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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No.	1-23649
First Inventor	James E. Smith and Anthony B. McDonald
Title	Automatic Directional Control System For Vehicle Headlights
Express Mail Label No.	EL 777901929 US

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

ADDRESS TO: Assistant Commissioner for Patents, Box Patent Application, Washington, D.C. 20231

1. ☐ Fee Transmittal Form (e.g., PTO/SB/17) *(Submit an original, and a duplicate for fee processing)*
2. ☐ Applicant claims small entity status. See 37 CFR 1.27.
3. ☑ Specification [Total Pages 25] *(preferred arrangement set forth below)*
   - Descriptive title of the invention
   - Cross Reference to Related Applications
   - Statement Regarding Fed sponsored R & D
   - Reference to sequence listing, a table, or a computer program listing appendix
   - Background of the Invention
   - Brief Summary of the Invention
   - Brief Description of the Drawings *(if filed)*
   - Detailed Description
   - Claim(s)
   - Abstract of the Disclosure
4. ☑ Drawing(s) *(35 U.S.C. 113)* [Total Sheets 7]
5. Oath or Declaration [Total Pages 2]
   a. ☐ Newly executed (original or copy)
   b. ☐ Copy from a prior application (37 CFR 1.63(d)) *(for continuation/divisional with Box 18 completed)*
      i. ☐ DELETION OF INVENTOR(S) Signed statement attached deleting inventor(s) named in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).
6. ☐ Application Data Sheet. See 37 CFR 1.76
7. ☐ CD-ROM or CD-R in duplicate, large table or Computer Program *(Appendix)*
8. Nucleotide and/or Amino Acid Sequence Submission *(if applicable, all necessary)*
   a. ☐ Computer Readable Form (CRF)
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      i. ☐ CD-ROM or CD-R (2 copies); or
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ACCOMPANYING APPLICATION PARTS

9. ☐ Assignment Papers (cover sheet & document(s))
10. ☐ 37 CFR 3.73(b) Statement *(when there is an assignee)* ☐ Power of Attorney
11. ☐ English Translation Document *(if applicable)*
12. ☐ Information Disclosure Statement (IDS)/PTO-1449 ☐ Copies of IDS Citations
13. ☐ Preliminary Amendment
14. ☑ Return Receipt Postcard (MPEP 503) *(Should be specifically itemized)*
15. ☐ Certified Copy of Priority Document(s) *(if foreign priority is claimed)*
16. ☐ Nonpublication Request under 35 U.S.C. 122 (b)(2)(B)(i). Applicant must attach form PTO/SB/35 or its equivalent.
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☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No.: ______ / ______

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Serial No.	Filing Date	Examiner	Group Art Unit

Invention: **AUTOMATIC DIRECTIONAL CONTROL SYSTEM FOR VEHICLE HEADLIGHTS**

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UTILITY PATENT APPLICATION

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TITLE

AUTOMATIC DIRECTIONAL CONTROL SYSTEM FOR VEHICLE HEADLIGHTS

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of United States Provisional Application Nos. 60/335,409, filed October 31, 2001; 60/356,703, filed February 13, 2002; and 60/369,447, filed April 2, 2002, the disclosures of which are incorporated herein by reference.

BACKGROUND OF THE INVENTION

This invention relates in general to headlights that are provided on vehicles for illuminating dark road surfaces or other areas in the path of movement. In particular, this invention relates to an automatic directional control system for such vehicle headlights.

Virtually all land vehicles, and many other types of vehicles (such as boats and airplanes, for example), are provided with one or more headlights that are adapted to illuminate a portion of a dark road surface or other area in the path of movement of the vehicle to facilitate safe travel thereon. Typically, each headlight is mounted on or near the front end of the vehicle and is oriented in such a manner that a beam of light is projected forwardly therefrom. The angle at which the beam of light projects from the headlight can, for example, be characterized in a variety of ways, including (1) up and down relative to a horizontal reference position or plane and (2) left and right relative to a vertical reference position or plane. Such directional aiming angles are usually set at the time of assembly of the headlight into the vehicle so as to illuminate a predetermined portion of the road surface or other area in the path of movement of the vehicle.

In the past, these headlights have been mounted on the vehicle in fixed positions relative thereto such that the beams of light are projected therefrom at

predetermined directional aiming angles relative to the vehicle. Although such fixed aiming angle headlight systems have and continue to function adequately, they cannot alter the directional aiming angles of the headlights to account for changes in the operating conditions of the vehicle. For example, if the speed of the vehicle is increased, it would be desirable to adjust the aiming angle of the headlights upwardly such that an area that is somewhat farther in front of the vehicle is more brightly illuminated. On the other hand, if the speed of the vehicle is decreased, it would be desirable to adjust the aiming angle of the headlights downwardly such that an area that is somewhat closer in front of the vehicle is more brightly illuminated. Similarly, if the vehicle turns a corner, it would be desirable to adjust the aiming angle of the headlights either toward the left or toward the right (depending on the direction of the turn) such that an area that is somewhat lateral to the front of the vehicle is more brightly illuminated.

To accomplish this, it is known to provide a directional control system for vehicle headlights that is capable of automatically altering the directional aiming angles of the headlights to account for changes in the operating conditions of the vehicle. A variety of such automatic directional control systems for vehicle headlights are known in the art. However, such known automatic headlight directional control systems have been found to be deficient for various reasons. Thus, it would be desirable to provide an improved structure for an automatic headlight directional control system that addresses such deficiencies.

SUMMARY OF THE INVENTION

This invention relates to an improved structure and method for operating a directional control system for vehicle headlights that is capable of automatically altering the directional aiming angles of the headlights to account for changes in the operating conditions of the vehicle. One or more operating condition sensors may be provided that generate signals that are representative of an operating condition of the vehicle, such as road speed, steering angle, pitch, suspension height, rate of change of road speed, rate of change of steering angle, rate of change of pitch, and rate of change

of suspension height of the vehicle. A controller is responsive to the sensor signal for generating an output signal. An actuator is adapted to be connected to the headlight to effect movement thereof in accordance with the output signal. The controller can include a table that relates values of sensed operating condition to values of the output signal. The controller is responsive to the sensor signal for looking up the output signal in the table.

Various objects and advantages of this invention will become apparent to those skilled in the art from the following detailed description of the preferred embodiments, when read in light of the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram of an automatic directional control system for a vehicle headlight in accordance with this invention.

Fig. 2 is a flow chart of an algorithm for calibrating the automatic directional control system illustrated in Fig. 1 so as to define an initial reference position for the headlight from which the headlight directional controller can implement directional angle adjustments.

Fig. 3 is a flow chart of an algorithm for generating a table that relates one or more sensed vehicle operating condition values to one or more headlight directional angle adjustment factors and for storing such table in the headlight directional controller illustrated in Fig. 1.

Fig. 4 is an example of a table that can be generated and stored in the headlight directional controller in accordance with the table generating algorithm illustrated in Fig. 3.

Fig. 5 is a flow chart of an algorithm for operating the headlight directional controller illustrated in Fig. 1 to automatically implement directional angle adjustments in accordance with sensed condition values.

Fig. 6 is a flow chart of an algorithm for operating the headlight directional controller illustrated in Fig. 1 to automatically implement directional angle

adjustments in accordance with the rate of change of one or more of the sensed condition values.

Fig. 7 is a flow chart of an algorithm for operating the headlight directional controller illustrated in Fig. 1 to automatically implement directional angle adjustments, but only when the rate of change of one or more of the sensed condition values is less than (or greater than) a predetermined value.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, there is illustrated in Fig. 1 an automatic directional control system, indicated generally at 10, for a vehicle headlight 11 in accordance with this invention. The illustrated headlight 11 is, of itself, conventional in the art and is intended to be representative of any device that can be supported on any type of vehicle for the purpose of illuminating any area, such as an area in the path of movement of the vehicle. The headlight 11 is typically mounted on or near the front end of a vehicle (not shown) and is oriented in such a manner that a beam of light is projected therefrom. In a manner that is well known in the art, the headlight 11 is adapted to illuminate a portion of a dark road surface or other area in the path of movement of the vehicle to facilitate safe travel thereon.

The headlight 11 is adjustably mounted on the vehicle such that the directional orientation at which the beam of light projects therefrom can be adjusted relative to the vehicle. Any desired mounting structure can be provided to accomplish this. Typically, the headlight 11 is mounted on the vehicle such that the angle at which the beam of light projects therefrom can be adjusted both (1) up and down relative to a horizontal reference position or plane and (2) left and right relative to a vertical reference position or plane. Although this invention will be described and illustrated in the context of a headlight that is adjustable in both the up/down direction and the left/right direction, it will be appreciated that this invention may be practiced with any headlight 11 that is adjustable in any single direction or multiple directions of movement, whether up/down, left/right, or any other direction.

To effect movement of the illustrated headlight 11 relative to the vehicle, an up/down actuator 12 and a left/right actuator 13 are provided. The actuators 12 and 13 are conventional in the art and may, for example, be embodied as servo motors, step motors, or any other electronically controlled mechanical actuators. It has been found to be desirable to use microstepping motors for the actuators 12 and 13. Such microstepping motors are known in the art and consist of conventional step motors that have appropriate hardware (i.e., driver integrated circuits) and software that allow the step motors to be operated in fractional step increments. The use of such microstepping motors has been found to be desirable because they can effect movements of the headlights in a somewhat faster, smoother, and quieter manner than conventional step motors, and further permit more precise positioning of the headlights 11. In the illustrated embodiment, the up/down actuator 12 is mechanically connected to the headlight 11 such that the headlight 11 can be selectively adjusted up and down relative to a horizontal reference position or plane. Similarly, the illustrated left/right actuator 13 is mechanically connected to the headlight 11 such that the headlight 11 can be selectively adjusted left and right relative to a vertical reference position or plane.

A headlight directional controller 14 is provided for controlling the operations of the up/down actuator 12 and the left/right actuator 13 and, therefore, the angle at which the beam of light projects from the headlight 11 relative to the vehicle. The headlight directional controller 14 can be embodied as any control system, such as a microprocessor or programmable electronic controller, that is responsive to one or more sensed operating conditions of the vehicle for selectively operating the up/down actuator 12 and the left/right actuator 13. To accomplish this, the automatic directional control system 10 can include, for example, a pair of condition sensors 15 and 16 that are connected to the headlight directional controller 14. The condition sensors 15 and 16 are conventional in the art and are responsive to respective sensed operating conditions of the vehicle for generating electrical signals to the headlight directional controller 14. However, if desired, only a single one of the condition sensors 15 and 16 need be provided. Alternatively, additional condition sensors (not

shown) may be provided if desired to generate electrical signals that are representative of any other operating conditions of the vehicle. A conventional input/output device 17 is connected to (or can be connected to) the headlight directional controller 14 for facilitating communication therewith in the manner described below.

If desired, a first position feedback sensor 18 may be provided for the up/down actuator 12, and a second position feedback sensor 19 may be provided for the left/right actuator 13. The position feedback sensors 18 and 19 are conventional in the art and are adapted to generate respective electrical signals that are representative of the actual up/down and left/right positions of the headlight 11. Thus, the first position feedback sensor 18 is responsive to the actual up/down position of the headlight 11 (as determined by a portion of the up/down actuator 12, for example) for generating an electrical signal to the headlight directional controller 14 that is representative thereof. Similarly, the second position feedback sensor 19 is responsive to the actual left/right position of the headlight 11 (as determined by a portion of the left/right actuator 13, for example) for generating an electrical signal to the headlight directional controller 14 that is representative thereof. The position feedback sensors 18 and 19 can be embodied as any conventional sensor structures, such as Hall effect sensors, that are responsive to movements of the headlight 11 (or to the movements of the respective actuators 12 and 13 that are connected to move the headlight 11) for generating such signals.

Alternatively, the position feedback sensors 18 and 19 can be embodied as respective devices that generate electrical signals whenever the headlight 11 has achieved respective predetermined up/down or left/right positions. This can be accomplished, for example, using a conventional optical interrupter (not shown) for each of the actuators 12 and 13. Each of the optical interrupters includes a flag or other component that is mounted on or connected to the headlight 11 for movement therewith. Each of the optical interrupters further includes an optical source and sensor assembly. As the headlight 11 is moved by the actuators 12 and 13, the flag moves therewith relative to the optical source and sensor assembly between a first position, wherein the flag permits light emitted from the source from reaching the

sensor, and a second position, wherein the flag prevents light emitted from the source from reaching the sensor. When the flag is in the first position relative to the optical source and sensor assembly, the sensor is permitted to receive light emitted from the source. As a result, a first signal is generated from the optical source and sensor assembly to the headlight directional controller 14. Conversely, when the flag is in the second position relative to the optical source and sensor assembly, the sensor is not permitted to receive light emitted from the source. As a result, a second signal is generated from the optical source and sensor assembly to the headlight directional controller 14. Thus, the edge of the flag defines a transition between the first and second positions of the flag relative to the optical source and sensor assembly and, therefore, defines a predetermined up/down or left/right position of the headlight 11. The nature of the signal generated from the optical source and sensor assembly to the headlight directional controller 14 (i.e., the first signal or the second signal) can also be used to determine on which side of the predetermined position (the left side or the right side, for example) that the headlight 11 is positioned. The purpose for such position feedback sensors 18 and 19 will be discussed below.

