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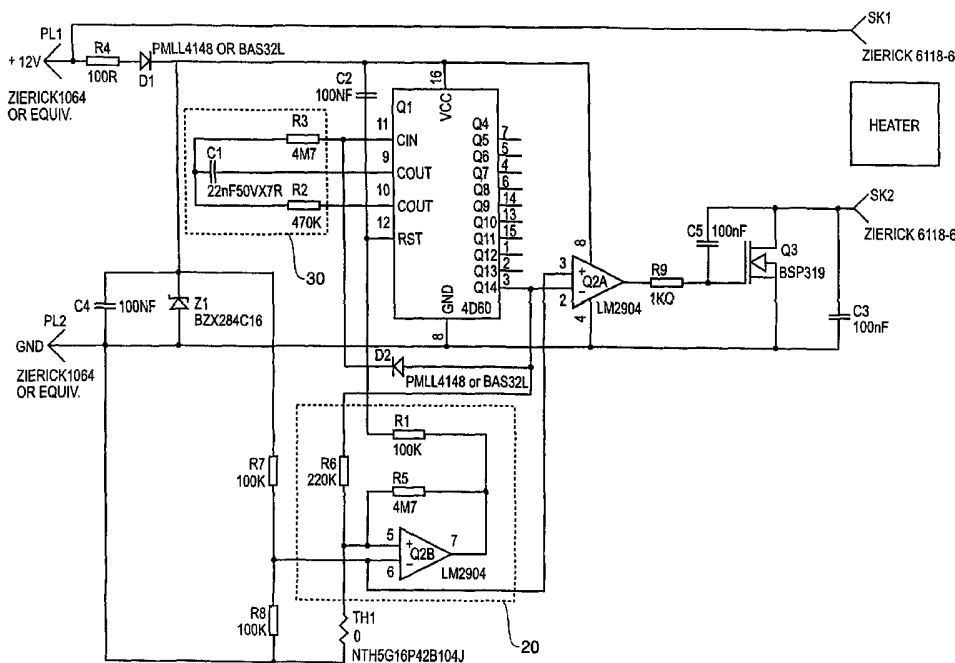
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- (71) Applicant (*for all designated States except US*): **SCHEFENACKER VISION SYSTEMS AUSTRALIA PTY LTD** [AU/AU]; Sherriffs Road, Lonsdale, South Australia 5160 (AU).
- (72) Inventor; and
- (75) Inventor/Applicant (*for US only*): **DUANCE, Roger** [AU/AU]; Sherriffs Road, Lonsdale, South Australia 5160 (AU).

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(54) Title: MIRROR HEATER



(57) Abstract: A heating device and method for de-icing or de-fogging the surface of a vehicle mirror. The device is activated upon ignition of the vehicle engine, and remains activated for a predetermined period of time. During the vehicle's journey the heater may be re-activated if the temperature of the mirror surface falls below a pre-set minimum threshold.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

MIRROR HEATER

TECHNICAL FIELD

This invention relates to mirrors and particularly automobile external mirrors and to methods for demisting or de-icing these mirrors.

BACKGROUND TO THE INVENTION

External mirrors on automobiles are essential to allow the driver to view areas to the side and to the rear of the automobile while driving, and particularly, to see other vehicles approaching.

In certain climates, the clarity of the view provided by the mirror can be severely compromised by ice forming over the surface of the mirror or, by condensation forming on the mirror. In such instances, the safety of the driver and surrounding road users is compromised as the driver is unable to properly view these critical areas about the vehicle.

This problem has traditionally been addressed by providing a heating element within the mirror which upon manual activation by the driver begins to heat the mirror surface and remove any ice or condensation formed thereon. This however requires the intervention of the driver and may take the driver's attention away from driving the vehicle.

Some automatic electronic systems also exist, which sense when a mirror is iced or fogged, however, these systems can be unreliable and can be complex and costly to manufacture and install.

It would be advantageous if a method and apparatus were provided which would allow for automatic demisting and de-icing of external automobile mirrors to reduce the formation of ice or condensation on the mirrors, while reducing costs and complexity.

