Fig. 2 shows an external perspective view of the washing machine in parts viewed from the front and a detailed drawing of a particular part.

Fig. 3 shows a block diagram of a control circuit of the washing machine.

Fig. 4 shows a sectional view of a front panel in parts for illustrating a method of mounting a speaker to the washing machine.

Fig. 5 shows a sectional view illustrating a part of the speaker to detail its mounted state to the washing machine.

Fig. 6 shows a perspective view partially cut-away of a conventional washing machine.

Fig. 7 shows a perspective view of a top plate whose side panel is discomposed for illustrating how a speaker is mounted to the conventional washing machine.

Fig. 8 shows a perspective view enlarging the side panel of the conventional washing machine.

Fig. 9 shows an exploded perspective view of a speaker and a resonating box of the conventional washing machine.

## PREFERRED EMBODIMENT OF THE INVENTION

[0014] An exemplary embodiment of the present invention is demonstrated hereinafter with reference to the accompanying drawings. Similar elements to those of the conventional product discussed hereinbefore have the same reference marks, and the detailed descriptions thereof are omitted here. The present invention is not limited to this exemplary embodiment.

### Exemplary Embodiment

[0015] Fig. 1 shows an external perspective view of a washing machine in accordance with this embodiment of the present invention. Top plate 5 is mounted to a top section of external frame 1 of a washing machine, and lid 4 is mounted at the front of the washing machine. Front panel 2, where operating switches and a display for indicating an operating status are disposed, is placed on the upper front of external frame 1. Water supplying hose 3 for supplying the water to the washing machine is mounted to the washing machine behind the top plate 5. Hose 3 is coupled to a faucet provided to, e.g. wall 33 of

the house.

[0016] A user of the washing machine loads/unloads the laundry through lid 4 into/from the washing machine, and inputs an operating signal to controller 13 through front panel 2, then monitors the operating status and the set conditions of the washing machine on front panel 2. At this time, the washing machine notifies the user of the operating guidance and remarks with voice, so that fewer errors in operation can be expected and the washing machine becomes more user-friendly.

[0017] Fig. 2 shows a perspective view of the washing machine in parts viewed from the front and a detailed drawing of a particular part. Front panel 2 placed at the front of top plate 5 includes speaker 25 to which audio signals are supplied from controller 13. Speaker 25 sounds voices forward of the washing machine through small openings 9 formed on front panel 2.

[0018] The planar disposition of speaker 25 and others is this: Speaker mounting case 27 to which speaker 25 is mounted is rigidly mounted to case 30 behind speaker 25, i.e. from the top of the detailed drawing in Fig. 2. Case 30 shows like letter "L" in its sectional view, and is screwed down (with screws 7) inside front panel 2 with its lateral opening 32 confronting small openings 9 of front panel 2.

[0019] Fig. 3 shows a block diagram of a control circuit of the washing machine in accordance with this embodiment. Controller 13 of the control circuit is mainly formed of microprocessor 14 incorporating a peripheral circuit such as a memory and input/output circuits. Controller 13 senses an input supplied from input device 15 such as input switch 15a, and transmits the input to load controller 16 as well as displays the input status and the progress of washing steps on display device 17. Load controller 16 controls a series of washing steps such as washing, rinsing, dehydrating and so on, and also controls the power to be fed into driving device 18 such as motor 18a according to signals supplied from controller 13.

[0020] Voice announcing device 19 reads voice data stored in voice ROM 21 built in microprocessor 14 of controller 13, and takes out the voice data, having undergone D/A converter 22, as analog signals, which then undergoes low-pass filter (LPF) 23 for shaping the waveform. The signals then are input to amplifier (AMP) 24, and then converted into a sound wave by speaker 25.

[0021] The voice announcement includes a guide of washing steps, advice on operation, notifying a user of an abnormality and so on, in order to make the washing machine more convenient for the user.

[0022] Fig. 4 shows a sectional view of the front panel in parts for illustrating a method of mounting the speaker to the washing machine. The method of mounting speaker 25 to the washing machine is demonstrated hereinafter. In Fig. 4, case 30 includes top opening 31 placed upper right, and lateral opening 32 placed on the left side, and its sectional view shows like a letter "L". This case 30 allows speaker 25 to be placed at top opening 31 such

that diaphragm 26 (cone paper) orients toward lower-left. Speaker mounting case 27 covers speaker 25 from the upper right, and is screwed down around top opening 31 with screws 10.