Fig. 2 is a flow chart of an algorithm, indicated generally at 20, for calibrating the automatic directional control system illustrated in Fig. 1 so as to define an initial reference position or positions for the headlight 11 from which the headlight directional controller 14 can implement directional angle adjustments. As mentioned above, the headlight 11 is mounted on the vehicle such that the angle at which the beam of light projects therefrom can be adjusted both up and down relative to a horizontal reference position or plane and left and right relative to a vertical reference position or plane. To insure accurate positioning of the headlight 11, it is desirable that a reference position or positions be initially established by the headlight directional controller 14. Subsequent directional angle adjustments can be made by the headlight directional controller 14 from the pre-established reference position or positions established by this calibration algorithm 20.

To accomplish this, the calibration algorithm 20 has a first step 21 wherein the headlight directional controller 14 is caused to enter a calibration mode of operation.

In the calibration mode of operation, the headlight directional controller 14 is responsive to input signals from the input/output device 17 (or from another source, if desired) for causing manual operation of the up/down actuator 12 and the left/right actuator 13. Thus, while the headlight directional controller 14 is in the calibration mode of operation, an operator of the input/output device 17 can manually effect either up/down movement of the headlight 11, left/right movement of the headlight 11, or both, as desired.

In a second step 22 of the calibration algorithm 20, the up/down actuator 12 and the left/right actuator 13 are manually operated to aim the headlight 11 in a predetermined reference orientation. This can be accomplished by use of the input/output device 17 that, as mentioned above, is connected to (or can be connected to) the headlight directional controller 14. Traditionally, the aiming of a headlight 11 has been accomplished by parking the vehicle on a surface near a wall or other vertical structure, providing a reference target at a predetermined location on the wall or other structure, and mechanically adjusting the mounting structure of the headlight 11 such that the center of the beam therefrom is projected at the reference target. In this invention, the vehicle is parked on a surface near a wall or other vertical structure, and a reference target is provided at a predetermined location on the wall or other structure, as described above. Next, in accordance with the second step 22 of this calibration algorithm 20, the input/output device 17 is operated to generate electrical signals to the headlight directional controller 14. In response to such electrical signals, the headlight directional controller 14 operates the up/down actuator 12 and the left/right actuator 13 to move the headlight 11 such that center of the beam projecting therefrom is aimed at the reference target. When the beam from the headlight 11 is so aimed, then the headlight 11 is determined to be oriented in the initial reference position from which the headlight directional controller 14 can subsequently implement directional angle adjustments.

In a third step 23 of the calibration algorithm 20, once this initial reference position for the headlight 11 has been achieved, such position is stored in the headlight directional controller 14 as the predetermined initial reference position. This can be

accomplished by means of the position feedback sensors 18 and 19. As discussed above, the position feedback sensors 18 and 19 are adapted to generate respective electrical signals that are representative of the actual up/down and left/right positions of the headlight 11 or of the predetermined positions for the headlight. Thus, the first position feedback sensor 18 is responsive to the actual up/down position of the headlight 11 (as determined by the up/down actuator 12, for example) for generating an electrical signal to the headlight directional controller 14 that is representative thereof. Similarly, the second position feedback sensor 19 is responsive to the actual left/right position of the headlight 11 (as determined by the left/right actuator 13, for example) for generating an electrical signal to the headlight directional controller 14 that is representative thereof. Accordingly, the third step 23 of the calibration algorithm 20 can be performed by causing the headlight directional controller 14 to read the signals from the position feedback sensors 18 and 19 and store the current up/down and left/right positions of the headlight 11 as the initial reference positions from which the headlight directional controller 14 can subsequently implement directional angle adjustments.

The current position of the headlight 11 is preferably stored in the non-volatile memory of the headlight directional controller 14 for reference during normal operation of the automatic directional control system 10 described below. Thus, when the automatic directional control system 10 is initially activated (such as when the electrical system of the vehicle is initially turned on), the headlight directional controller 14 can position the headlight 11 at or near the calibrated position utilizing the signals comparing the current position of the headlight 11 (as determined by the signals generated by the position feedback sensors 18 and 19) with the predetermined reference position determined by the calibration algorithm 20.

Fig. 3 is a flow chart of an algorithm, indicated generally at 30, for generating a table that relates the sensed condition values from the condition sensors 15 and 16 to the headlight directional angle adjustment factors that will be implemented by the headlight directional controller 14, and further for storing such table in the headlight directional controller 14 illustrated in Fig. 1. As used herein, the term "table" is

intended to be representative of any collection or association of data that relates one or more of the sensed condition values to one or more of the headlight directional angle adjustment factors. The table of data can be generated, stored, and expressed in any desired format. For example, this table of data can be generated, stored, and expressed in a conventional spreadsheet format, such as shown in Fig. 4, which will be discussed in detail below.

In a first step 31 of the table generating algorithm 30, an adjustment control algorithm is selected. The adjustment control algorithm can be, generally speaking, any desired relationship that relates one or more operating conditions of the vehicle to one or more angular orientations of the headlight 11. A variety of such relationships are known in the art, and this invention is not intended to be limited to any particular relationship. Typically, such relationships will be expressed in terms of a mathematical equation or similar relationship that can be readily processed using a microprocessor or similar electronic computing apparatus, such as the above-described headlight directional controller 14. The particular adjustment control algorithm that is selected may, if desired, vary from vehicle to vehicle in accordance with a variety of factors, including relative size and performance characteristics of the vehicle or any other desired condition.

As mentioned above, a plurality of operating conditions may be sensed by the condition sensors 15 and 16 and provided to the headlight directional controller 14 for use with the adjustment control mechanism. For example, the condition sensors 15 and 16 may generate electrical signals to the headlight directional controller 14 that are representative of the road speed, the steering angle, and the pitch of the vehicle (which can, for example, be determined by sensing the front and rear suspension heights of the vehicle or by a pitch or level sensor). Additionally, the time derivative of these operating conditions (i.e., the rate of change of the road speed, steering angle, and pitch of the vehicle) can be sensed or calculated. However, any other operating condition or conditions of the vehicle may be sensed and provided to the headlight directional controller 14.

In a second step 32 of the table generating algorithm 30, the table is generated using the adjustment control algorithm selected in the first step 31. The table can be generated in any desired manner. For example, let it be assumed that the selected adjustment control algorithm relates a single sensed operating condition to each of the angular adjustment control values for adjusting both the up/down orientation and the left/right orientation of the headlight 11. The table can be generated by initially selecting a first discrete sensed operating condition value that might be encountered during operation of the vehicle. Then, the selected adjustment control algorithm is solved using such first discrete sensed operating condition value to obtain the corresponding adjustment control values for the up/down and left/right orientation of the headlight 11. Then, the first discrete sensed operating condition value and the corresponding adjustment control values are stored in the table. This process can be repeated for any desired number of other discrete sensed operating condition values that might be encountered during operation of the vehicle.

As mentioned above, Fig. 4 is a representative example of a table, indicated generally at 40, that can be generated in accordance with the second step 32 of the table generating algorithm 30 illustrated in Fig. 3. As shown therein, a series of discrete sensed operating condition values (degrees of steering angles, for example) is related to the angular adjustment control values (degrees of movement from the associated up/down and left/right reference positions or planes, for example) for adjusting both the up/down orientation and the left/right orientation of the headlight 11. For the purposes of illustration only, let it be assumed that (1) a positive steering angle value represents steering toward left, while a negative steering angle value represents steering toward the right, (2) a positive up/down adjustment factor represents aiming the headlight 11 upwardly, while a negative up/down adjustment factor represents aiming the headlight 11 downwardly, and (3) a positive left/right adjustment factor represents aiming the headlight 11 toward the left, while a negative left/right adjustment factor represents aiming the headlight 11 toward the right.

Thus, in accordance with the selected adjustment control algorithm, a sensed steering angle of +6° results in an up/down adjustment factor of -3.00° and a left/right

adjustment factor of +4.50°. Similarly, a sensed steering angle of +5° results in an up/down adjustment factor of -2.50° and a left/right adjustment factor of +3.75°, and so on as shown in the table 40. The illustrated table 40 relates thirteen different sensed steering angle values to their corresponding adjustment control values for both the up/down and left/right orientation of the headlight 11. However, the table 40 can include a greater or lesser number of such sensed operating condition values, together with their corresponding adjustment control values. Furthermore, although the illustrated table 40 relates only a single sensed operating condition value (steering angle) to the corresponding adjustment control values for both the up/down and left/right orientation of the headlight 11, the selected adjustment control algorithm may, as mentioned above, be responsive to a plurality of sensed operating condition values for determining the corresponding adjustment control values. Alternatively, as will be discussed further below, a plurality of tables 40 can be generated, one for each of the plurality of sensed operating condition values. The size and extent of the table 40 or tables can be varied to accommodate any desired number of such sensed operating conditions.

Referring back to Fig. 3, in a third step 33 of the table generating algorithm 30, the table 40 generated in the second step 32 is stored in the memory of the headlight directional controller 14 illustrated in Fig. 1. The contents of the table 40 can be communicated serially to the headlight directional controller 14 by means of the input/output device 17 illustrated in Fig. 1 or in any other desired manner. Regardless of how it is communicated, the table 40 is preferably stored in a non-volatile memory of the headlight directional controller 14 for subsequent use in the manner described further below when the vehicle is operated.

As mentioned above, it may be desirable to vary the algorithm that is selected for use in implementing the headlight directional angle adjustment factors. The generation of the table 40 and the storage of such table 40 in the memory of the headlight directional controller 14 allow a designer of the automatic directional control system 10 to quickly and easily alter the response characteristics of the system 10 as desired, without the need for direct access to the computer code or software that is

used to operate the headlight directional controller 14. Rather, to effect such alterations, a designer can simply change some or all of the data points that are contained within the table 40. As will be described in detail below, the headlight directional controller 14 will use whatever data points that are contained within the table 40 in determining the need for adjustments in the angular orientation of the headlight 11. This structure also reduces the amount of processing power that is necessary for the headlight directional controller 14 because it can operate on a relatively simple look-up basis using the table 40, rather than having to calculate relatively high order equations that may be used to determine the data points contained within the table 40.

Fig. 5 is a flow chart of an algorithm, indicated generally at 50, for operating the headlight directional controller illustrated in Fig. 1 to automatically implement directional angle adjustments in accordance with one or more of the sensed condition values from the condition sensors 15 and 16. In a first step 51 of the operating algorithm 50, the values of one or more of the condition sensors 15 and 16 are read by the headlight directional controller 14. Then, the operating algorithm 50 enters a decision point 52, wherein it is determined whether the value or values of the condition sensors 15 and 16 that have been read by the headlight directional controller 14 are specifically contained in the table 40. For example, using the table 40 illustrated in Fig. 4, if the headlight directional controller 14 has read a steering angle value of -2°, then it is determined that the value of the condition sensor 15 is specifically contained within the table 40. In this instance, the operating algorithm 50 branches from the decision point 52 to an instruction 53, wherein the adjustment factors contained in the table 40 that correspond to the sensed condition value are looked up and stored in the headlight directional controller 14.

The operating algorithm 50 next enters an instruction 54 wherein the value of the magnitude of the adjustment factor (i.e., the desired position for the headlight 11) is compared with the current position of the headlight 11. This step 54 of the operating algorithm 50 is optional and can be performed if one or more of the position feedback sensors 18 and 19 are provided in the automatic directional control system 10

to generate respective electrical signals that are representative of the actual up/down and left/right positions of the headlight 11, as described above. This step 54 of the operating algorithm 50 can be performed to determine how much of an adjustment is necessary to move the headlight 11 from its current position, as determined by the position feedback sensors 18 and 19, to the desired position, as defined by the adjustment factor obtained from the table 40. To accomplish this, the value of the adjustment factor may, for example, be subtracted from the current position of the headlight 11 to determine the magnitude of the difference therebetween and, therefore, the magnitude of the adjustment that is necessary to move the headlight 11 from its current position to the desired position. However, this step 54 of the operating algorithm 50 can be accomplished in any other desired manner.

Next, the operating algorithm 50 enters a decision point 55, wherein it is determined whether the magnitude of the adjustment that is necessary to move the headlight 11 from its current position to the desired position is greater than a predetermined minimum threshold. This step in the operating algorithm 50 is also optional, but may be desirable to prevent the actuators 12 and 13 from being operated continuously or unduly frequently in response to relatively small variations in the sensed operating condition or conditions, such as relatively small bumps in the road. For example, if the current position of the headlight 11 is relatively close to the desired position, then it may be undesirable to effect any movement thereof. This step 55 will prevent the actuators 12 and 13 from being operated unless the current position of the headlight 11 is relatively far from the desired position. As another example, if the condition sensors 15 and 16 are respectively responsive to the front and rear suspension heights of the vehicle for the purpose of determining the pitch thereof, then the headlight directional controller 14 may be programmed to be responsive only to changes in the suspension heights that occur at frequencies that are lower than the suspension rebound frequency of the vehicle (thereby ignoring relatively high frequency changes in suspension height that are likely the result of bumps in the road). However, relatively high frequency changes in the suspension heights could also be

monitored to assist in deciphering relatively rough suspension changes from other suspension changes.

In any event, the provision of the predetermined minimum threshold functions as a filter or dead band that minimizes or eliminates undesirable "hunting" of the actuators 12 and 13 for relatively small magnitudes of movement of the headlight 11. If the magnitude of the adjustment factor is not greater than the predetermined minimum threshold, then the operation of the actuators 12 and 13 is considered to be undesirable. Thus, the operating algorithm 50 branches from the decision point 55 back to the instruction 51, wherein the above-described steps of the operating algorithm 50 are repeated.