SUMMARY OF THE INVENTION

According to a first aspect of the present invention, there is provided a vehicle mirror heating system comprising;

a vehicle mirror for mounting to a vehicle, the vehicle having an engine and an ignition line;

a heating element disposed adjacent a surface of the mirror; and

a heating control circuit for controlling the operation of the heating element, wherein in use, the control circuit activates the heating element for a first predetermined period of time upon ignition of the vehicle engine.

Preferably, the heating system will also comprise a temperature sensor for sensing the temperature of the surface of the mirror and for providing control signals to the heating control circuit to activate the heating element for a second predetermined period of time, after the first predetermined period of time has elapsed, when the temperature of the mirror surface falls below a minimum threshold.

Preferably, the temperature sensor is disposed behind the surface of the mirror and is preferably a thermistor.

Preferably, the heating system is powered by the vehicle ignition line.

According to a second aspect of the present invention, there is provided a method of de-fogging or de-icing a vehicle mirror, the method comprising;

activating a heating element disposed adjacent a surface of the vehicle mirror upon ignition of an engine of the vehicle; and

deactivating the heating element after a first predetermined period of time.

Preferably, the method further comprises sensing the temperature of the mirror surface and reactivating the heating element for a second predetermined period of time when the sensed temperature falls below a minimum threshold.

According to a third aspect of the present invention, there is provided a vehicle mirror heater for de-fogging or de-icing the surface of a vehicle mirror, the heater comprising a heating element for mounting adjacent the surface of the vehicle mirror of a vehicle having an engine and an ignition line; and

a heating control circuit for controlling operation of the heating element, wherein in use, the control circuit activates the heating element for a first predetermined period of time upon ignition of the vehicle engine.

Preferably, the vehicle mirror heater will also comprise a temperature sensor for mounting adjacent the surface of the vehicle mirror, to sense the temperature of the surface of the mirror and for providing control signals to the heating control circuit to activate the heating element for a second predetermined period of time, after the first predetermined period of time has elapsed, when the temperature of the mirror surface falls below a minimum threshold.

Preferably, the temperature sensor is a thermistor.

Preferably, the mirror heater is, in use, powered by the vehicle ignition line.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows a circuit layout of the heating control system of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to Figure 1, there is shown a circuit diagram of the heating control system of the present invention. Power to the circuit is provided by the vehicle ignition line (not shown), which is powered only when the vehicle engine is running. When the vehicle ignition line is powered, a positive voltage is provided to power line PL1, which provides a reset pulse to counter Q1 via capacitor C2. This reset pulse sets all Q1 outputs Q4 to Q14 to

logic 0. When Q14 output is low, this enables an oscillator (30) formed by components R2, R3 and C1, via diode D2. Upon actuation of the oscillator 30, counter Q1 begins to count up.

A low output on Q14 also switches on heating element 10 via amplifier Q2A and via mosfet Q3.

The timing of the oscillator is set such that output Q14 goes high after the desired time period, for example 5 minutes. When Q14 goes high (ie when counter Q1 has counted out), it switches off both the oscillator (via diode D2) and the heater 10 (via amplifier Q2A and mosfet Q3).

When output Q14 goes high, this also enables thermistor circuit 20 by bringing thermistor divider resistor R6 to a logic 1. R6 and the negative temperature coefficient thermistor TH1 are chosen such that the thermistor resistance becomes equal to the resistance of R6 at the temperature selected for circuit activation. For example, the thermistor may be selected to be equal to the value of R6 at 5°C. As the thermistor value rises above 220K when the temperature falls below 5°C, the output from amplifier Q2B goes high and resets outputs Q4 to Q14 to low via resistor R1.

In practice, thermistor TH1 will be mounted behind the mirror glass within the mirror housing. In this way, it can obtain a relatively accurate reading of the temperature of the mirror glass while being unobtrusive.

Counter Q1 then commences to count up as described above, causing heater 10 to actuate until the count period has expired, again as described above. As the temperature of the mirror increases, the thermistor value will drop below that of R6 causing the thermistor circuit to remain off until the temperature of the mirror surface has sufficiently dropped to again activate amplifier Q2B.

It is also desirable to provide to the driver an indication as to when the heater 10 is actually on. This may be provided by any convenient means, whether it be an audible

indication or a visual indication such as an LED which is illuminated upon actuation of heater 10, and extinguished when heater 10 is turned off.

