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(54) **Electronic control device for an electric household appliance with an access door**

(57) An electric household appliance (1) having a casing (2); an access door (5) fitted to the casing (2) to move between an open position and a closed position respectively opening and closing an opening (4) formed in the casing (2); an electronic switch (11) located along a power branch of the electric household appliance (1); and an electronic control device (6) in turn having a detecting module (12) for detecting a hazard condition corresponding to the access door (5) being opened during a power cut, or a safety condition corresponding to the access door (5) not being opened during the power cut, and a control module (13) for selectively disabling or enabling the electronic switch (11) upon detection of the hazard condition or the safety condition respectively.

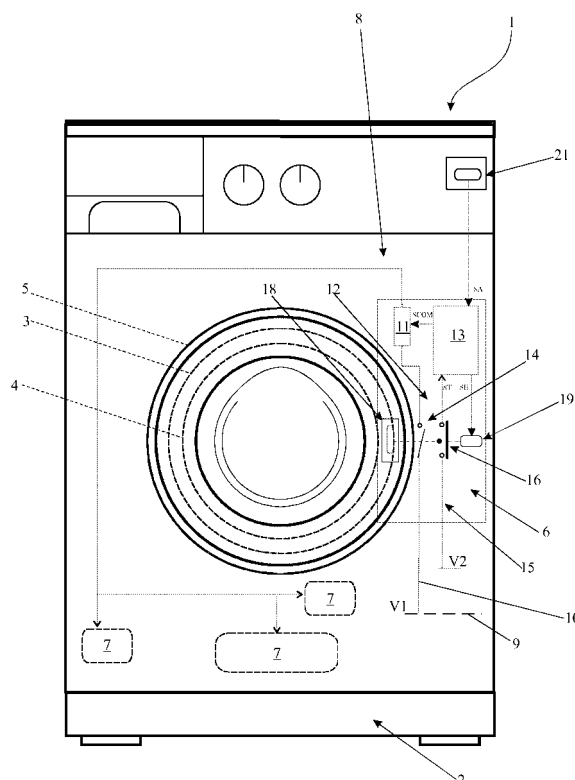


Fig. 1

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Description

[0001] The present invention relates to an electronic control device for an electric household appliance with an access door.

[0002] More specifically, the present invention relates to an electronic control device for use in an electric household appliance, such as a washing machine and/or drier or any similar household appliance, to disable operation of the appliance in the event electric power supply to the appliance is cut off; to which application the following description refers purely by way of example.

[0003] As is known, electric household appliances, particularly washing machines or driers, normally comprise a casing; a laundry drum housed inside the casing and communicating with the outside through a drum access opening formed in the casing; and an access door closing the opening.

[0004] In electric household appliances of the above type, opening the access door opens a safety switch in the main power supply circuit of the appliance, which cuts off power supply to stop the appliance; and, when the access door is closed, the main power supply circuit safety switch closes to power and so restart the appliance.

[0005] Appliances of the above type have the major drawback of restarting automatically when the access door is in the closed position closing the safety switch.

[0006] Though ensuring immediate stoppage of the appliance in the event the access door is inadvertently opened during a wash cycle, the main power supply circuit safety switch fails to provide for all-round safety. That is, during a power cut, the access door may be opened, thus allowing a child to climb into the laundry drum. In which case, accidental closure of the door closes the safety switch, thus enabling the appliance to restart automatically when power is restored, with obvious disastrous consequences to the child inside the drum.

[0007] It is an object of the present invention to provide an electric household appliance featuring an access door and an electronic control device designed to safeguard against the above hazard by preventing the appliance restarting automatically in the event the access door is opened during a power cut.

[0008] A non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a schematic front view of an electric household appliance featuring an electronic control device in accordance with the teachings of the present invention;

Figure 2 shows a schematic of the Figure 1 electronic control device.

[0009] Number 1 in Figure 1 indicates as a whole an electric household appliance substantially comprising a casing 2; a laundry drum 3 mounted inside casing 2 to hold a given amount of laundry, and directly facing a laun-

dry loading/unloading opening 4 formed in casing 2; and an access door 5 fitted to casing 2 to move, e.g. rotate, between an open position and a closed position opening and closing opening 4 respectively.