If, on the other hand, the magnitude of the adjustment factor is greater than the predetermined minimum threshold, then the operation of the actuators 12 and 13 is considered to be desirable. Thus, the operating algorithm 50 branches from the decision point 55 to an instruction 56, wherein either or both of the actuators 12 and 13 are actuated to effect movement of the headlight 11. For example, using the table 40 illustrated in Fig. 4, if the headlight directional controller 14 has read a steering angle value of -2°, then the headlight directional controller 14 will look up an up/down adjustment factor of -1.00° and a left/right adjustment factor of -1.50° from the table 40. The headlight directional controller 14 operates the actuators 12 and 13 to adjust the angular orientation of the headlight 11 to achieve the noted adjustment factors.

In some instances, the amounts of movement that are to be implemented by the two actuators 12 and 13 will be the same (i.e., the amount of up/down movement of the headlight 11 will be the same as the amount of left/right movement). More frequently, however, the amounts of movement that are to be implemented by the two actuators 12 and 13 will be different from one another. In the latter instances, it may be desirable to operate the two actuators 12 and 13 at two different speeds such that the overall movement of the headlight 11 is relatively uniform. For example, if the amount of movement that is to be implemented by the up/down actuator 12 is twice as large as the amount of movement that is to be implemented by the left/right actuator 13, then it may be desirable to operate the up/down actuator 12 at one-half of the

speed of the left/right actuator 13 so that the movements of both actuators 12 and 13 (and, therefore, the overall movement of the headlight 11) will start and stop at approximately the same time. Similarly, if the vehicle is provided with two different headlights 11, as is commonly found, then it may be desirable to control the respective movements of such different headlights 11 in such a manner that they both start and stop at approximately the same time. This can be accomplished, for example, by providing a single headlight directional controller 14 for not only controlling, but also coordinating the movements of both of the headlights 11 in response to the sensed operating conditions.

Such operations can be performed in an open loop manner if desired, wherein the actuators 12 and 13 are operated to achieve predetermined amounts of movement. For example, the actuators 12 and 13 can be embodied as step motors that are operated a predetermined number of steps to achieve predetermined amounts of movement. Alternatively, the actuators 12 and 13 can be operated for predetermined periods of time to achieve the predetermined amounts of movement. However, more desirably, the operations of the actuators 12 and 13 are performed in a closed loop manner. To accomplish this, the actuators 12 and 13 are operated until either or both of the position feedback sensors 18 and 19 generate signals indicate that the headlight 11 has actually achieved the predetermined amounts of movement or desired position. In either event, the operating algorithm 50 then branches back to the instruction 51, wherein the above-described steps of the algorithm 50 are repeated.

Referring back to the decision point 52, if the value or values of the condition sensors 15 and 16 that have been read by the headlight directional controller 14 are not specifically contained in the table 40, then the operating algorithm 50 branches from the decision point 52 to an instruction 57, wherein the adjustment factors that are specifically contained in the table 40 that correspond to the adjacent sensed condition values are looked up and stored in the headlight directional controller 14. For example, using the table 40 illustrated in Fig. 4, if the headlight directional controller 14 has read a steering angle value of -1.5°, then it is determined that the value of the condition sensor 15 is not specifically contained within the table 40. Rather than

simply default to the closest value that is contained within the table 40, the two adjustment factors specifically contained in the table 40 that are adjacent to the sensed condition value (namely, the adjustment factors for the steering angle values of -1° and -2°) are looked up and stored in the headlight directional controller 14.

The operating algorithm 50 next enters an instruction 58, wherein the actual adjustment factors to be implemented by the headlight directional controller 14 are interpolated or otherwise calculated from the stored adjustment factors that are adjacent to the sensed condition value. For example, as mentioned above, if the actual sensed steering angle value is -1.5°, then the headlight directional controller 14 looks up the adjustment factors for the steering angle values of -1° and -2°. The up/down adjustment factor for a steering angle value of -1° is -0.50 while the up/down adjustment factor for a steering angle value of -2° is -1.00°. If the calculation that is performed by the headlight directional controller 14 is a simple arithmetic mean, then the interpolated up/down adjustment factor would be -0.75°. Similarly, the left/right adjustment factor for a steering angle value of -1° is -0.75°, while the left/right adjustment factor for a steering angle value of -2° is -1.50°. If the calculation that is performed by the headlight directional controller 14 is a simple arithmetic mean, then the interpolated left/right adjustment factor would be -1.13°. Thereafter, the operating algorithm 50 branches to the decision point 55, and the remainder of the operating algorithm 50 is performed as described above.

The interpolation that is performed by the headlight directional controller 14 can be accomplished in any desired manner. The performance of the simple arithmetic mean described above is intended to be representative of any mathematical or other function that can be performed to calculate, derive, or otherwise obtain adjustment factors that are not present in the table 40. Furthermore, although this interpolation has been described in the context of using only the two condition values that are directly adjacent to the actual sensed condition value, it will be appreciated that the adjustment values for any single condition value or combination of sensed condition values may be selected for the interpolation. For example, several of the condition values both above and below the sensed condition value can be read from the table 40

to derive a trend line or other good estimate of the adjustment factors that are not present in the table 40. Performance of this interpolation does not require any significant increase in the amount of processing power that is necessary for the headlight directional controller 14.

The above discussion has assumed the use of a single table 40 that provides adjustment values based upon a single sensed operating condition (steering angle of the vehicle, in the illustrated embodiment). However, as discussed above, this invention may be practiced by sensing a plurality of operating conditions of the vehicle. For example, let it be assumed that both steering angle and vehicle road speed are sensed by the condition sensors 15 and 16. As previously discussed, the adjustment control algorithm that is selected in the first step 31 of the table generating algorithm 30 can be designed to accommodate multiple sensed conditions. Alternatively, however, a first table (such as the table 40 illustrated in Fig. 4) may be generated that relates the steering angle of the vehicle to the angular adjustment control values for adjusting both the up/down orientation and the left/right orientation of the headlight 11. A second, similar table (not shown) may also be generated that relates the road speed of the vehicle to the angular adjustment control values for adjusting both the up/down orientation and the left/right orientation of the headlight 11. Thus, for a given steering angle and road speed of the vehicle, the first and second tables may provide differing angular adjustment control values. To address this, the interpolation step 57 of the operating algorithm 50 can be performed to interpolate a single composite adjustment value that is based upon the two different values provided in the first and second tables for the pair of sensed operating conditions. This interpolation can be performed in the same manner as described above for each of the actuators 12 and 13.

A variety of control strategies can be implemented using the automatic directional control system 10 described above. For example, the pitch of the vehicle can change as a result of a variety of factors, including acceleration, deceleration, and weight distribution of the vehicle. These pitch variations can alter the angle at which the beam of light projects from the headlight 11 in the up and down direction relative

to a horizontal reference position or plane. The automatic directional control system 10 can be responsive to such pitch variations for operating the up/down actuator 12 to maintain the angle at which the beam of light projects from the headlight 11 in the up and down direction relatively constant to the horizontal reference position or plane.

As discussed above, the angle at which the beam of light projects from the headlight 11 in the left and right direction relative to a vertical reference position or plane can be adjusted in accordance with the sensed steering angle. However, the angle at which the beam of light projects from the headlight 11 in the up and down direction relative to a horizontal reference position or plane can also be adjusted in accordance with the sensed steering angle. This can be done to lower the headlight beams as the vehicle is turning a corner. The advantages of this are not only to better illuminate the road surface in the path of movement of the vehicle, but also to reduce headlight glare to other vehicles as the turn is negotiated.

Lastly, many vehicles on the road today have halogen lamps or other lights that are aimed to illuminate the sides of the roads in front of the vehicle during the turn. These other lights are activated by the manual operation of the turn signals of the vehicle. The automatic directional control system 10 of this invention can be responsive to one or more operating conditions of the vehicle to automatically activate these other lights on the vehicle. For example, the automatic directional control system 10 of this invention can be responsive to a steering angle in excess of a predetermined magnitude for automatically activating these other lights on the vehicle. This can be effective to extend the angular range of illumination of the road surface.

Fig. 6 is a flow chart of an algorithm, indicated generally at 60, for operating the headlight directional controller illustrated in Fig. 1 to automatically implement directional angle adjustments in accordance with the rate of change of one or more of the sensed condition values. As mentioned above, the headlight directional controller 14 can be operated to automatically implement directional angle adjustments in accordance with one or more of the sensed condition values or in accordance with the rate of change of one or more of the sensed condition values.

To accomplish this, the algorithm 60 has a first step 61 wherein the values of one or more of the condition sensors 15 and 16 are initially read by the headlight directional controller 14. Then, the algorithm 60 enters a second step 62 wherein the values of one or more of the condition sensors 15 and 16 are subsequently read a second time by the headlight directional controller 14. The second reading of the condition sensors 15 and 16 occurs a predetermined amount of time after the first reading thereof. Next, the algorithm enters a third step 63 wherein a rate of change of the sensed condition or conditions is calculated. The rate of change of the sensed condition can be calculated as the difference between the first and second readings divided by the amount of time therebetween or by any other desired means. For example, if the sensed condition is vehicle speed, then the difference between the first sensed vehicle speed and the second sensed vehicle speed, divided by the amount of time therebetween, would yield a number that is representative of the acceleration of the vehicle. In a final step 64 of the algorithm 60, either or both of the actuators 12 and 13 are actuated to effect movement of the headlight 11 in accordance with the calculated rate of change of the sensed condition. Such movement of the headlight 11 can be effected in a manner that is similar to that described above.

Fig. 7 is a flow chart of an algorithm, indicated generally at 70, for operating the headlight directional controller illustrated in Fig. 1 to automatically implement directional angle adjustments, but only when the rate of change of one or more of the sensed condition values is less than (or greater than) a predetermined value. As mentioned above, the headlight directional controller 14 can be operated to automatically implement directional angle adjustments in accordance with one or more of the sensed condition values. In this variation of the invention, the headlight directional controller 14 automatically implements directional angle adjustments in response to the sensed condition values (or in response to the rate of change of the sensed condition values), but only when the rate of change of one or more of the sensed condition values is less than (or greater than) a predetermined value.

To accomplish this, the algorithm 70 has a first step 71 wherein the values of one or more of the condition sensors 15 and 16 are initially read by the headlight

directional controller 14. Then, the algorithm 70 enters a second step 72 wherein the values of one or more of the condition sensors 15 and 16 are subsequently read a second time by the headlight directional controller 14. The second reading of the condition sensors 15 and 16 occurs a predetermined amount of time after the first reading thereof. Next, the algorithm enters a third step 73 wherein a rate of change of the sensed condition or conditions is calculated. The rate of change of the sensed condition can be calculated as the difference between the first and second readings divided by the amount of time therebetween or by any other desired means. For example, if the sensed condition is suspension height, then the difference between the first sensed suspension height and the second sensed suspension height, divided by the amount of time therebetween, would yield a number that is representative of the rate of change of the suspension height of the vehicle.

In a fourth step 74 of the algorithm 70, a determination is made as to whether the rate of change of the sensed condition value is less than a predetermined threshold value. If the rate of change of the sensed condition value is less than this predetermined threshold value, then the algorithm 70 branches from the decision point 74 to a final step 75 of the algorithm 70, wherein either or both of the actuators 12 and 13 are actuated to effect movement of the headlight 11 in accordance with the calculated rate of change of the sensed condition. Such movement of the headlight 11 can be effected in a manner that is similar to that described above. If, however, the rate of change of the sensed condition value is not less than this predetermined threshold value, then the algorithm 70 branches from the decision point 74 back to the first step 71, wherein the algorithm 70 is repeated. This threshold sensing algorithm 70 can function to prevent the headlight directional controller 14 from being operated to automatically implement directional angle adjustments when the rate of change of the suspension height of the vehicle changes more rapidly than the system can effect corrective changes. For example, if the vehicle is operated on a bumpy road, the algorithm 70 will prevent the headlight directional controller 14 from attempting to correct for every single bump that is encountered. However, for relatively low frequency or rates of change in the suspension height of the vehicle, such as can occur

when accelerating, decelerating, and weight changes, the headlight directional controller 14 will be operated in the normal manner to effect corrective actions, as described above.

As mentioned above, the input/output device 17 is connected to (or can be connected to) the headlight directional controller 14 for facilitating communication therewith, and the input/output device 17 can be used for calibrating the automatic directional control system illustrated in Fig. 1 so as to define an initial reference position or positions for the headlight 11 from which the headlight directional controller 14 can implement directional angle adjustments. Additionally, however, the input/output device 17 can be employed as a diagnostic tool. To accomplish this, the input/output device 17 can be embodied as a conventional microprocessor or similar electronically programmable device that can be connected to the headlight directional controller 14 to read fault codes that may be generated during the operation thereof. The headlight directional controller 14 can be programmed to generate fault codes whenever a fault condition or other anomaly occurs or is detected. Such fault codes can be stored in the headlight directional controller 14 until the input/output device 17 is subsequently connected thereto. When so connected, the input/output device 17 can read such codes and display them for an operator. As a result, the operator can take whatever corrective actions are necessary to address the fault condition or anomaly. The input/output device 17 can also be programmed to clear the fault codes from the headlight directional controller 14 after they are read.

In accordance with the provisions of the patent statutes, the principle and mode of operation of this invention have been explained and illustrated in its preferred embodiments. However, it must be understood that this invention may be practiced otherwise than as specifically explained and illustrated without departing from its spirit or scope.

What is claimed is:

1. An automatic directional control system for a vehicle headlight comprising:

a sensor that is adapted to generate a signal that is representative of a condition of the vehicle, said sensed condition includes one or more of road speed, steering angle, pitch, and suspension height of the vehicle;

a controller that is responsive to said sensor signal for generating an output signal; and

an actuator that is adapted to be connected to the headlight to effect movement thereof in accordance with said output signal.

2. The automatic directional control system defined in Claim 1 wherein said sensor generates a signal that is representative of the road speed of the vehicle.