**[0023]** Next, mounting of speaker 25 to speaker mounting case 27 is described hereinafter. Fig. 5 shows a sectional view in parts of the speaker to detail its mounted state to the washing machine in accordance with this embodiment. Case 27 shows like a letter "U", and is placed such that its opening, i.e. the top of letter "U", orients toward lower-left. Speaker 25 is mounted to the opening such that its diaphragm 26 (cone paper) orients downward. Case 27 is molded of, e.g. resin, and unitarily molded with stopper 29 shaped like a letter "L" at its perimeter. An outer perimeter of speaker 25 is mounted to this "L" shaped stopper 29. Another outer perimeter of speaker 25 is mounted to elastic projection 28 shaped like a letter "L" and formed oppositely to stopper 29 about 180 degrees. The elasticity of projection 28 is used for mounting this another outer perimeter of speaker 25 to projection 28.

**[0024]** The mechanism discussed above allows mounting speaker 25 to case 27, and then speaker 25 is fixed with screws 10 to case 27 from the outside of top opening 31 as shown in Fig. 4. Speaker 25 is thus held approx. at right angles with respect to front panel 2 as shown in Fig. 4. As a result, diaphragm 26 slants to approx. 90 degrees with respect to case 30 showing a letter "L" in its sectional view.

**[0025]** Cover 8 is sandwiched between perimeter 32a of lateral opening 32 and cylindrical rib 2a so that cover 8 can be mounted to lateral opening 32 of case 30. Cover 8 includes multiple slits 8a, and rib 2a is unitarily molded with front panel 2 at inside panel 2 and around small opening 9.

**[0026]** In order to simplify the mounting of cover 8 and ensure the mounting position for cover 8, outer wall 8b of cover 8 is made cylindrical so that outer wall 8b can be inserted inside cylindrical rib 2a of front panel 2. Then lateral opening 32 as a grille, small openings 9 of front panel 2, and slits 8a of cover 8 (referred to as slit cover 8) are arranged so that they can be placed on one plane. Thus, a voice is not prevented and orients forward of the washing machine.

**[0027]** Slit cover 8 includes cut-away section 40 at its lower end. To be more specific, cut-away section 40 is placed corresponding to air-space 41 formed between cylindrical rib 2a and perimeter 32a of lateral opening 32, so that air-space 41 can drain the water entered through small openings 9.

**[0028]** Between case 30 and cover 8 including slits 8a, protective sheet 39 is placed such that the outer wall of cover 8 and perimeter 32a of lateral opening 32 sandwich sheet 39 for preventing the water from entering into case 30. Protective sheet 39 is formed by providing, e.g. felt material, with a water-proof process or a water repellent process, so that the air can run through sheet 39 with no resistance, but a drop of water cannot run through.

**[0029]** Operation of the washing machine having the structure discussed above is demonstrated hereinafter. As shown in Fig. 4, speaker 25 sounds audio from its diaphragm 26 (cone paper), and the audio is resonated and thus becomes loud during its travel along the inside of case 30 as indicated by arrow mark A before it is transmitted outside the washing machine.

**[0030]** Since speaker 25 is mounted to top opening 31 located at the upper right of case 30, diaphragm 26 slants to 90 degrees with respect to lateral opening 32 and is placed upward of lateral opening 32. Lateral opening 32 is covered with cover 8 including slits 8a which prevents external foreign substances from entering through opening 32. Therefore even if water or something sharp enters through small openings 9 formed on front panel 2, they can least approach to speaker 25.

**[0031]** Front panel 2 having small openings 9 functioning as a speaker grille is placed at the front of the washing machine. The size of opening 9 is reduced; however, the number of openings 9 is increased in response to a sound volume necessary for users, so that it is difficult to insert a finger or a sharp stick into openings 9. On top of that, the presence of slit cover 8 can prevent powder such as detergent from entering into case 30.

**[0032]** As discussed above, the washing machine in accordance with this embodiment includes diaphragm 26 which is placed not to face the outside directly, so that speaker 25 is free from the worry about being damaged from the outside. Placement of speaker 25 at the front of the washing machine allows obtaining a necessary sound pressure with ease at the front regardless of the surrounding environment of the washing machine installed, so that a smaller speaker can be used.

**[0033]** On top of that, case 30 showing a letter "L" in its sectional view provides an air space between lateral opening 32 and cover 8 having slits 8a (slit cover 8) for placing protective sheet 39 in the air space. Protective sheet 39 positively receives the water or detergent entering through small openings 9 formed on front panel 2, so that the water or detergent can be prevented utterly from entering into case 30. As a result, speaker 25 does not need a water-proof structure, and since protective sheet 39 employs a special sheet that allows the air to pass through with no resistance but blocks liquid to pass through, so that a voice announcement free from the reduction in sound pressure can be achieved.