[0010] Electric household appliance 1 may be a drier or washing machine or any similar appliance, and comprises an electronic control device 6 for determining a hazard condition - corresponding to door 5 being opened when electric power supply to the appliance is cut off, i.e. during a power cut - or a safety condition - corresponding to door 5 not being opened during the power cut.

[0011] Electronic control device 6 is also designed to selectively disable or enable operation of appliance 1 upon detecting the hazard or safety condition respectively.

[0012] In the Figure 2 example, the appliance comprises various internal electric equipment 7, such as an electric motor, pumps, and various known electric devices; and a main power circuit 8 connecting internal electric equipment 7 to a main power source 9 comprising, for example, an electric line at a predetermined supply potential V1 of preferably, though not necessarily, about 230 V.

[0013] Main power circuit 8 comprises a power branch 10 connecting the external electric power source to electric equipment 7; an electronic switch 11 located along power branch 10, and which switches to off or on to respectively disconnect or connect appliance 1 to power source 9; and an electromechanical switch 14 located along power branch 10 and connected to door 5 to open and close when door 5 is moved into the open and closed position respectively.

[0014] More specifically, electronic switch 11 may preferably, though not necessarily, comprise a TRIAC which receives a control signal SCOM and, depending on control signal SCOM, switches to on or off to respectively enable or cut off electric power supply to electric equipment 7.

[0015] Control device 6 comprises a detecting module 12 for detecting the hazard or safety condition; and a control module 13 for selectively disabling or enabling electronic switch 11 on detecting the hazard or safety condition respectively.

[0016] With reference to Figure 2, detecting module 12 comprises an electric detecting branch 15 having a first terminal at a reference potential V2 of preferably, though not necessarily, about V2=5V; and a movable electric contact 16 located along electric detecting branch 15 and movable between a work position closing electric detecting branch 15 to set a second terminal to potential V3=V2, and a rest position opening electric detecting branch 15 to set the second terminal to potential V3=0V.

[0017] Detecting module 12 also comprises a mechanism 18, which cooperates with door 5 to move electric contact 16 mechanically from the work position to the rest position when door 5 is moved from the closed to the open position. More specifically, mechanism 18 is designed not to move electric contact 16 in any way when door 5 moves from the open to the closed position.

[0018] Detecting module 12 also comprises an electromagnetic device 19 which, when excited, generates a magnetic field to move electric contact 16 from the rest position, i.e. opening, to the work position, i.e. closing electric detecting branch 15.

[0019] In the example shown, electromagnetic device 19 may comprise a coil which receives an excitation signal SE to generate a magnetic field to move electric contact 16 from the rest to the work position.

[0020] Electric detecting branch 15 therefore generates at the second terminal a status signal ST indicating in code the hazard condition, when electric contact 16 is in the rest position corresponding to a zero potential V3, or the safety condition when electric contact 16 is in the work position corresponding to potential V3=V2.

[0021] Control module 13 comprises a microprocessor having a first input connected to the second terminal of electric detecting branch 15 to receive status signal ST; a second input receiving a priority enabling signal SA; a first output supplying control signal SCOM to electronic switch 11; and a second output supplying excitation signal SE to electromagnetic device 19.

[0022] In the example shown, when signal ST indicates the hazard condition, control module 13 generates control signal SCOM which disables electronic switch 11; and, when signal ST indicates the safety condition, control module 13 generates control signal SCOM to enable electronic switch 11.

[0023] Priority enabling signal SA may be generated by a control interface 21 on casing 2, to allow user consent to start appliance 1 after a power cut. In the Figure 2 example, control interface 21 comprises a button which is pressed by the user to supply priority enabling signal SA to the control module.

[0024] In the event of a power cut during a wash cycle of appliance 1, the following situations may arise.

[0025] If door 5 has remained closed throughout the power cut, electric contact 16 is in the work position, so electric detecting branch 15 generates status signal ST indicating the safety condition. When power is restored, control module 13, receiving status signal ST indicating the safety condition, therefore generates control signal SCOM to enable the TRIAC and so allow the appliance to continue the wash cycle interrupted by the power cut.