3. The automatic directional control system defined in Claim 1 wherein said sensor generates a signal that is representative of the steering angle of the vehicle.

4. The automatic directional control system defined in Claim 1 wherein said sensor generates a signal that is representative of the pitch of the vehicle.

5. The automatic directional control system defined in Claim 1 wherein said sensor generates a signal that is representative of the suspension height of the vehicle.

6. The automatic directional control system defined in Claim 1 wherein said controller generates said output signal only when said sensor signal changes by more than a predetermined amount.

7. The automatic directional control system defined in Claim 1 wherein said controller is responsive to a rate of change of said sensor signal for generating said output signal.

8. The automatic directional control system defined in Claim 7 wherein said sensor generates a signal that is representative of the rate of change of the road speed of the vehicle.

9. The automatic directional control system defined in Claim 7 wherein said sensor generates a signal that is representative of the rate of change of the steering angle of the vehicle.

10. The automatic directional control system defined in Claim 7 wherein said sensor generates a signal that is representative of the rate of change of the pitch of the vehicle.

11. The automatic directional control system defined in Claim 7 wherein said sensor generates a signal that is representative of the rate of change of the suspension height of the vehicle.

12. The automatic directional control system defined in Claim 7 wherein said controller generates said output signal only when the rate of change of said sensor signal changes by more than a predetermined threshold amount.

13. The automatic directional control system defined in Claim 1 further including a plurality of sensors adapted to generate a respective plurality of signals that are representative of a respective plurality of conditions of the vehicle, and wherein said controller is responsive to said plurality of sensor signals for generating said output signal.

ABSTRACT OF THE DISCLOSURE

A structure and method for operating a directional control system for vehicle headlights that is capable of altering the directional aiming angles of the headlights to account for changes in the operating conditions of the vehicle. One or more operating condition sensors may be provided that generate signals that are representative of a condition of the vehicle, such as road speed, steering angle, pitch, suspension height, rate of change of road speed, rate of change of steering angle, rate of change of pitch, and rate of change of suspension height of the vehicle. A controller is responsive to the sensor signal for generating an output signal. An actuator is adapted to be connected to the headlight to effect movement thereof in accordance with the output signal. The controller can include a table that relates values of sensed operating condition to values of the output signal. The controller is responsive to the sensor signal for looking up the output signal in the table.

AUTOMATIC DIRECTIONAL CONTROL SYSTEM FOR VEHICLE HEADLIGHTS

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Name & Telephone Number of Person to Call If Necessary:
Richard S. MacMillan - (419) 255-5900
Serial No. Docket No.
Sheet 1 of 7 1-23649

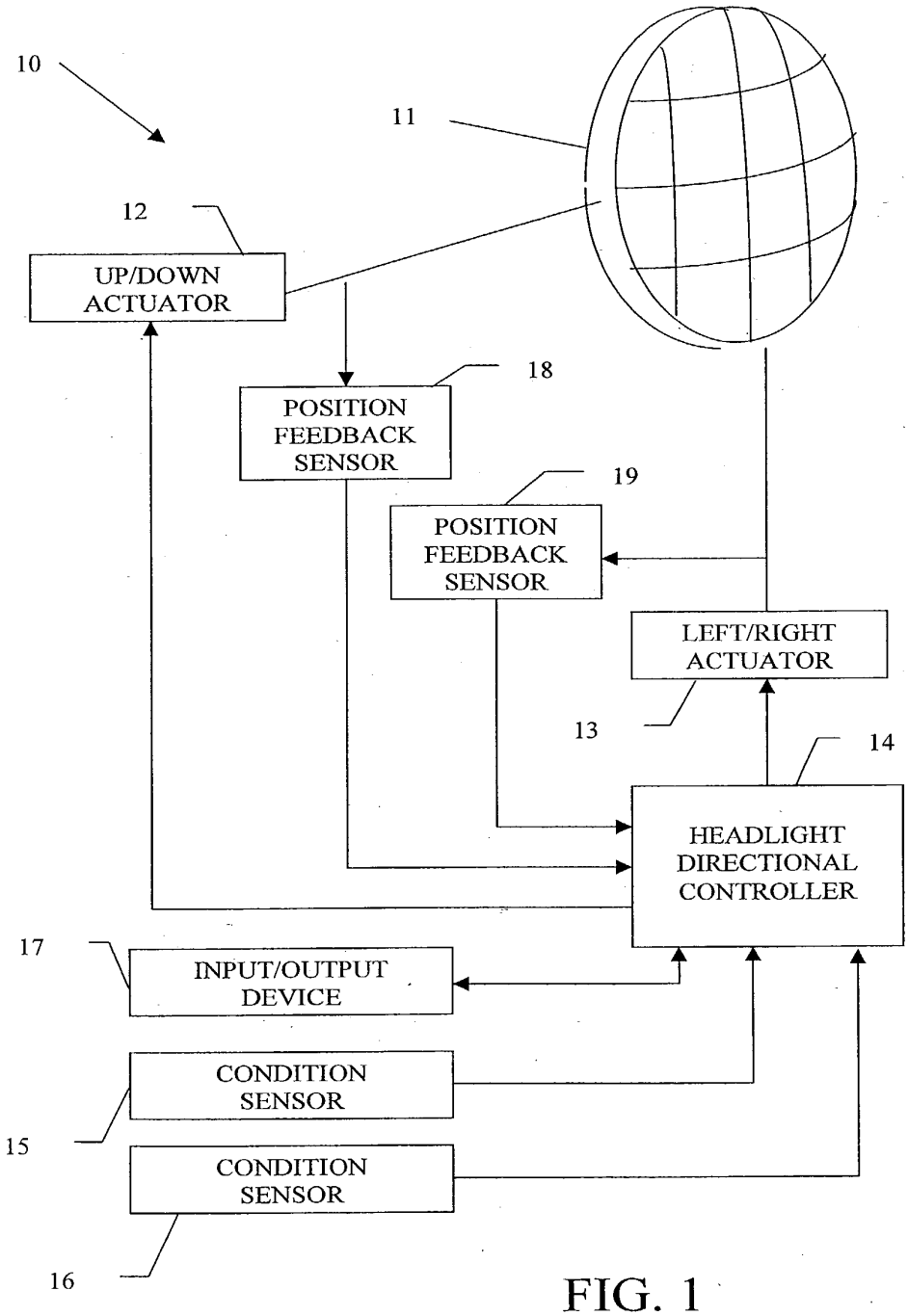

FIG. 1

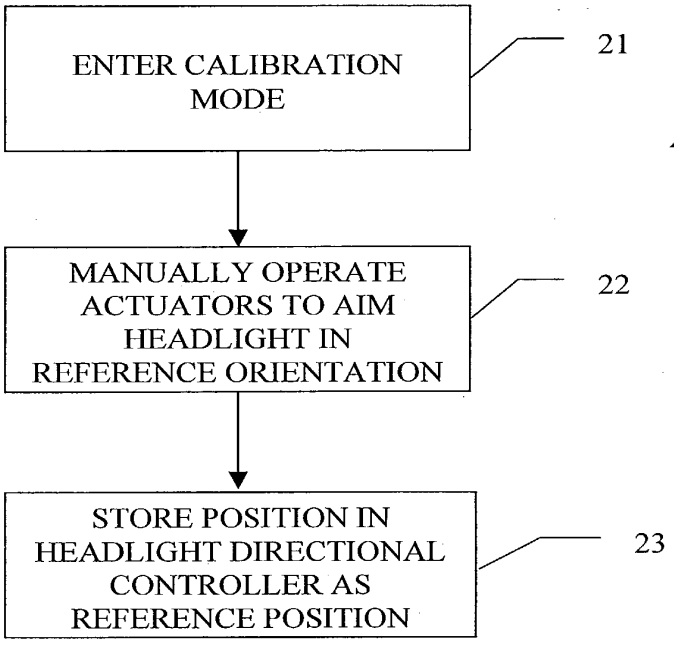
ENTER CALIBRATION MODE
21
20
MANUALLY OPERATE ACTUATORS TO AIM HEADLIGHT IN REFERENCE ORIENTATION
22
STORE POSITION IN HEADLIGHT DIRECTIONAL CONTROLLER AS REFERENCE POSITION
23

FIG. 2

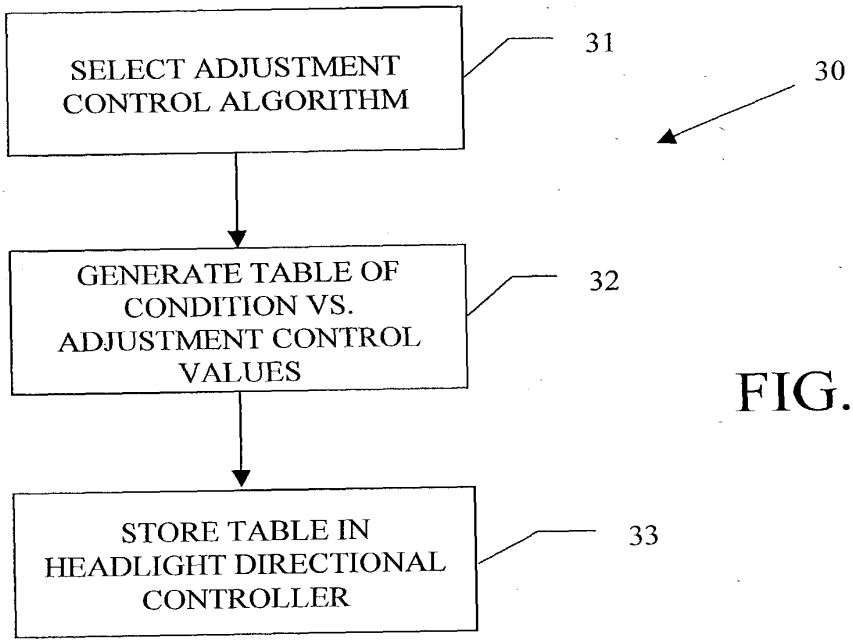
SELECT ADJUSTMENT CONTROL ALGORITHM
31
30
GENERATE TABLE OF CONDITION VS. ADJUSTMENT CONTROL VALUES
32
STORE TABLE IN HEADLIGHT DIRECTIONAL CONTROLLER
33

FIG. 3

40

SENSED CONDITION (STEERING ANGLE) VALUES	UP/DOWN ADJUSTMENT FACTORS	LEFT/RIGHT ADJUSTMENT FACTORS
+6°	-3.00°	+4.50°
+5°	-2.50°	+3.75°
+4°	-2.00°	+3.00°
+3°	-1.50°	+2.25°
+2°	-1.00°	+1.50°
+1°	-0.50°	+0.75°
0°	0.00°	0.00°
-1°	-0.50°	-0.75°
-2°	-1.00°	-1.50°
-3°	-1.50°	-2.25°
-4°	-2.00°	-3.00°
-5°	-2.50°	-3.75°
-6°	-3.00°	-4.50°

FIG. 4

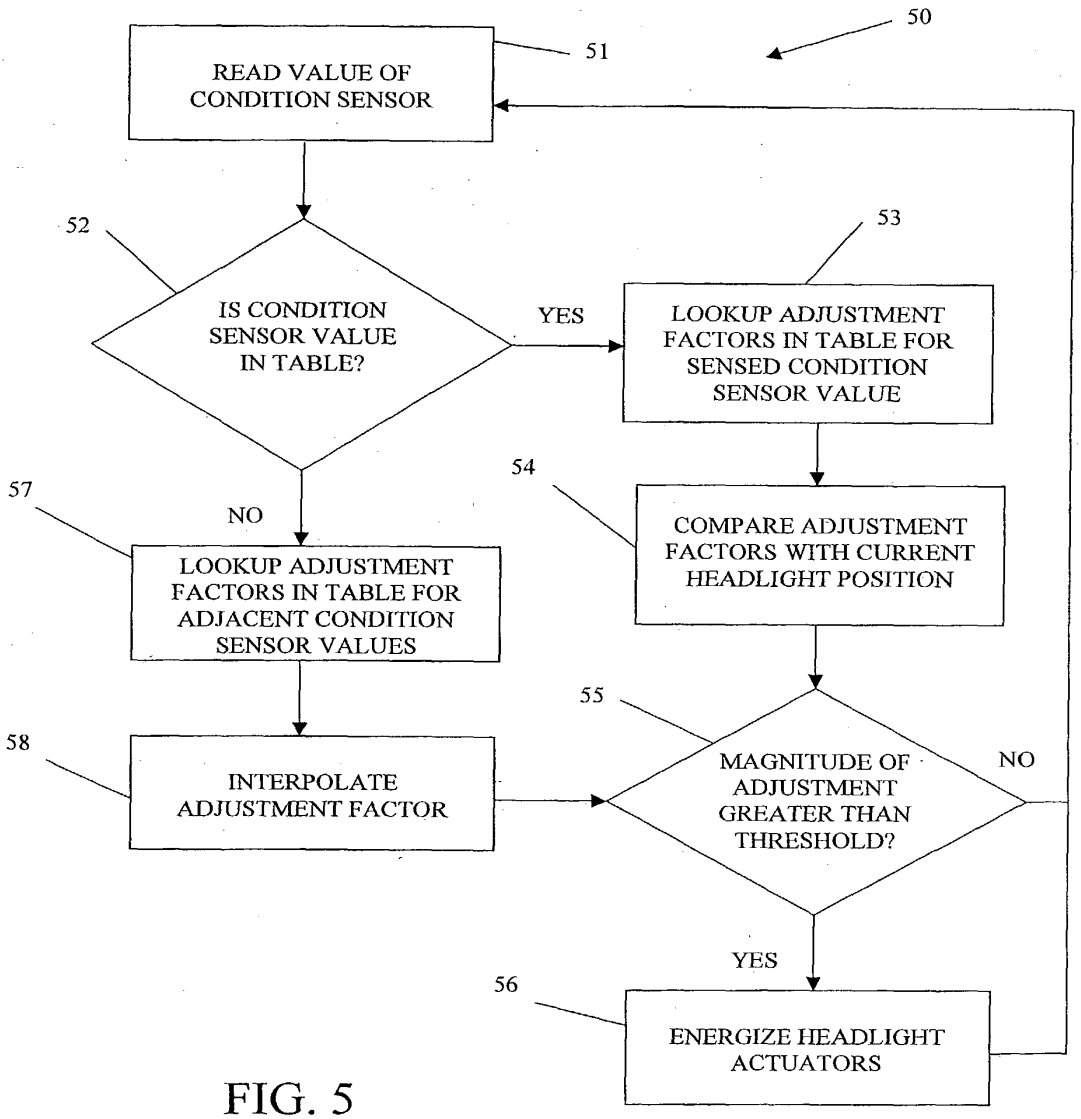
50
READ VALUE OF CONDITION SENSOR
51
52
IS CONDITION SENSOR VALUE IN TABLE?
YES
53
LOOKUP ADJUSTMENT FACTORS IN TABLE FOR SENSED CONDITION SENSOR VALUE
54
COMPARE ADJUSTMENT FACTORS WITH CURRENT HEADLIGHT POSITION
55
MAGNITUDE OF ADJUSTMENT GREATER THAN THRESHOLD?
NO
YES
56
ENERGIZE HEADLIGHT ACTUATORS
57
NO
LOOKUP ADJUSTMENT FACTORS IN TABLE FOR ADJACENT CONDITION SENSOR VALUES
58
INTERPOLATE ADJUSTMENT FACTOR