**[0034]** Lateral opening 32 provided to case 30 and cut-away section 40 provided to the lower end of cover 8 having slits 8a allow the liquid which has entered through small openings 9 formed on front panel 2 to flow out smoothly. The liquid entering thus cannot muffle or damp the voice of announcement, and the electric members including the speaker invite no degradation in insulation. As a result, a stable voice announcement can be expected.

**[0035]** Cylindrical rib 2a is unitarily molded with front panel 2 around small openings 9 and inside front panel 2, and slit cover 8 has outer wall 8b shaped like a cylinder

so that outer wall 8b can be inserted inside rib 2a. This structure allows front panel 2 to be airtight, so that the voice travels inside case 30 cannot leak out. The voice can be sounded through small openings 9 formed on front panel 2, so that even a small speaker can serve sufficiently for this application. 5

**[0036]** The voice announcing structure of the washing machine of the present invention places the speaker at front as near as possible to a user so that the user can hear the announcement with ease. The structure allows prohibiting the water or foreign matters entering from the outside of the washing machine from reaching to the speaker, and a downsized speaker can maintain a sufficient sound pressure for the voice announcement. 10

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## Claims

1. A washing machine comprising: 20

a controller for controlling at least steps of washing, rinsing, and dehydrating;  
 a speaker for receiving an audio signal supplied from the controller and sounding a voice;  
 an external frame of the washing machine; 25  
 a front panel disposed in the external frame at its front and having a small opening; and  
 a top plate for covering a top section of the external frame,  
 wherein the front panel includes thereinside: 30

a case, whose sectional view shows like a letter "L", having a top opening and a lateral opening on both ends;  
 a diaphragm of the speaker mounted to the top opening such that the diaphragm orients downward; 35  
 a speaker mounting case for covering the speaker;  
 a slit cover held between the lateral opening and the front panel, 40

wherein the lateral opening is placed directing toward the small opening. 45

2. The washing machine of claim 1, wherein the case, whose sectional view shows like a letter "L", includes an air space between the lateral opening and the slit cover, and a protective sheet is disposed in the air space for preventing water from entering. 50

3. The washing machine as defined in claim 1 or claim 2, wherein the slit cover includes a cut-away section at its lower end for draining water entering through the small opening. 55

4. The washing machine as defined in claim 1 or claim 2 further including a cylindrical rib disposed inside

the front panel and around the small opening, wherein an outer wall of the slit cover is inserted inside the rib.