[0026] Conversely, if door 5 is opened during the power cut, mechanism 18 moves electric contact 16 from the work position to the rest position. At this stage, electromagnetic device 19, receiving no excitation signal from the control module, generates no magnetic field, so electric contact 16 remains in the rest position. Closure of door 5 produces no movement of electric contact 16, which therefore remains in the rest position, thus generating a status signal ST indicating the hazard condition.

[0027] When power is restored, control module 13 acquires the hazard condition indicated in status signal ST, and generates control signal SCOM to keep electronic switch 11 disabled and so cut off power supply to electric equipment 7. In which case, control module 13 keeps the

TRIAC and, hence, appliance 1 disabled, and remains on standby awaiting priority enabling signal SA from the user. The standby condition terminates when the user presses the button to generate priority enabling signal SA. More specifically, on receiving priority enabling signal SA, control module 13 enables the TRIAC to allow appliance 1 to start operating again, and at the same time supplies excitation signal SE to electromagnetic device 19 which moves electric contact 16 into the work position.

[0028] Electronic control device 6 described above has the advantage of eliminating the hazard posed by the appliance starting up automatically after a power cut during which the appliance door has been opened.

[0029] Clearly, changes may be made to the electronic control device as described herein without, however, departing from the scope of the present invention as defined in the accompanying Claims.

Claims

1. An electric household appliance (1) comprising a casing (2); a laundry drum (3) housed inside the casing (2) and facing an opening (4) formed in said casing (2); an access door (5) fitted to the casing (2) to move between an open position and a closed position opening and closing said opening (4) respectively; and electric power supply means comprising a power branch (10) connectable to an external electric power source (9) to power said electric household appliance (1), and electronic switching means (11) located along said power branch and which switch to off or on to respectively disconnect or connect the electric household appliance (1) to the power source (9);
said electric household appliance (1) being **characterized by** comprising an electronic control device (6) in turn comprising:

- detecting means (12) for detecting a hazard condition corresponding to said access door (5) being opened during a power cut in electric power supply to said electric household appliance (1) by said electric power source (9), or a safety condition corresponding to said access door (5) not being opened during said power cut; and
- electronic control means (13) for selectively disabling or enabling said electronic switching means (11) upon detection of said hazard condition or said safety condition respectively.

2. An electric household appliance as claimed in Claim 1, wherein said detecting means (12) comprise an electric contact (16) movable between a work position and a rest position; mechanical means (18) which cooperate with said access door (5) to move said electric contact (16) from said work position to said rest position when the access door (5) is moved

into said open position; and electromagnetic means (19) which generate a magnetic field to move said electric contact (16) into said work position.