FIG. 5

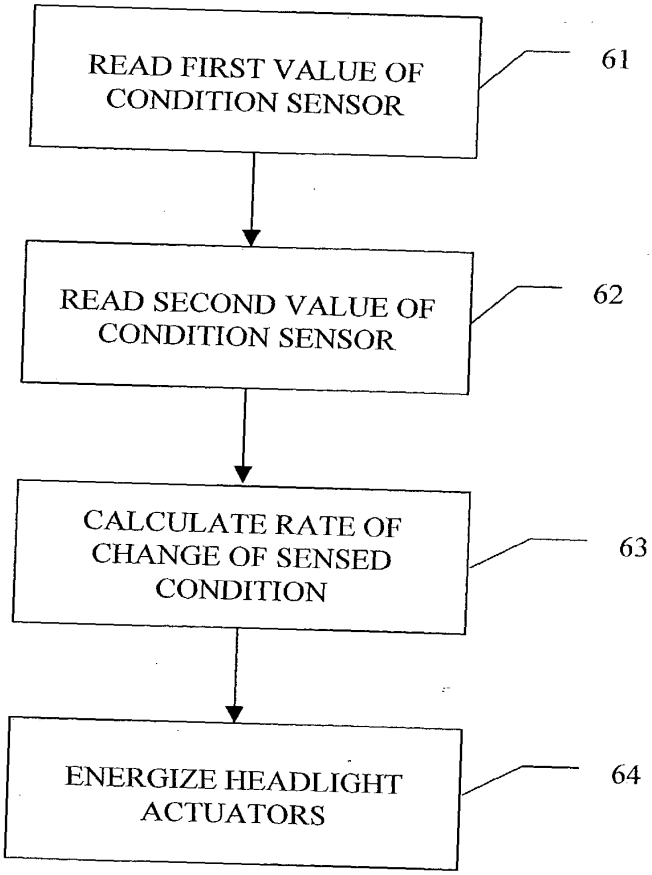
READ FIRST VALUE OF CONDITION SENSOR
61
60
READ SECOND VALUE OF CONDITION SENSOR
62
CALCULATE RATE OF CHANGE OF SENSED CONDITION
63
ENERGIZE HEADLIGHT ACTUATORS
64

FIG. 6

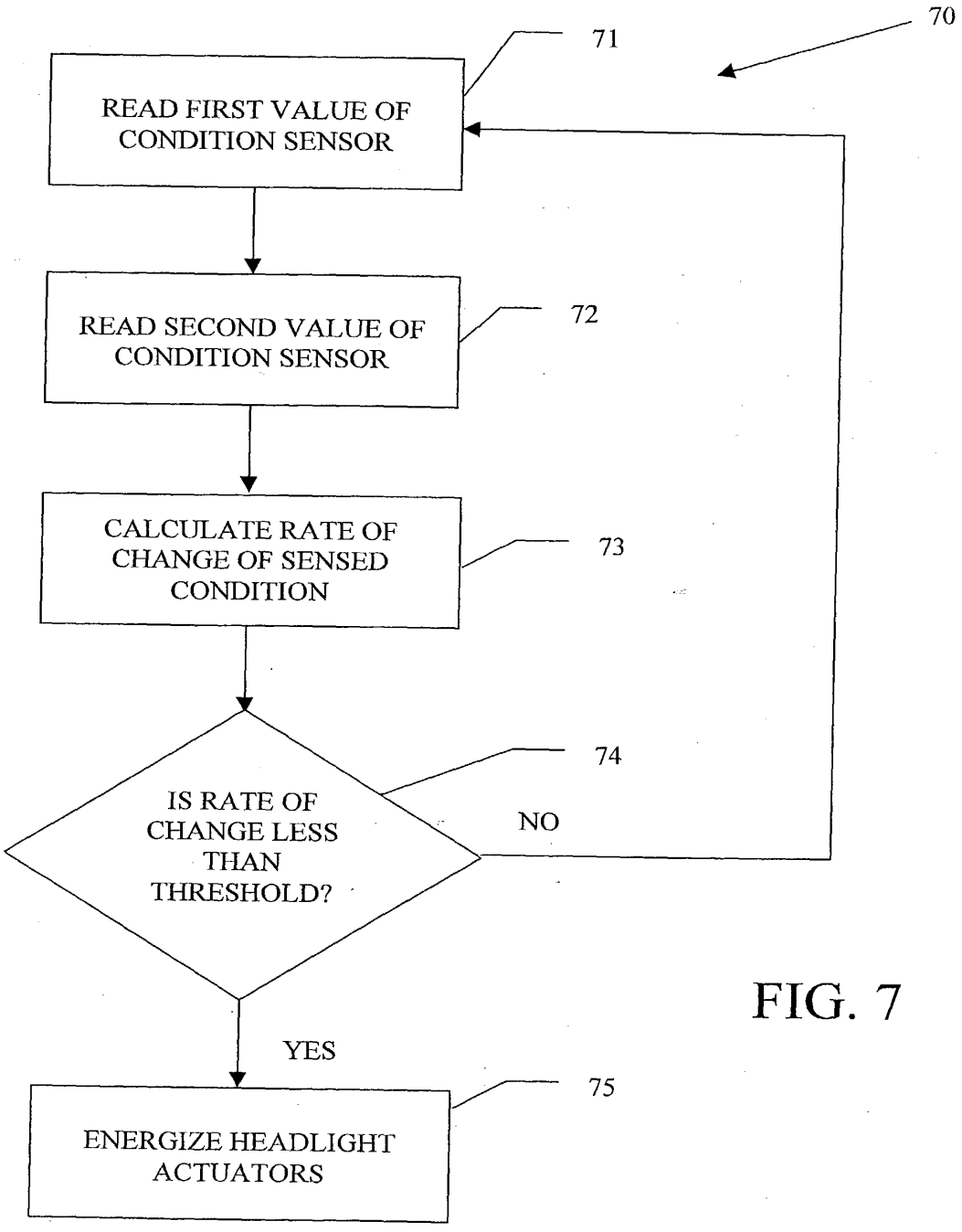
70
71
READ FIRST VALUE OF CONDITION SENSOR
READ SECOND VALUE OF CONDITION SENSOR
72
CALCULATE RATE OF CHANGE OF SENSED CONDITION
73
IS RATE OF CHANGE LESS THAN THRESHOLD?
74
NO
YES
ENERGIZE HEADLIGHT ACTUATORS
75

FIG. 7

COMBINED DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name.

I believe I am the original, first, and sole inventor (if only one name is listed below) or an original, first, and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

AUTOMATIC DIRECTIONAL CONTROL SYSTEM FOR VEHICLE HEADLIGHTS,

the specification of which is attached hereto unless the following box is checked:

[ ] was filed on _____ as U.S. Application Number or PCT International Application Number _____ and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 C.F.R. §1.56.

I hereby claim foreign priority benefits under 35 U.S.C. §119(a)-(d) or §365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)			Priority Claimed	
(Number)	(Country)	(Day/Month/Year Filed)	Yes	No
(Number)	(Country)	(Day/Month/Year Filed)	Yes	No

I hereby claim the benefit under 35 U.S.C. §119(e) of any United States provisional application(s) listed below.

60/335,409 (Application No.)	10/31/01 (Filing Date)
60/356,703 (Application No.)	2/13/02 (Filing Date)
60/369,447 (Application No.)	4/2/02 (Filing Date)

I hereby claim the benefit under 35 U.S.C. §120 of any United States application(s), or §365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. §112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 C.F.R. §1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

(Application No.)	(Filing Date)	(status - patented, pending, abandoned)

I hereby appoint the attorney(s) and/or agent(s) associated with the following Customer Number to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith with full power of substitution and revocation:

27210

PATENT TRADEMARK OFFICE

Address all telephone calls to Richard S. MacMillan at (419) 255-5900.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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Full name of third inventor: _____

Inventor's signature _____ Date: _____

Residence: _____

Citizenship: _____ Post Office Address: _____

Full name of fourth inventor: _____

Inventor's signature _____ Date: _____

Residence: _____

Citizenship: _____ Post Office Address: _____

PATENT APPLICATION FEE DETERMINATION RECORD
Effective October 1, 2001

Application or Docket Number

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)
TOTAL CLAIMS	13	
FOR	NUMBER FILED	NUMBER EXTRA
TOTAL CHARGEABLE CLAIMS	13 minus 20=	*
INDEPENDENT CLAIMS	1 minus 3 =	*
MULTIPLE DEPENDENT CLAIM PRESENT		☐

* If the difference in column 1 is less than zero, enter "0" in column 2

SMALL ENTITY TYPE ☐		OR	OTHER THAN SMALL ENTITY	
RATE	FEE		RATE	FEE
BASIC FEE	370.00	OR	BASIC FEE	740.00
X$ 9=		OR	X$18=	
X42=		OR	X84=	
+140=		OR	+280=	
TOTAL		OR	TOTAL	

CLAIMS AS AMENDED - PART II

AMENDMENT A

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X42=		OR	X84=	
+140=		OR	+280=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT B

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X42=		OR	X84=	
+140=		OR	+280=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT C

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X42=		OR	X84=	
+140=		OR	+280=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20."
***If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3."
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

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Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE

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Washington, DC 20231
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APPLICATION NUMBER	FILING/RECEIPT DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NUMBER
10/285,312	10/31/2002	James E. Smith	I-23649

CONFIRMATION NO. 1413

FORMALITIES LETTER

OC000000009206431

27210
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Date Mailed: 12/05/2002

NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

Filing Date Granted

Items Required To Avoid Abandonment:

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing. Applicant is given **TWO MONTHS** from the date of this Notice within which to file all required items and pay any fees required below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- The statutory basic filing fee is missing.
  Applicant must submit $ **740** *to complete the basic filing fee for a non-small entity. If appropriate, applicant may make a written assertion of entitlement to small entity status and pay the small entity filing fee (37 CFR 1.27).*
- The oath or declaration is unsigned.
- To avoid abandonment, a late filing fee or oath or declaration surcharge as set forth in 37 CFR 1.16(e) of $130 for a non-small entity, must be submitted with the missing items identified in this letter.

SUMMARY OF FEES DUE:

Total additional fee(s) required for this application is **$870** for a Large Entity

- **$740** Statutory basic filing fee.
- **$130** Late oath or declaration Surcharge.

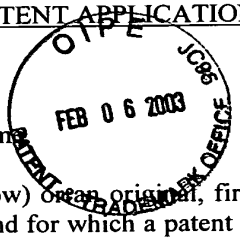
A copy of this notice MUST be returned with the reply.

Customer Service Center
Initial Patent Examination Division (703) 308-1202
PART 3 - OFFICE COPY

Attorney Docket No. 1-23649

#3

COMBINED DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION



As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name.

I believe I am the original, first, and sole inventor (if only one name is listed below) or an original, first, and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

AUTOMATIC DIRECTIONAL CONTROL SYSTEM FOR VEHICLE HEADLIGHTS,

the specification of which is attached hereto unless the following box is checked:

[X] was filed on October 31, 2002 as U.S. Application Number or PCT International Application Number 10/285,312 and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 C.F.R. §1.56.

I hereby claim foreign priority benefits under 35 U.S.C. §119(a)-(d) or §365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)			Priority Claimed	
(Number)	(Country)	(Day/Month/Year Filed)	Yes	No
(Number)	(Country)	(Day/Month/Year Filed)	Yes	No

I hereby claim the benefit under 35 U.S.C. §119(e) of any United States provisional application(s) listed below.