FIG. 1

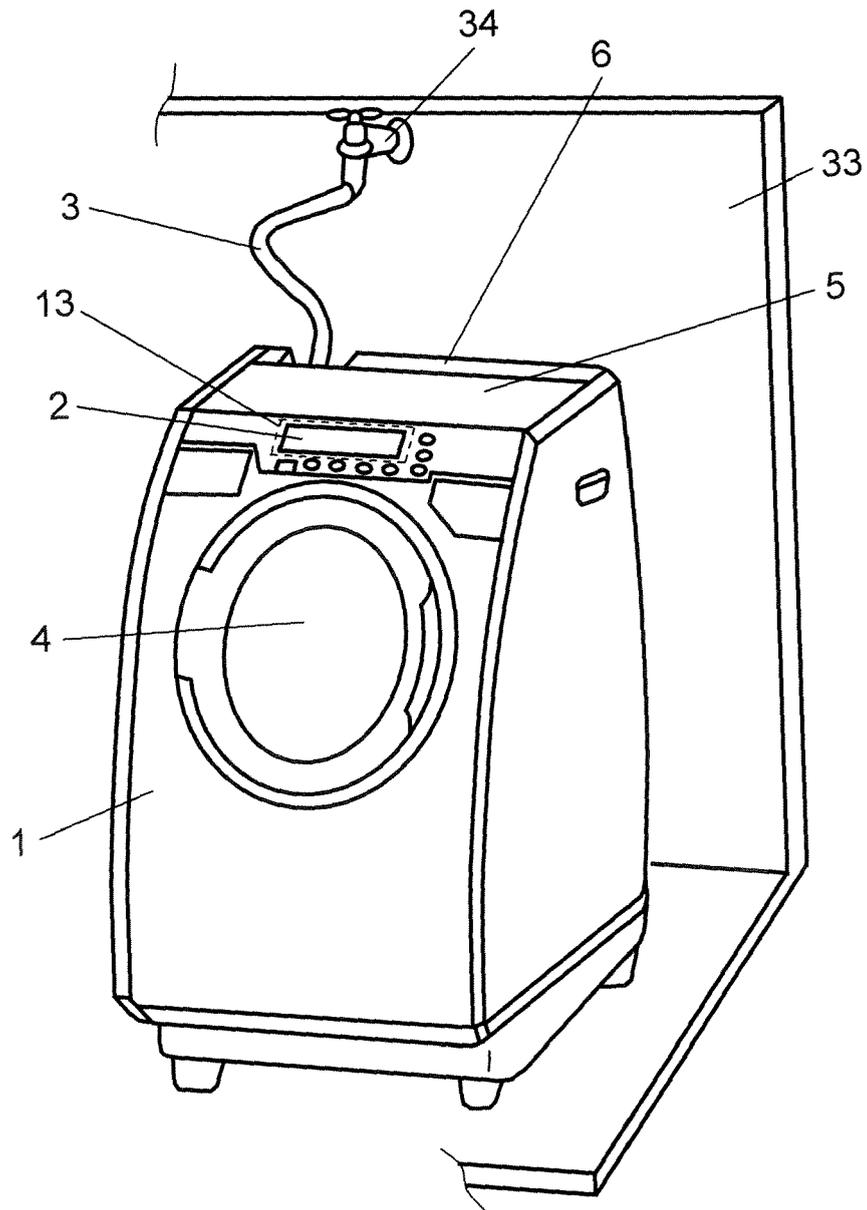


FIG. 2

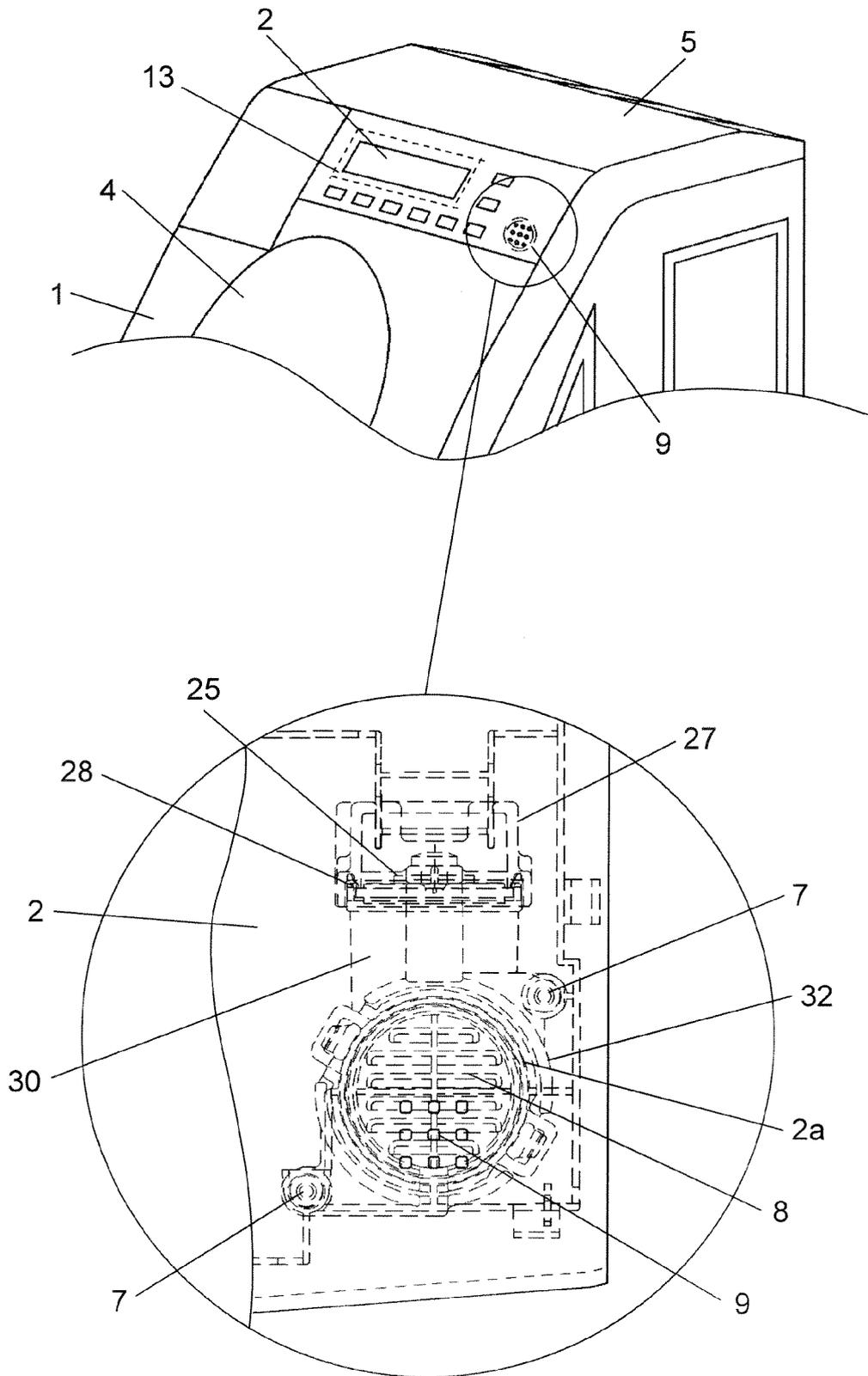


FIG. 3

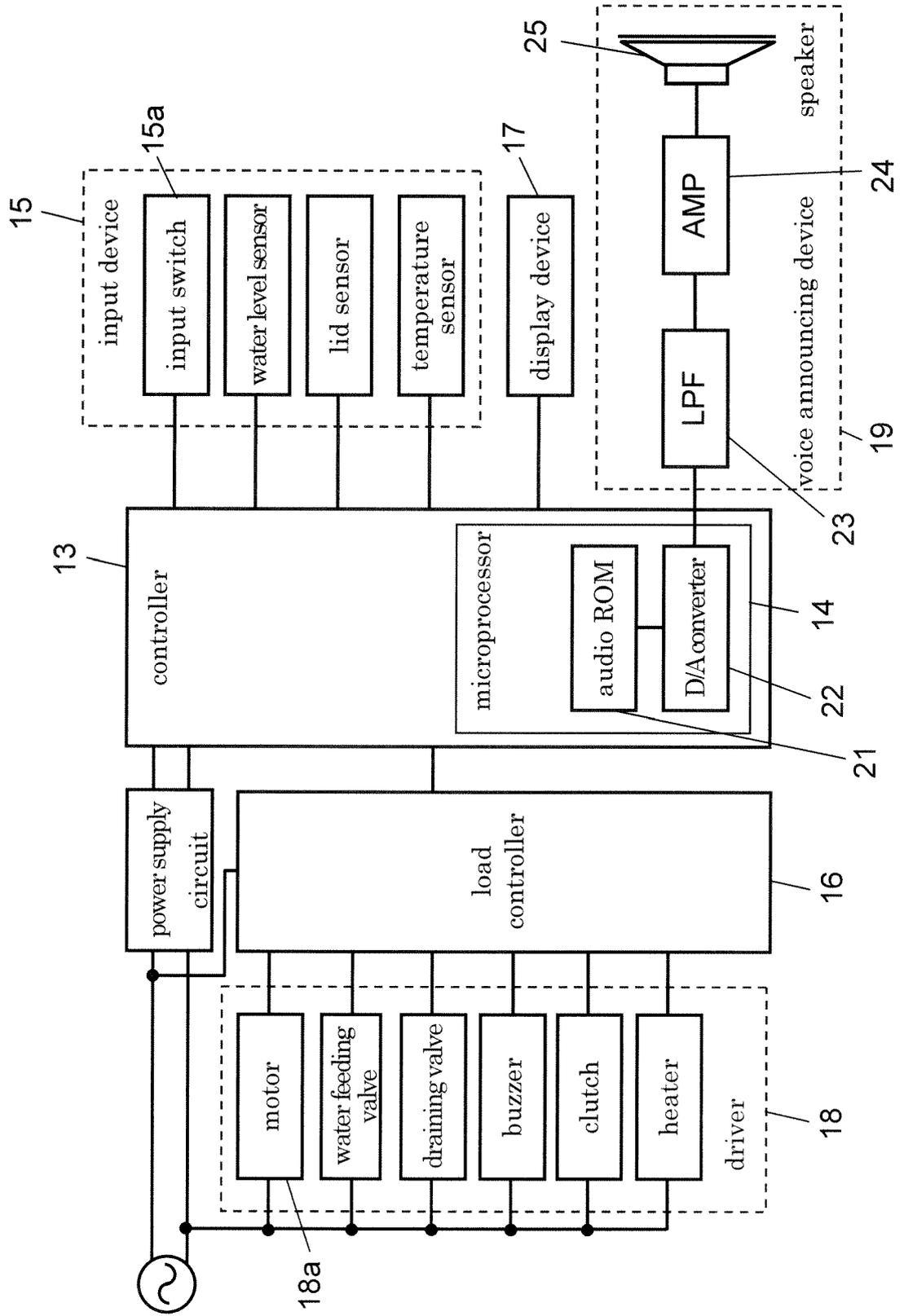


FIG. 4

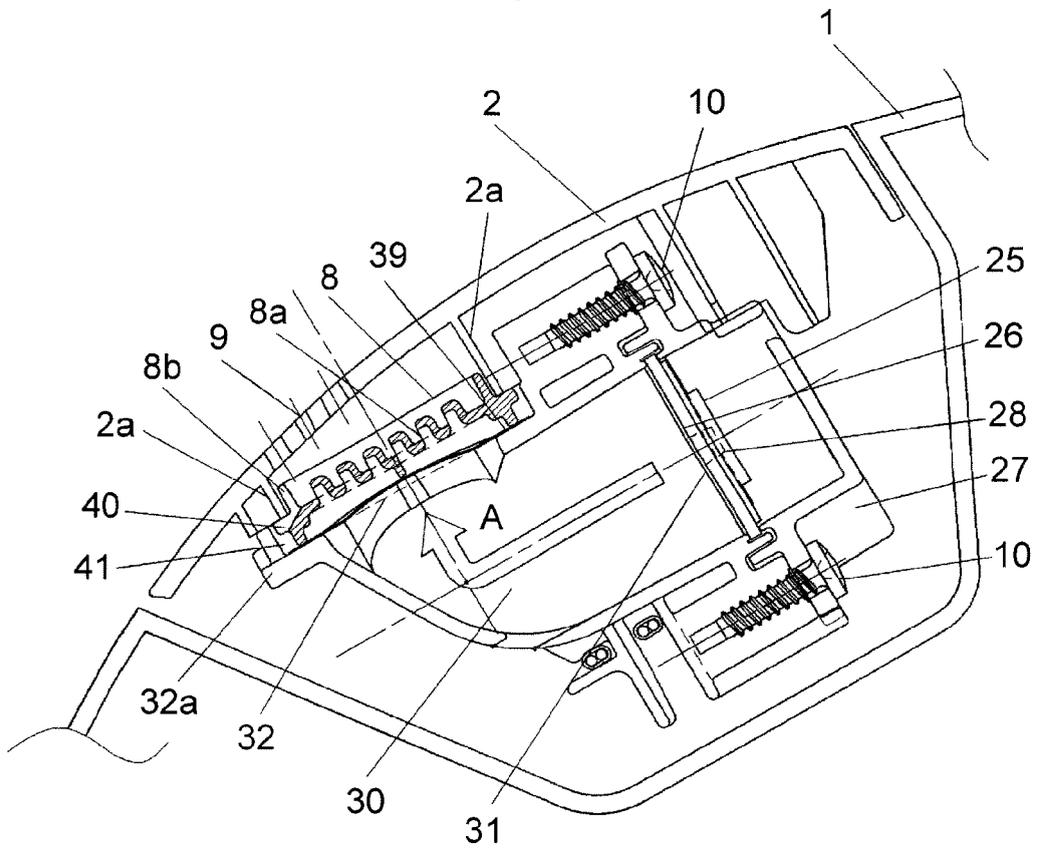


FIG. 5