3. An electric household appliance as claimed in Claim 2, wherein said electronic control means (13) disable said electronic switching means (11) when said electric contact (16) is in said rest position, or enable said electronic switching means (11) when said electric contact (16) is in said work position. 5
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4. An electric household appliance as claimed in any one of the foregoing Claims, and comprising interface means (21) on said casing (2) to allow a user to generate a priority enabling signal (SA) enabling operation of said electric household appliance (1); upon receiving said priority enabling signal (SA), said electronic control means (13) switching said electronic switching means (11) from off to on. 15
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5. An electric household appliance as claimed in Claim 4, wherein, upon receiving said priority enabling signal (SA), said electronic control means (13) command said electromagnetic means (19) to generate a magnetic field to move said electric contact (16) from said rest position to said work position. 25
6. An electric household appliance as claimed in any one of Claims 2 to 5, wherein said mechanical means (18) are designed not to move said electric contact (16) when said access door (5) is moved from said open position to said closed position. 30
7. An electric household appliance as claimed in any one of the foregoing Claims, wherein said electronic switching means (11) comprise a TRIAC. 35
8. An electric household appliance as claimed in any one of the foregoing Claims, wherein said electronic control means (13) comprise a microprocessor. 40
9. An electric household appliance as claimed in any one of the foregoing Claims, wherein said electromagnetic means (19) comprise an electric coil. 45
10. An electric household appliance as claimed in any one of the foregoing Claims, and corresponding to a washing machine or a drier. 50
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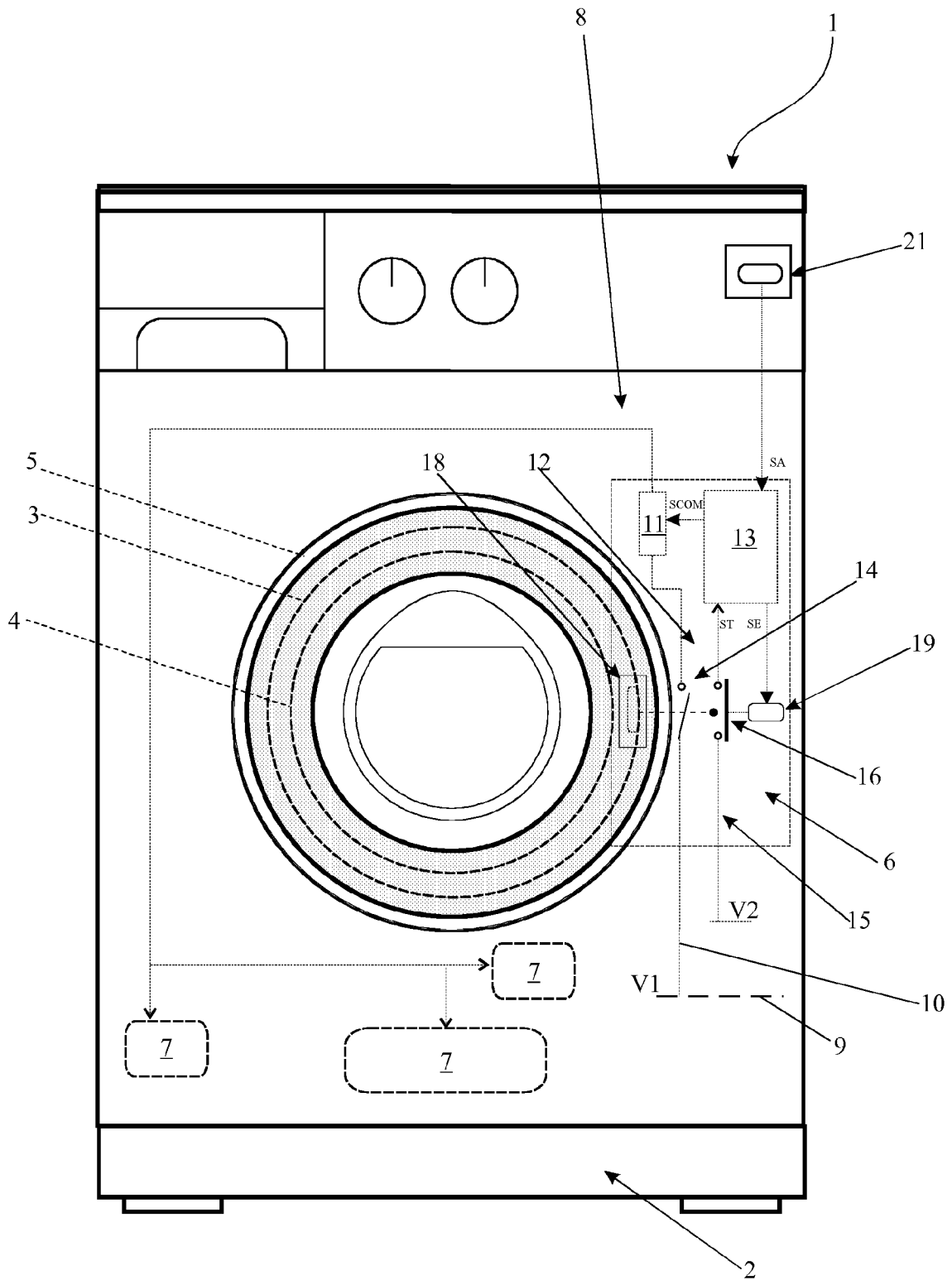