60/335,409 (Application No.)	10/31/01 (Filing Date)
60/356,703 (Application No.)	2/13/02 (Filing Date)
60/369,447 (Application No.)	4/2/02 (Filing Date)

I hereby claim the benefit under 35 U.S.C. §120 of any United States application(s), or §365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. §112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 C.F.R. §1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

(Application No.)	(Filing Date)	(status - patented, pending, abandoned)

I hereby appoint the attorney(s) and/or agent(s) associated with the following Customer Number to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith with full power of substitution and revocation:

Address all telephone calls to Richard S. MacMillan at (419) 255-5900.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of sole or first inventor: James E. Smith

Inventor's signature James E. Smith Date: 1-31-03

Residence: 4753 Richfield Center Road, Berkey, Ohio 43504

Citizenship: U.S.A. Post Office Address: Same

Full name of second inventor: Anthony B. McDonald

Inventor's signature Anthony B. McDonald Date: 1-31-03

Residence: ~~10332 Bramblewood, Perrysburg, Ohio 43551~~ 4136 New Castle 302 Sylvania OH 43560

Citizenship: U.S.A. Post Office Address: Same

Full name of third inventor: _____

Inventor's signature _____ Date: _____

Residence: _____

Citizenship: _____ Post Office Address: _____

Full name of fourth inventor: _____

Inventor's signature _____ Date: _____

Residence: _____

Citizenship: _____ Post Office Address: _____

CERTIFICATE OF MAILING BY FIRST CLASS MAIL

PATENT

MP/1
#3

I hereby certify that this document is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Assistant Commissioner For Patents, Washington, D.C. 20231 on the date set forth below.

Wanda J. Lawrence
(signature)

Date of signature and deposit - 01-31-03

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: JAMES E. SMITH et al.	)	Group Art Unit 2875
Serial No. 10/285,312	)	
Filed: October 31, 2002	)	
For: AUTOMATIC DIRECTIONAL CONTROL SYSTEM FOR VEHICLE HEADLIGHTS	)	Attorney Docket 1-23649

Box Missing Parts
Assistant Commissioner for Patents
Washington, D. C. 20231

RESPONSE TO NOTICE TO FILE MISSING PARTS OF APPLICATION

Honorable Sir:

In response to the Notice To File Missing Parts Of Application dated December 5, 2002, enclosed is an executed Declaration and a copy of the Formalities Letter. Please charge Deposit Account No. 13-0005 in the amount of $880.00 to cover the $750.00 filing fee pursuant to 37 C.F.R. 1.16(a) and the $130.00 surcharge fee pursuant to 37 C.F.R. 1.16(e). A duplicate copy of this paper is enclosed.

Respectfully submitted,

Richard S. MacMillan
Reg. No. 30,085

MacMillan, Sobanski & Todd, LLC
One Maritime Plaza, Fourth Floor
720 Water Street
Toledo, Ohio 43604
(419) 255-5900

#3

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
Washington, DC 20231
www.uspto.gov

APPLICATION NUMBER	FILING/RECEIPT DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NUMBER
10/285,312	10/31/2002	James E. Smith	I-23649

CONFIRMATION NO. 1413

27210
MACMILLAN, SOBANSKI & TODD, LLC
ONE MARITIME PLAZA - FOURTH FLOOR
720 WATER STREET
TOLEDO, OH 43604

FORMALITIES LETTER

OC000000009206431

Date Mailed: 12/05/2002

NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

Filing Date Granted

Items Required To Avoid Abandonment:

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing. Applicant is given **TWO MONTHS** from the date of this Notice within which to file all required items and pay any fees required below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- The statutory basic filing fee is missing.
  Applicant must submit $ **740** *to complete the basic filing fee for a non-small entity. If appropriate, applicant may make a written assertion of entitlement to small entity status and pay the small entity filing fee (37 CFR 1.27).*
- The oath or declaration is unsigned.
- To avoid abandonment, a late filing fee or oath or declaration surcharge as set forth in 37 CFR 1.16(e) of $130 for a non-small entity, must be submitted with the missing items identified in this letter.

SUMMARY OF FEES DUE:

Total additional fee(s) required for this application is **$870** for a Large Entity

- **$740** Statutory basic filing fee.
- **$130** Late oath or declaration Surcharge.

02/07/2003 JBALINAN 00000058 130005 10285312

01 FC:1001 750.00 CH
02 FC:1051 130.00 CH

A copy of this notice MUST be returned with the reply.

Customer Service Center
Initial Patent Examination Division (703) 308-1202
PART 2 - COPY TO BE RETURNED WITH RESPONSE

PATENT 2875

CERTIFICATE OF MAILING BY FIRST CLASS MAIL

I hereby certify that this document is being deposited with the United States Postal Service as first class mail in an envelope addressed to the Commissioner For Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450 on the date set forth below.

Joni Bosch
(signature)
Date of signature and deposit - Sept. 23, 2003

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: JAMES E. SMITH et al.	)	Group Art Unit 2875
Serial No. 10/285,312	)	
Filed: October 31, 2002	)	
For: AUTOMATIC DIRECTIONAL CONTROL SYSTEM FOR VEHICLE HEADLIGHTS	)	Attorney Docket 1-23649

Commissioner For Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

INFORMATION DISCLOSURE STATEMENT

Honorable Sir:

Pursuant to 37 C.F.R. 1.97(b), record is hereby made of information that the Patent Office may wish to consider in connection with its examination of the above-identified application. Copies of such information, as well as a completed PTO-1449 form, are enclosed.

Respectfully submitted,

Richard S. MacMillan
Reg. No. 30,085

MacMillan, Sobanski & Todd
One Maritime Plaza, Fourth Floor
720 Water Street
Toledo, Ohio 43604
(419) 255-5900

1

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

ATTY. DOCKET NO.	SERIAL NO.
1-23649	10/285,312
APPLICANT	
JAMES E. SMITH et al.	
FILING DATE	**GROUP**
October 31, 2002	2875

U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
		3,634,677	1/1972	Stuttgart et al.			
		3,939,339	2/1976	Alphen			
		3,953,726	4/1976	Scarritt, Sr.			
		4,024,388	5/1977	Skoff			
		4,066,886	1/1978	Martin			
		4,162,424	7/1979	Zillgitt et al.			
		4,186,428	1/1980	Deverrewaere			
		4,204,270	5/1980	d'Orsay			
		4,217,631	8/1980	Bergkvist			
		4,225,902	9/1980	Ishikawa et al.			
		4,310,172	1/1982	Claude et al.			
		4,583,152	4/1986	Kawai et al.			
		4,768,135	8/1988	Kretschmer et al.			
		4,791,343	12/1988	Ahrendt			
		4,833,573	5/1989	Miyauchi et al.			
		4,868,720	9/1989	Miyauchi et al.			
		4,868,721	9/1989	Soardo			
		4,870,545	9/1989	Hatanaka et al.			
		4,891,559	1/1990	Matsumoto et al.			
		4,907,877	3/1990	Fukuda et al.			

FOREIGN PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	NO
		EP0306611	3/1989	E.P.O.			(abstract)	

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

DATE CONSIDERED

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

ATTY. DOCKET NO.	SERIAL NO.
1-23649	10/285,312
APPLICANT: JAMES E. SMITH et al.	
FILING DATE: October 31, 2002	GROUP: 2875

U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
		4,908,560	3/1990	Shibata et al.			
		4,916,587	4/1990	Hirose et al.			
		4,943,893	7/1990	Shibata et al.			
		4,948,249	8/1990	Hopkins et al.			
		5,060,120	10/1991	Kobayashi et al.			
		5,099,400	3/1992	Lee			
		5,158,352	10/1992	Ikegami et al.			
		5,164,785	11/1992	Hopkins et al			
		5,181,429	1/1993	Sieber			
		5,193,894	3/1993	Lieter et al.			
		5,331,393	7/1994	Hopkins et al.			
		5,373,357	12/1994	Hopkins et al.			
		5,392,111	2/1995	Murata et al.			
		5,404,278	4/1995	Shibata et al.			
		5,426,571	6/1995	Jones			
		5,428,512	6/1995	Mouzas			
		5,485,265	1/1996	Hopkins			
		5,526,242	6/1996	Takahashi et al.			
		5,550,717	8/1996	Liao			
		5,633,710	5/1997	Kumra			

FOREIGN PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

DATE CONSIDERED

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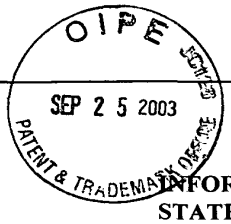

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE

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U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
		5,660,454	8/1997	Mori et al.			
		5,707,129	1/1998	Kobayashi			
		5,751,832	5/1998	Panter et al.			
		5,779,342	7/1998	Kluge			
		5,781,105	7/1998	Bitar et al.			
		5,785,405	7/1998	Huhn			
		5,868,488	2/1999	Speak et al.			
		5,877,680	3/1999	Okuchi et al.			
		5,896,011	4/1999	Zillgitt			
		5,907,196	5/1999	Hayami et al.			
		5,920,386	7/1999	Panter et al.			
		5,938,319	8/1999	Hege			
		5,977,678	11/1999	Miller et al.			
		6,010,237	1/2000	Gotou			
		6,049,749	4/2000	Kobayashi			
		6,097,156	8/2000	Diep			
		6,118,113	9/2000	Hibbard et al.			
		6,142,655	11/2000	Zillgitt et al.			
		6,144,159	11/2000	Lopez et al.			
		6,176,590	1/2001	Prevost et al.			

FOREIGN PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

DATE CONSIDERED

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U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

ATTY. DOCKET NO.	SERIAL NO.
1-23649	10/285,312
APPLICANT: JAMES E. SMITH et al.	
FILING DATE: October 31, 2002	GROUP: 2875

U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
		6,183,118	2/2001	Toda et al.			
		6,193,398	2/2001	Okuchi et al.			
		6,227,691	5/2001	Hogrefe et al.			
		6,231,216	5/2001	Frasch			
		6,234,654	5/2001	Okuchi et al.			
		6,281,632	8/2001	Stam et al.			
		6,293,686	9/2001	Hayami et al.			
		2001/0019225	9/2001	Toda et al.			

FOREIGN PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

DATE CONSIDERED

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

Device for monitoring or controlling the position of an actuator with servomotor and feedback potentiometer.

Patent Number: EP0306611
Publication date: 1989-03-15
Inventor(s): KNITTEL OTTO
Applicant(s):: HELLA KG HUECK & CO (DE)
Requested Patent: ⌜ EP0306611, A3, B1
Application Number: EP19880106455 19880422
Priority Number(s): DE19873727499 19870818
IPC Classification: G05D3/14
EC Classification: G05D3/14H, G05D3/18
Equivalents: ⌜ DE3727499, ES2054728T

Abstract

In a device for the open-loop or closed-loop control of the position of an actuator, in particular an actuator for controlling the passenger compartment temperature or headlight range of motor vehicles, having an electrical open-loop or closed-loop control with a position control circuit, having an electrical adjustment device which can be controlled by means of the open-loop or closed-loop control and which has an adjustment motor with an acknowledgement potentiometer and with an actuator whose position can be changed by the adjustment device, the adjustment device has the position control circuit for the purpose of reducing the number of connecting lines between open-loop or closed-loop control and the electrical adjustment device and the adjustment device can be controlled by a pulse sequence. 

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Veröffentlichungsnummer: **0 306 611 A2**

(12) EUROPÄISCHE PATENTANMELDUNG

(21) Anmeldenummer: **88106455.4**

(51) Int. Cl.⁴: **G05D 3/14**

(22) Anmeldetag: **22.04.88**

Die Bezeichnung der Erfindung wurde geändert (Richtlinien für die Prüfung im EPA, A-III, 7.3).

(30) Priorität: **18.08.87 DE 3727499**

(43) Veröffentlichungstag der Anmeldung: **15.03.89 Patentblatt 89/11**

(84) Benannte Vertragsstaaten: **DE ES FR GB IT SE**

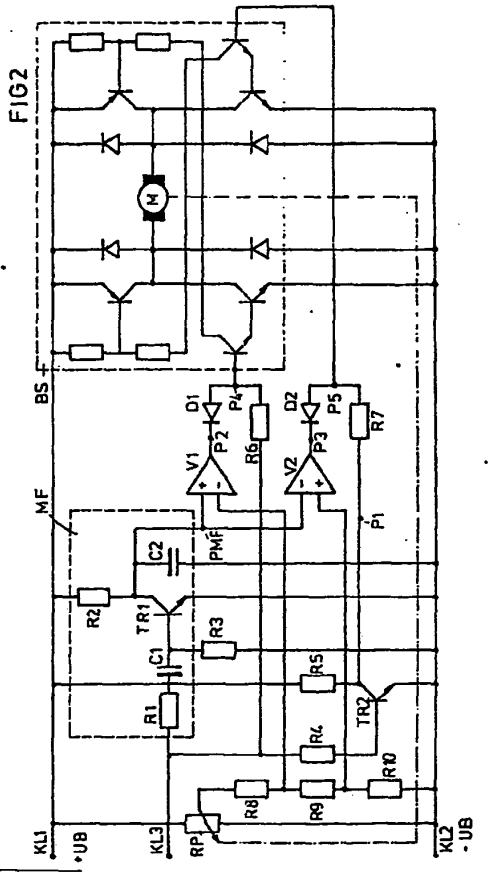
(71) Anmelder: **Hella KG Hueck & Co.**
Postfach 28 40
D-4780 Lippstadt(DE)

(72) Erfinder: **Knittel, Otto**
Grabbeweg 3
D-4770 Soest(DE)

(54) Einrichtung zum Steuern oder Regeln der Lage eines Stellglieds mit Servomotor und Rückmeldepotentiometer.