Feed-back resistor R5 provides a measure of hysteresis to the temperature such that the temperature must fall a little below 5° before the circuit activates and rise a little above 5° before it deactivates. This hysteresis prevents oscillation around the trigger point.

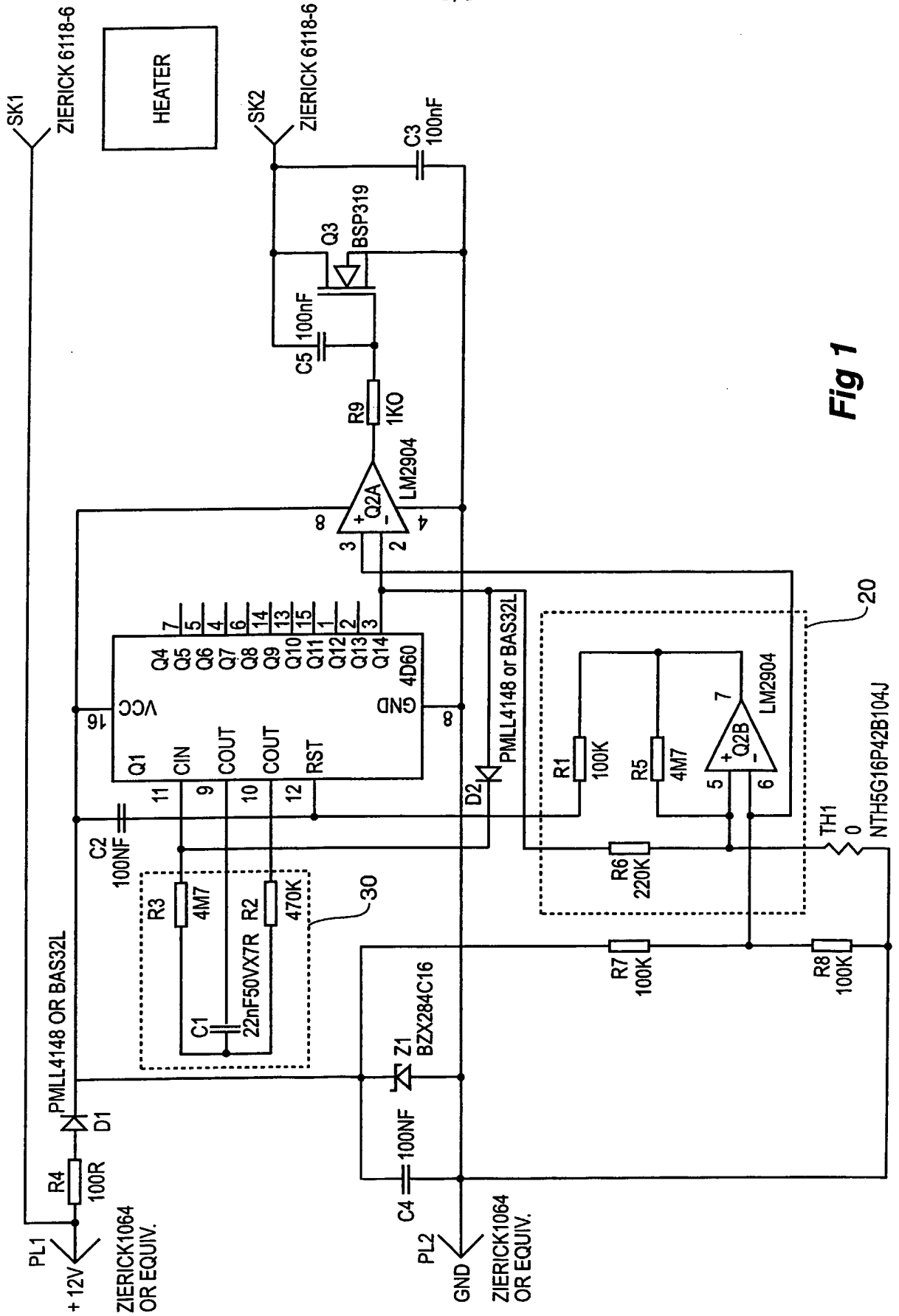
Diode D1 in power line PL1 provides for negative voltage isolation and resistor R4 and diode D1 guard against over voltage spikes as will be understood by the person skilled in the art. Capacitors C3, C4 and C5 provide further protection against voltage spikes and slow the output switching speed to reduce noise generated by the circuit.