Fig. 1

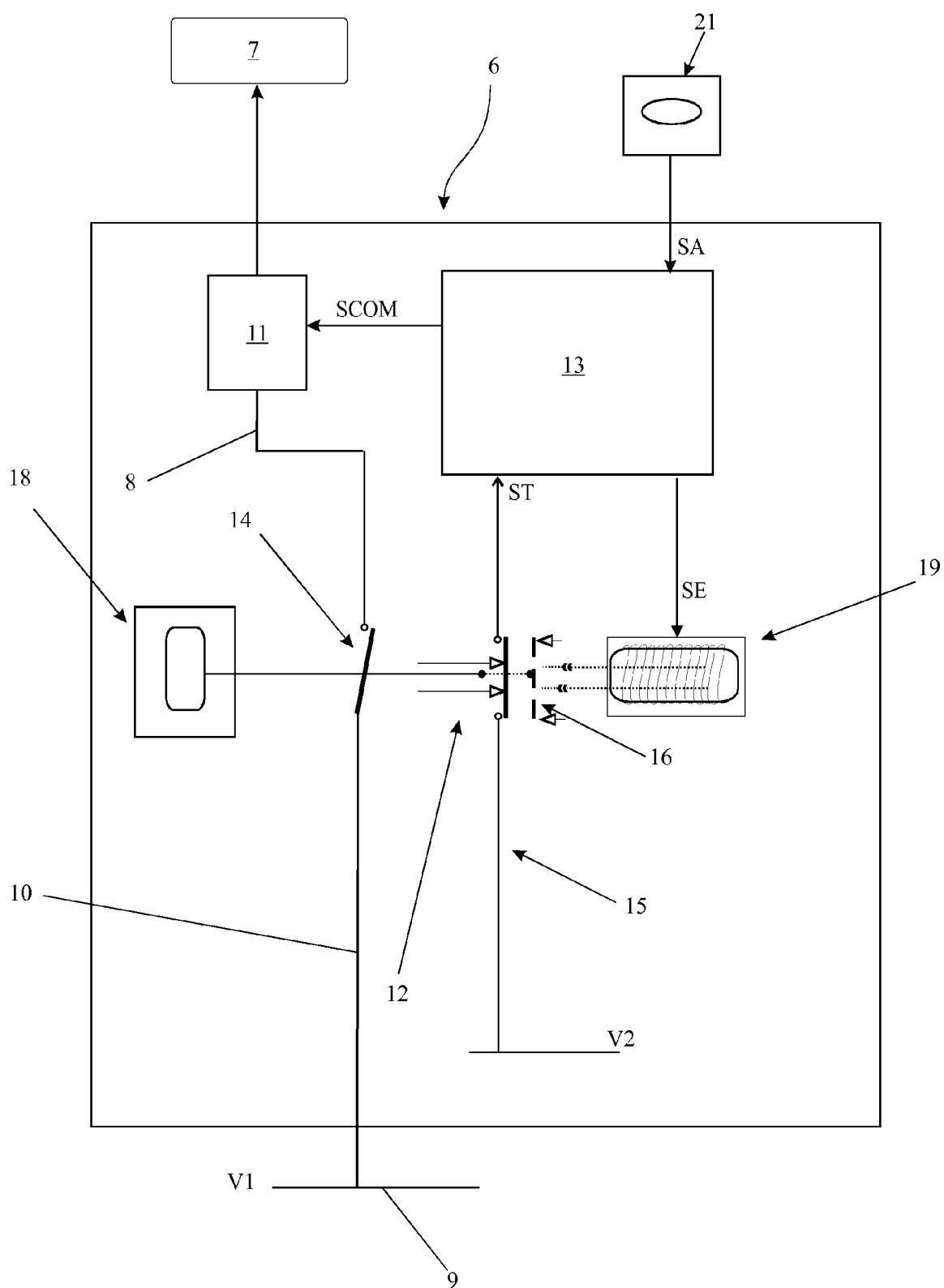


Fig. 2



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 08 15 6770

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 2003/197387 A1 (DIRNBERGER ALBERT [DE]) 23 October 2003 (2003-10-23) * paragraph [0002] * * paragraph [0011] - paragraph [0013] * * paragraph [0028]; figure 1 * -----	1	INV. D06F37/42 D06F58/28
A	US 4 056 891 A (RAYBURN BILLY R) 8 November 1977 (1977-11-08) * column 1, line 43 - column 2, line 45; figures 2-4 * -----	1	
			TECHNICAL FIELDS SEARCHED (IPC)
			D06F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 1 October 2008	Examiner Fachin, Fabiano
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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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 08 15 6770

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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01-10-2008

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2003197387 A1	23-10-2003	NONE	
US 4056891 A	08-11-1977	NONE	