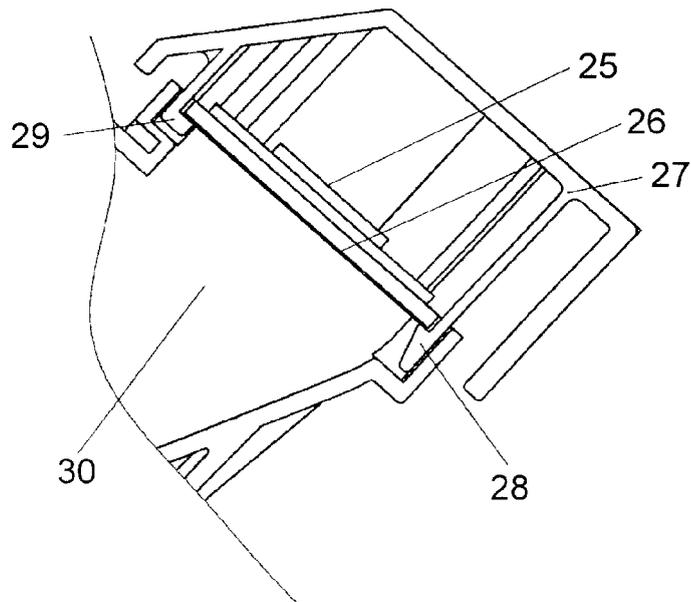


FIG. 6

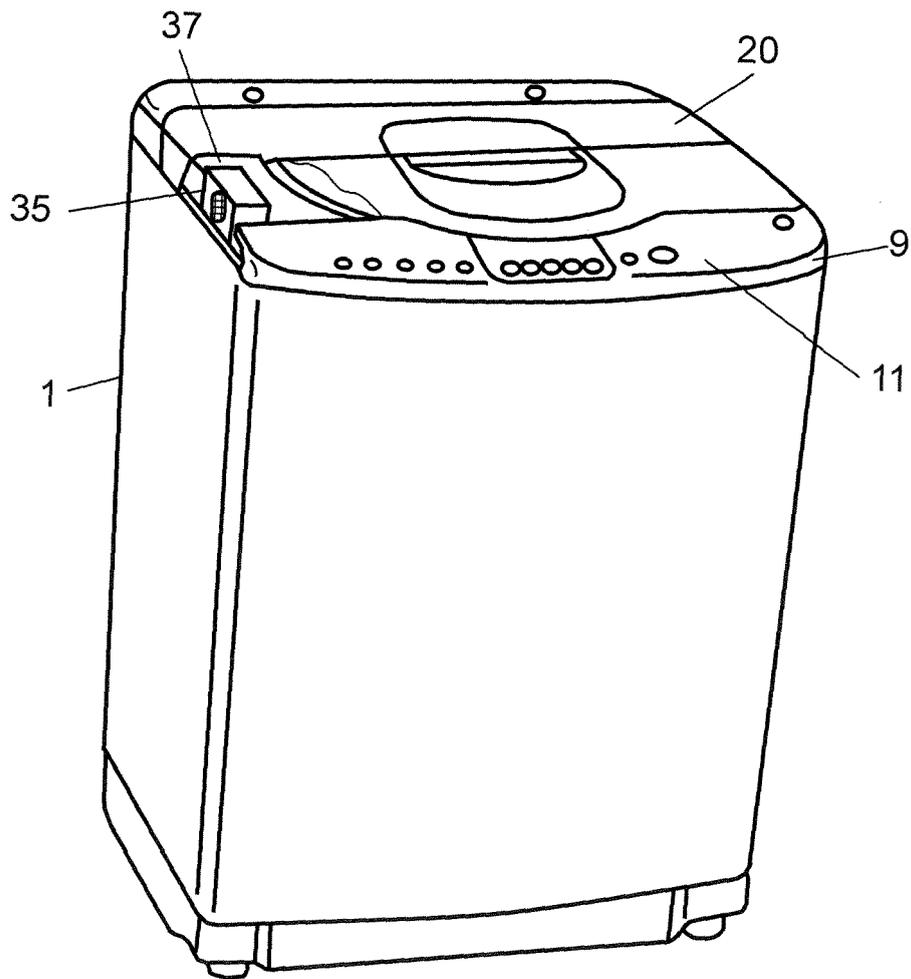


FIG. 7

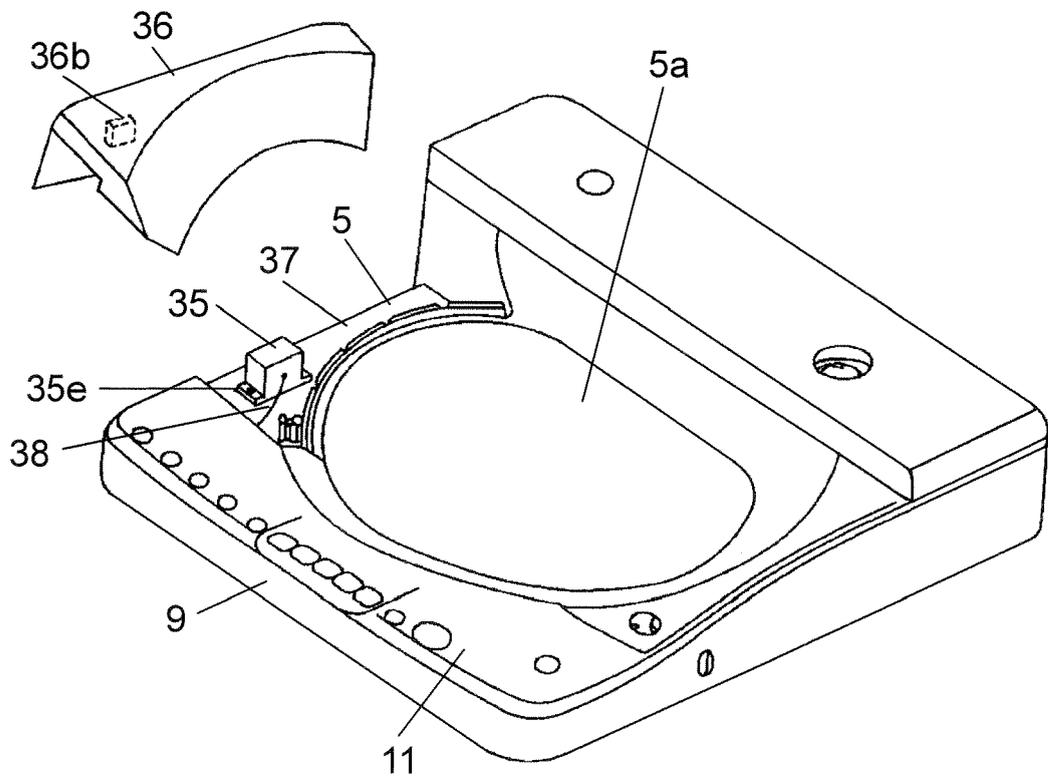


FIG. 8

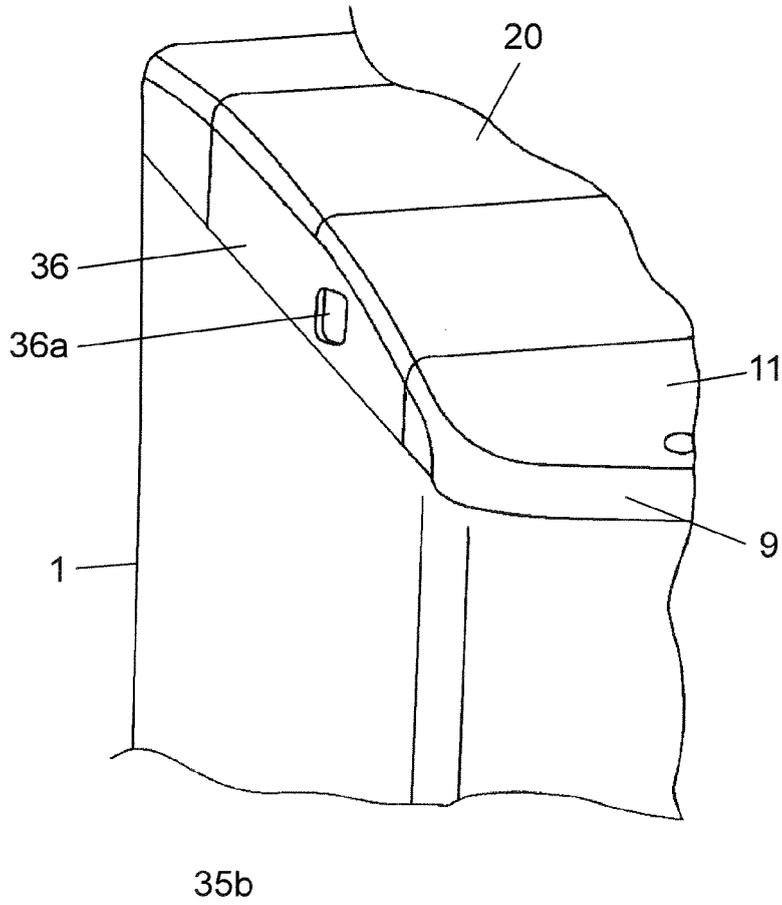