The invention described herein provides a reliable and automatic method of demisting and/or de-icing external automobile mirrors. It will be understood that the invention has been described with reference to a particular preferred embodiment and that many other means of carrying out the invention are possible within the scope of the invention as will be understood by the person skilled in the art.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A vehicle mirror heating system comprising;
 - a vehicle mirror for mounting to a vehicle having an engine and an ignition line;
 - a heating element disposed adjacent a surface of the mirror; and
 - a heating control circuit for controlling the operation of the heating element, wherein, in use, the control circuit activates the heating element for a first predetermined period of time upon ignition of the vehicle engine.
2. A vehicle mirror heating system according to claim 1 further comprising a temperature sensor for sensing the temperature of the surface of the mirror and providing control signals to the heating control circuit to activate the heating element for a second predetermined period of time, after the first predetermined period of time has elapsed, when the temperature of the mirror surface falls below a minimum threshold.
3. A vehicle mirror heating system according to any one of claims 1 or 2 wherein the temperature sensor is disposed behind the surface of the mirror.
4. A vehicle mirror heating system according to claim 3 wherein the temperature sensor is a thermistor.
5. A vehicle mirror heating system according to any one of claims 1 or 2 wherein the heating system is powered by the vehicle ignition line.
6. A method of de-fogging or de-icing a vehicle mirror, the method comprising;
 - activating a heating element disposed adjacent a surface of the vehicle mirror upon ignition of an engine of the vehicle; and
 - deactivating the heating element after a first predetermined period of time.

7. A method of de-fogging or de-icing a vehicle mirror, according to claim 6, further comprising sensing the temperature of the mirror surface and reactivating the heating element for a second predetermined period of time when the sensed temperature falls below a minimum threshold.
8. A vehicle mirror heater for de-fogging or de-icing a surface of a vehicle mirror of a vehicle having an engine and an ignition line, the heater comprising;
 - a heating element for mounting adjacent the surface of the mirror; and
 - a heating control circuit for controlling the operation of the heating element, wherein, in use, the control circuit activates the heating element for a first predetermined period of time upon ignition of the vehicle engine.
9. A vehicle mirror heater according to claim 8, further comprising a temperature sensor for mounting adjacent the surface of the mirror, for sensing the temperature of the surface of the mirror and for providing control signals to the heating control circuit to activate the heating element for a second predetermined period of time, after the first predetermined period of time has elapsed, when the temperature of the mirror surface falls below a minimum threshold.
10. A vehicle mirror heater according to claim 9 wherein the temperature sensor is a thermistor.
11. A vehicle mirror heater according to claim 8 wherein the heater is powered by an ignition line of the vehicle.



INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER		
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According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols)		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
DWPI, JAPIO: IPC as above with keywords <i>mirror, reflect, heat, warm condens+, fog, defog+ defrost, demist+, time+, sens+, thermist+</i>		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Patent Abstracts of Japan JP 09-002212 A (MURAKAMI KAIMEIDOU) 21 June 1995 See abstract	1-11
X	GB 2325993 A (BOSCH) 9 December 1998 See figures	1-11
X	CA 2093479 A (NAVISTAR) 8 June 1994 See figures	1-11
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C <input checked="" type="checkbox"/> See patent family annex		
* Special categories of cited documents:		
"A"	document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E"	earlier application or patent but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O"	document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P"	document published prior to the international filing date but later than the priority date claimed	
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Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized officer N. STOJADINOVIC Telephone No : (02) 6283 2124	

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 991301 A1 (VOLKSWAGEN) 5 April 2000 See figures	1-11
X	EP 1053911 A2 (MEKRA LANG) 22 November 2000 See figures	1-11
A	WO 200076274 A1 (SONSIN) 14 December 2000 See figures	

INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU02/00906

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member			
GB	2325993	DE	19723858	FR	2764258
CA	2093479	US	6163013		
EP	991301	DE	19845009		
EP	1053911	BR	200001774	CN	1280931
		JP	2000351348	TR	200001416
WO	200076274	NONE			
END OF ANNEX					