(57) Bei einer Vorrichtung zum Steuern oder Regeln der Lage eines Stellglieds, insbesondere eines Stellglieds zur Steuerung der Innenraumtemperatur oder Leuchtweite von Kraftfahrzeugen, mit einer elektrischen Steuerung oder Regelung mit einem Lageregelkreis, mit einer elektrischen Stellvorrichtung, die durch die Steuerung oder Regelung steuerbar ist und die einen Stellmotor mit einem Rückmelde-Potentiometer aufweist und mit einem Stellglied, dessen Stellung durch die Stellvorrichtung veränderbar ist, weist die Stellvorrichtung zur Verringerung der Zahl der Verbindungsleitungen zwischen Steuerung oder Regelung und der elektrischen Stellvorrichtung den Lageregelkreis auf und die Stellvorrichtung ist durch eine Pulsfolge steuerbar.

FIG2



EP 0 306 611 A2

Einrichtung zum Steuern oder Regeln der Lage eines Stellglieds, insbesondere eines Stellglieds zum Steuern der Innenraumtemperatur oder Leuchtweite von Kraftfahrzeugen.

Die Erfindung betrifft eine Einrichtung zum Steuern oder Regeln der Lage eines Stellglieds, insbesondere eines Stellglieds zum Steuern der Innenraumtemperatur oder Leuchtweite von Kraftfahrzeugen, mit einer elektrischen Steuerung oder Regelung, mit einem Lageregelkreis, mit einer elektrischen Stellvorrichtung, die durch die Steuerung oder Regelung steuerbar ist und die einen Stellmotor und einen Rückmelde-Potentiometer aufweist und mit einem Stellglied, dessen Stellung durch die Stellvorrichtung veränderbar ist.

Derartige Vorrichtungen werden insbesondere in Kraftfahrzeugen verwendet zur Beeinflussung der Temperatur und/oder der Verteilung der den Kraftfahrzeuginnenraum durchströmenden Luft oder zur Regelung der Leuchtweite von Scheinwerfern. Dazu sind Stellglieder, wie z. B. Luftklappen in Luftschichten oder Wasserventile in Heizwasserkreisläufen von Brennkraftmaschinen der Kraftfahrzeuge erforderlich, deren Stellung durch elektrische Stellvorrichtungen veränderbar sind. Insbesondere Innenraumtemperaturregelvorrichtungen in Kraftfahrzeugen weisen eine Vielzahl z. B. fünf solcher Stellvorrichtungen auf, die durch die Heizungsregelung unabhängig voneinander steuerbar sind.

Aus der DE-OS 35 10 648 ist eine derartige Einrichtung bekannt, die eine Stellvorrichtung mit Stellmotor und Rückmelde-Potentiometer aufweist. Der Stellmotor ist durch die Heizungssteuerung oder Heizungsregelung steuerbar und dient zur Beeinflussung der Stellung des Stellglieds. Das Rückmelde-Potentiometer ist Teil eines Lageregelkreises, der in der Heizungssteuerung oder Heizungsregelung angeordnet ist und der eine der Stellung von Stellglied und Stellmotor entsprechende Spannung an die Heizungssteuerung oder Heizungsregelung zurückmeldet.

Diese vorbekannte Vorrichtung hat jedoch Nachteile. Zur elektrischen Verbindung der Heizungssteuerung oder Heizungsregelung mit jeder Stellvorrichtung sind jeweils mindestens vier Leitungen erforderlich. Zwei Leitungen verbinden den Stellmotor mit der Heizungssteuerung oder Heizungsregelung. Zwei bis drei weitere Leitungen sind zur elektrischen Verbindung des Rückmelde-Potentiometers mit der Heizungssteuerung oder Heizungsregelung notwendig, abhängig davon, ob die Masse an der Kraftfahrzeugkarosserie abgegriffen wird.

Dies verteuert den Aufbau der vorbekannten Einrichtung, weil insbesondere in Kraftfahrzeugen ein Vielzahl elektrischer Leitungen Zeit und kostenaufwendig zu verlegen ist und weil eine große Menge Leitungen zu beschaffen ist.

Durch die Vielzahl erforderlicher Verbindungsleitungen weist die vorbekannte Einrichtung ein vergleichsweise hohes Gewicht auf, das den Forderungen nach energiesparenden Leichtbau, insbesondere von Kraftfahrzeugen, entgegensteht.

Die Leitungen, insbesondere die Rückmelde-Leitung vom Rückmelde-Potentiometer zur Steuerung oder Regelung, sind möglicherweise anfällig für hochfrequente Einstreuungen aus den übrigen Teilen des Kraftfahrzeugbordnetzes bzw. gegen Spannungsschwankungen des Kraftfahrzeugbordnetzes. Dies kann zu Störungen in der Stellungsänderung des Stellgliedes der vorbekannten Einrichtung führen und die vorbekannte Einrichtung störanfällig machen.

Die Erfindung hat die Aufgabe eine Einrichtung zu schaffen, die gegenüber dem Vorbekannten leichter ist und die weniger Verbindungsleitungen und damit weniger Installationsaufwand erfordert.

Diese Aufgbe wird dadurch gelöst, daß die Stellvorrichtung den Lageregelkreis aufweist und daß die Stellvorrichtung durch eine Pulsfolge steuerbar ist.

Dadurch, daß die Stellvorrichtung durch eine Pulsfolge steuerbar ist, ist nur noch eine Leitung zur Steuerung des Stellmotors erforderlich gegenüber zwei Leitungen beim Vorbekannten.

Dadurch, daß die Stellvorrichtung den Lageregelkreis aufweist, ist keine Rückmelde-Leitung zur Rückmeldung einer Schleiferstellung des Rückmelde-Potentiometers an die Steuerung erforderlich.

Durch beide erfindungsgemäßen Maßnahmen kann also die Zahl der erforderlichen Verbindungsleitungen von vier bis fünf, beim Vorbekannten auf eins, zwei bis drei bei der erfindungsgemäßen Vorrichtung reduziert werden.

Die erfindungsgemäße Vorrichtung hat gegenüber dem Vorbekannten den Vorteil, daß der zur Installation der Vorrichtung z. B. im Kraftfahrzeug erforderliche Aufwand, gegenüber dem Vorbekannten verringert ist. Die dadurch erzielte Kostenreduzierung ist so groß, daß ein eventuell erforderlicher Mehraufwand für den Aufbau des Lageregelkreises in der erfindungsgemäßen Stellvorrichtung häufig mehr als kompensiert wird. Dies ist insbesonder dann der Fall, wenn z. B. bei einer Heizungsregelung eines Kraftfahrzeuges ein Vielzahl von Stellvorrichtungen unabhängig voneinander zu steuern ist.

Die erfindungsgemäße Einrichtung hat gegenüber dem Vorbekannten weiterhin den Vorteil der Gewichtsersparnis, weil weniger Leitungen weniger G wicht benötigen.

Weitere vorteilhaft Ausgestaltungen und Weiterbildungen des Erfindungsgegenstands gehen aus den Unteransprüchen hervor.

Ein Ausführungsbeispiel des Erfindungsgegenstands ist in den Zeichnungen dargestellt und wird im folgendem näher erläutert:

Es zeigen

Figur 1 grobschematisch einen Installationsplan einer erfindungsgemäßen Einrichtung ausgebildet als Heizungssteuerung oder -regelung in einem Kraftfahrzeug,

Figur 2 ein Schaltbild einer Stellvorrichtung der erfindungsgemäßen Einrichtung nach Figur 1 und

Figur 3 Spannungszeitdiagramme an verschiedenen Meßpunkten der Stellvorrichtung nach Figur 2.

In der Figur 1 ist der positive Pol einer Stromquelle (B), die als Kraftfahrzeugbatterie ausgebildet sein kann, über einen Schalter (S), der als Zündanlaßschalter eines Kraftfahrzeugschalters ausgebildet sein kann, parallel mit einer Heizungssteuerung oder -regelung (HS) und an einer ersten Klemme (KL1) mit einer Stellvorrichtung (SV) leitend verbunden. Der negative Pol der Kraftfahrzeugbatterie (B) ist ebenfalls parallel mit der Heizungssteuerung oder -regelung (HS) und über eine zweite Klemme (KL2) mit der Stellvorrichtung (SV) leitend verbunden.

Über eine Steuerleitung ist die Heizungssteuerung oder -regelung (HS) mit einer dritten Klemme (KL3) der Stellvorrichtung (SV) leitend verbunden. Über diese Steuerleitung ist die Stellvorrichtung (SV) durch eine Pulsfolge der Heizungsteuerung oder -regelung (HS) steuerbar. Ein Stellmotor (M) der Stellvorrichtung (SV) ist derart mechanisch mit einer Luftklappe (LK) verbunden, daß er abhängig von seiner Bewegung die Stellung der Luftklappe (LK) in einem in den Figuren nicht dargestellten Luftführungskanal verändern kann. Durch diese Veränderung der Stellung der Luftklappe (LK) in einem Luftführungskanal kann der Luftdurchsatz durch den Luftführungskanal gedrosselt werden.

In der Figur 2 sind gleiche oder gleichwirkende Teile wie in der Figur 1 mit den gleichen Bezugszeichen versehen. Die erste Klemme (KL1) ist mit der positiven Versorgungsspannung (+UB) und die zweite Klemme (KL2) ist mit der negativen Versorgungsspannung (-UB) leitend verbunden. Die dritte Klemme (KL3) ist mit der Steuerleitung leitend verbunden zum Empfang der von der Heizungssteuerung oder -regelung (HS) ausgesandten Pulsfolge.

Die dritte Klemme (KL3) ist parallel mit einer monostabilen Kippschaltung oder Monoflop (MF) über einen sechsten Widerstand (R6) mit einem vierten Meßpunkt (P4) und über einen vierten Widerstand (R4) mit der Basis eines zweiten Transistors (TR2) leitend verbunden, dessen Emitter mit der zweiten Klemme (KL2) über einen fünften Widerstand (R5) mit der ersten Klemme (KL1) über einen siebten Widerstand (R7) mit einem fünften Meßpunkt (P5) leitend verbunden sind. Der Monoflop (MF) besteht aus einem ersten Widerstand (R1) an seinem Eingang, der mit der ersten Elektrode eines ersten Kondensators (C1) leitend verbunden ist, dessen zweite Elektrode parallel über einen dritten Widerstand (R3) mit der zweiten Klemme (KL2) und mit der Basis eines ersten NPN-Transistor (TR1) leitend verbunden ist. Der Emitter des ersten Transistors (TR1) ist mit der zweiten Klemme (KL2) leitend verbunden. Der Kollektor des ersten Transistors (TR1) ist parallel über einen zweiten Widerstand (R2) mit der ersten Klemme (KL1) über einen zweiten als Elektrolyd-Kondensator ausgebildeten Kondensator (C2) mit der zweiten Klemme (KL2) und über einen Monoflop-Meßpunkt (PMF) mit dem nichtinvertierenden Eingang eines ersten Vergleichers (V1) und einem invertierenden Eingang eines zweiten Vergleichers (V2) leitend verbunden.

Der Ausgang des ersten Vergleichers (V1) ist über einen zweiten Meßpunkt (P2) und eine antiparallelgeschaltete erste Diode (D1) mit dem vierten Meßpunkt (P4) leitend verbunden, der wiederum mit einer Basis eines Transistors einer bekannten Transistor-Brücken-Schaltung (BS) leitend verbunden ist, die zur Stromversorgung des Stellmotors (M) und zu dessen Umsteuerung dient. Der Ausgang des zweiten Vergleichers (V2) ist über einen dritten Meßpunkt (P3) und eine antiparallelgeschaltete zweite Diode (D2) mit dem fünften Meßpunkt (P5) leitend verbunden, der mit einer Basis eines weiteren Transistors der Transistor-Brücken-Schaltung (BS) leitend verbunden ist. Die Signale an den Meßpunkten (P4, P5) steuern zwei unterschiedlich Brückendiagonalen der Transistor-Brücke (BS) an, wodurch der Stellmotor (M) in seiner Drehrichtung umsteuerbar ist.

Die Stromversorgungsanschlüsse eines Rückmelde-Potentiometers (RP) sind einerseits mit der ersten Klemme (KL1) und andererseits mit der zweiten Klemme (KL2) leitend verbunden. Der Schleiferkontakt des Rückmelde-Potentiometers (RP) ist mit einer Serienschaltung dreier Widerstände (R8, R9, R10) leitend verbunden, dessen anderer Anschluß mit der zweiten Klemme (KL2) leitend verbunden ist. Die Widerstände (R8, R9, R10) bilden einen Spannungsteiler, der zwei Spannungsteiler der zwei Spannungsabgriffe aufweist. Die zwischen dem achten Widerstand (R8) und dem neunten Widerstand (R9) abgegriffen Spannung wird dem invertierenden Eingang des ersten Vergleichers (R1) zugeleitet. Die zwischen dem neunten Widerstand (R9) und dem zehnten Widerstand (R10) abgegriffene Spannung wird dem nichtinvertierenden Eingang des zweiten Vergleichers

chers (V2) zugeleitet. Durch die Größe des neunten Widerstandes (R9) kann ein sogenannter Totbereich festgelegt werden, in dem die erfindungsgemäße Stellvorrichtung (SV) auch bei Änderungen entweder der Stellung der Luftklappe (LK) oder bei Änderungen der Pulsfolge an der Klemme (KL3) nicht in Funktion gesetzt wird . Dies trägt zu einem stabilen Steuerverhalten der Stellvorrichtung (SV) ohne Schwing- oder Flatterneigung bei.