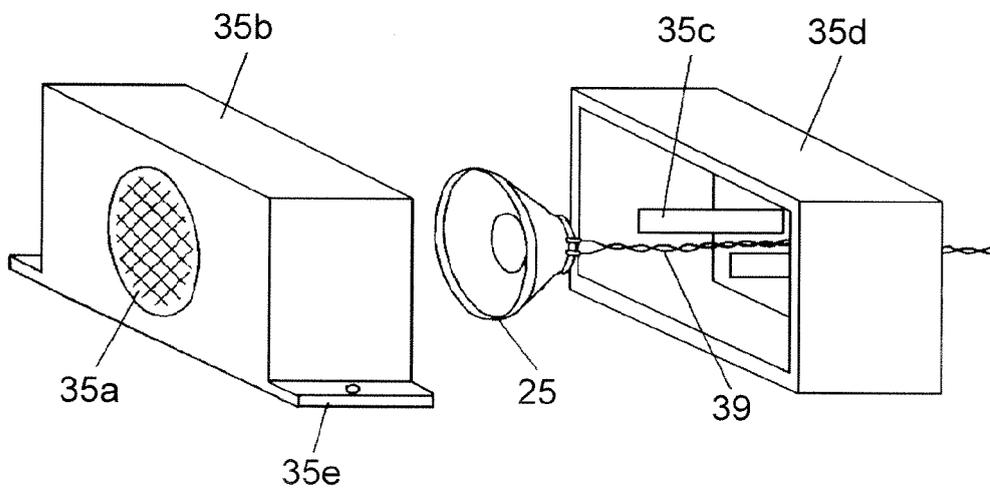


FIG. 9





EUROPEAN SEARCH REPORT

Application Number  
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			TECHNICAL FIELDS SEARCHED (IPC)
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The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
Munich		9 December 2008	Dupuis, Jean-Luc
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 03/02 (P04/C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT  
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EP 08 16 0729

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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