Der Schleifer des Rückmelde-Potentiometers (RP) ist wie durch die strichpunktierte Linie in der Figur 2 dargestellt, mechanisch mit der Welle des Störmotors (M) verbunden, so daß die Stellung des Schleifers und damit der am Spannungsteiler anliegende Spannungswert von der Lage des Stellmotors (M) bzw. von der Stellung der Luftklappe abhängig ist.

Die Funktion der erfindungsgemäß ausgebildeten Stellvorrichtung (SV) nach der Figur 2 wird nun anhand der Figur 3 näher erläutert:

Es sei angenommen, daß an der dritten Klemme (KL3) eine der Figur 3a entsprechende Pulsfolge anliegt. Die Frequenz und damit die Periode (T1) der Pulse sei dabei konstant. Die Pulsbreite der Pulse sei durch die Heizungssteuerung oder -regelung (HS) veränderbar. Das zu einem gegebenen Zeitpunkt (t) an der dritten Klemme (KL3) anliegende Signal bzw. Potential wird dann parallel dem Monoflop (MF), dem vierten Meßpunkt (P4) und der Basis des zweiten Transistors (TR2) zugeführt. Der zweite Transistor (TR2) dient zur Invertierung des Eingangssignals, so daß an einem ersten Meßpunkt (P1) das in der Figur 3b dargestellte zeitabhängige Potential meßbar ist. Die Pulsfolge am ersten Meßpunkt (P1) ist gleich der invertierten Pulsfolge an der Klemme (KL3).

Solange an der dritten Klemme (KL3) negatives oder Massepotential anliegt, befindet sich der erste Transistor (TR1) in seinem nichtstromleitenden Zustand, so daß sich der zweite Kondensator (C2) über den zweiten Widerstand (R2) auflädt. Mit jeder Änderung des Signals an der dritten Klemme (KL3) zu hohem oder Plus-Potential wird der erste Transistor (TR1) leitend geschaltet, so daß sich der zweite Kondensator (C2) über die Emitter-Kollektor-Strecke des ersten Transistors (TR1) entlädt. Demzufolge ist an dem Monoflop-Meßpunkt (PMF) dss in der Figur 3c dargestellte Potential in seinem zeitlichen Verlauf meßbar.

Die Ausgangssignale der Vergl icher (V1 und V2) sind vom Potential vom Monoflop-Meßpunkt (PMF) und von der Spannung am Spannungsteiler, bestehend aus den Widerständen (R8, R9, R10), abhängig. Das Potential am Spannungsteiler wiederum ist abhängig von der Stellung des Schleifers des Rückmelde-Potentiometers (RP), die wiederum von der Stellung der Achse des Stellmotors (M) bzw. von der Stellung der Luftklappe (RK) abhängig ist. In der Figur 3d ist die Spannung am zweiten Meßpunkt (P2) in ihrem zeitlichen Verlauf bei vorgegebenem zeitlichen Verlauf des Potentials an der dritten Klemme (KL3) und bei vorgegebener Schleiferstellung des Rückmelde-Potentiometers (RP) wiedergegeben. In der Figur 3e ist das Potential am dritten Meßpunkt (P3) in seinem zeitlichen Verlauf bei dem gleichen zeitlichen Verlauf der Spannung an der dritten Klemme (KL3) und bei dem gleichen zeitlichen Verlauf der Schleiferstellung des Rückmelde-Potentiometers (RP) wiedergegeben.

Die Spannung am vierten Meßpunkt (P4) und am fünften Meßpunkt (P5) ist abhängig vom Ausgangssignal der Vergleicher (V1 und V2) und von der Spannung an der dritten Klemme (KL3). Der zeitliche Verlauf des Potentials am vierten Meßpunkt (P4) ist in der Figur 3f wiedergegeben. Der zeitliche Verlauf des Potentials am fünften Meßpunkt (P5) ist in der Figur 3g wiedergegeben.

In den ersten drei Perioden der Pulsfolge an der dritten Klemme (KLZ) betrage die Pulsbreite etwa die Hälfte der Periode (T1). In den zweiten drei Perioden der Pulsfolge an der dritten Klemme (KL3) betrage die Pulsdauer etwa 1/4 der Periode (T1). In den dritten drei Perioden der Pulsfolge an der dritten Klemme (KL3) betrage die Pulsbreite etwa 3/4 der Periode (T1). Das invertierte Signal an dem ersten Meßpunkt (P1) zeigt dann das in der Figur 3b dargestellte Verhalten. Der Potentialverlauf am Monoflop-Meßpunkt (PMF) zeigt dann den in etwa in Figur 3c dargestellten zeitabhängigen Verlauf. Weiterhin sei angenommen, daß der Schleifer des Rückmelde-Potentiometers (RP) sich in der ersten, vierten und siebten Periode der Pulsfolge an der dritten Klemme (KL3) in etwa in einer Mittelstellung befinde. In einer zweiten, fünften und achten Periode der Pulsfolge an der Klemme (KL3) befinde sich der Schleifer des Rückmelde-Potentiometer (RP) in einer Stellung, die einem höheren Potential am Spannungsteiler entspricht. In der dritten, sechsten und neunten Periode der Pulsfolge an der dritten Klemme (KL3) befinde sich der Schleifer des Rückmelde-Potentiometers (RP) in einer Stellung, die einem geringeren Potential am Spannungsteiler entspricht. Der Verlauf der Ausgangsspannung der Vergleicher (V1 und V2) entspricht dann den in den Figuren 3d und 3e dargestellten Diagrammen. Am vierten Meßpunkt (P4) und am fünften Meßpunkt (P5) ist genau dann ein von Null verschiedener Steuerstrom zur Steuerung der Transistoren der jeweiligen Brückendiagonale der Transistor-Brücken-Schaltung (BS) vorhanden, wenn sowohl der jeweilige Ausgang des Vergleichers (V1 oder V2), als auch die Spannung entweder an der dritten Klemme (KL3) oder an dem ersten Meßpunkt (P1) hohes Potential aufweisen. Dies ist grundsätzlich nur entweder am vierten

Meßpunkt (P4) oder am fünften Meßpunkt (P5) der Fall, so daß der Stellmotor (M) immer nur jeweils in ein Drehrichtung mit Strom versorgt wird. Die Dauer der Versorgung mit Strom ist dabei von der jeweiligen Zeitdauer abhängig, in der sowohl der Ausgang des jeweiligen Vergleichers, als auch der jeweilige Meßpunkt positives Potential aufweist. Daraus ergibt sich der in der Figur 3f für den vierten Meßpunkt (P4) bzw. der in der Figur 3g für den fünften Meßpunkt (P5) dargestellte zeitliche Verlauf des Potentials.

Man erkennt, daß im Falle der Gleichheit der Potentiometerstellung mit der Vorgabe der Pulsfolge an der dritten Klemme (KL3) die Transistoren beider Brückendiagonalen im geöffneten Zustand sind, so daß der Stellmotor (M) nicht angesteuert wird. Weicht die Potentiometerstellung und damit die Stellung der Luftklappe (LK) von der durch die Pulsfolge vorgegebenen Stellung, so wird die Brükkendiagonale angesteuert, die den Motor und damit die Luftklappe (LK) in Richtung der vorgegebenen Luftklappenstellung bewegt. Dies ist am vierten Meßpunkt (P4) für eine dritte Zeitdauer (t3), eine siebte Zeitdauer (t7), eine achte Zeitdauer (t8) und eine neunte zeitdauer (t9) für eine erste Drehrichtung der Fall. Für eine andere Drehrichtung wird der Stellmotor (M) über das positive Potential am fünften Meßpunkt (P5) für eine zweite Zeitdauer (t2), eine vierte Zeitdauer (t4), eine fünfte Zeitdauer (t5) und eine sechste Zeitdauer (t6) angesteuert.

Man erkennt weiterhin, daß die Zeitdauer oder Pulsbreite, in der der Stellmotor (M) periodisch angesteuert wird, abhängig ist von der Abweichung der Schleiferstellung des Rückmelde-Potentiometers (RP) von der durch die Pulsfolge an der dritten Klemme (KL3) vorgegebenen Größe. Weicht die Schleiferstellung des Rückmelde-Potentiometers (RP) stark von dem durch die Pulsfolge vorgegebenen Sollwert ab, wie dies z. B. während der fünften Zeitdauer (t5) für die andere Drehrichtung und während der neunten Zeitdauer (t9) für die eine Drehrichtung der Fall ist, so wird der Stellmotor (M) entsprechend länger angesteuert. Ist die Abweichung der Schleiferstellung des Rückmelde-Potentiometers (RP) vom durch die Pulsfolge vorgegebenen Sollwert geringer, so wird der Stellmotor (M) z. B. in den Zeitdauern (t2 und t6) für die andere Drehrichtung und in den Zeitdauern (t3 und t8) für die eine Drehrichtung entsprechend kürzer angesteuert. Durch diese Maßnahme wird also die Stellung der Luftklappe (LK) sukzessive und pulsweise der durch die Pulsfolge an der dritten Klemme (KL3) vorgegebenen Größe angeglichen, wobei die Änderungsgeschwindigkeit der Stellung der Luftklappe (KL) mit geringer werdender Abweichung ebenfalls geringer wird, so daß ein Überschwengen der Stellung der Luftklappe über den durch die Pulsfolge vorgegebenen Sollwert hinaus, sicher vermieden wird.

Aus dem Ausführungsbeispiel wird ersichtlich, daß durch die erfindungsgemäßen Maßnahmen der Steuerung der Stellvorrichtung (SV) durch eine Pulsfolge und dadurch, daß die Stellvorrichtung erfindungsgemäß den Lageregelkreis aufweist, nicht nur die Zahl der zwischen der Heizungssteuerung oder -regelung (HS) und der Stellvorrichtung (SV) erforderlichen Verbindungsleitungen wesentlich reduziert ist. Wie das Ausführungsbeispiel zeigt, wird durch die in den Unteransprüchen aufgeführten Maßnahmen die Erfindung vorteilhaft dahingehend ausgestaltet, daß die Verarbeitung der Pulsfolge an der dritten Klemme (KL3) und der Aufbau des Lageregelkreises mit einfachen Mitteln kostengünstig und mit geringer Empfindlichkeit gegen äußere Einflüsse wie z. B. hochfrequente Störstrahlung oder Spannungsschwankung realisiert werden kann.

Die erfindungsgemäße Vorrichtung kann insbesondere aufgrund ihrer Einfachheit und der damit erzielbaren Vorteile nicht nur in Kraftfahrzeugen, sondern auch für andere Räume verwendet werden, deren Temperatur zu steuern oder zu regeln ist.

Ansprüche

1. Einrichtung zum Steuern oder Regeln der Lage eines Stellglieds, insbesondere eines Stellglieds zum Steuern der Innenraumtemperatur oder Leuchtweite von Kraftfahrzeugen, mit einer elektrischen Steuerung oder Regelung, mit einem Lageregelkreis, mit einer elektrischen Stellvorrichtung, die durch die Steuerung oder Regelung steuerbar ist und die einen Stellmotor und einen Rückmelde-Potentiometer aufweist und mit einem Stellglied, dessen Stellung durch die Stellvorrichtung veränderbar ist, dadurch gekennzeichnet, daß die Stellvorrichtung (SV) den Lageregelkreis aufweist und daß die Stellvorrichtung durch eine Pulsfolge steuerbar ist.

2. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß die Pulsfolge eine konstante Periode (T1) aufweist.

3. Vorrichtung nach Anspruch 2, dadurch gekennzeichnet, daß die Pulsfolge eine abhängig von der Steuerung oder Regelung veränderliche Pulsbreite aufweist.

4. Vorrichtung nach Anspruch 3, dadurch gekennzeichnet, dan die Stellvorrichtung (SV) eine monostabile Kippschaltung (MF) aufweist, die die Pulsfolge als Eingangssignal empfängt.

5. Vorrichtung nach Anspruch 4, dadurch gekennzeichnet, daß die Stellvorrichtung zwei Vergleicher (V1, V2) aufweist und daß der nichtinvertierende Eingang des ersten Vergleichers (V1) und der

invertierende Eingang des zweiten Vergleichers (V2) mit dem Ausgang der Kippschaltung (MF) verbunden sind.

6. Vorrichtung nach Anspruch 5, dadurch gekennzeichnet, daß der invertierende Eingang des rsten Vergleichers (V1) und der nichtinvertierende Eingang des zweiten Vergleichers (V2) mit dem Mittelabgriff eines Spannungsteiles verbunden sind, dessen Spannungsabfall von der Stellung des Rückmelde-Potentiometers (RP) abhängig ist.

7. Vorrichtung nach Anspruch 6, dadurch gekennzeichnet, daß der Spannungsteiler drei Widerstände (R8, R9, R10) aufweist und daß die Vergleicher (V1, V2) derart mit dem Spannungsteiler verbunden sind, daß der invertierende Eingang des ersten Vergleichers (Vl) ein höheres Potential aufweist, als der nichtinvertierende Eingang des zweiten Vergleichers (V2).

8. Vorrichtung nach Anspruch 5, dadurch gekennzeichnet, daß der Ausgang des ersten Vergleichers (Vl) über eine erste Diode (D1) mit der ersten Pulsfolge beaufschlagbar ist und/oder daß der Ausgang des zweiten Vergleichers (V2) über eine zweite Diode (D2) mit der invertierten Pulsfolge beaufschlagbar ist.

9. Vorrichtung nach Anspruch 8, dadurch gekennzeichnet, daß der Stellmotor (M) durch eine Brücken-Transistor-Brücken-Schaltung mit Strom beaufschlagbar ist, daß eine erste Brückendiagonale durch den ersten Vergleicher (V1) steuerbar ist und daß eine zweite Brückendiagonale durch den zweiten Vergleicher (V2) steuerbar ist.

FIG 3

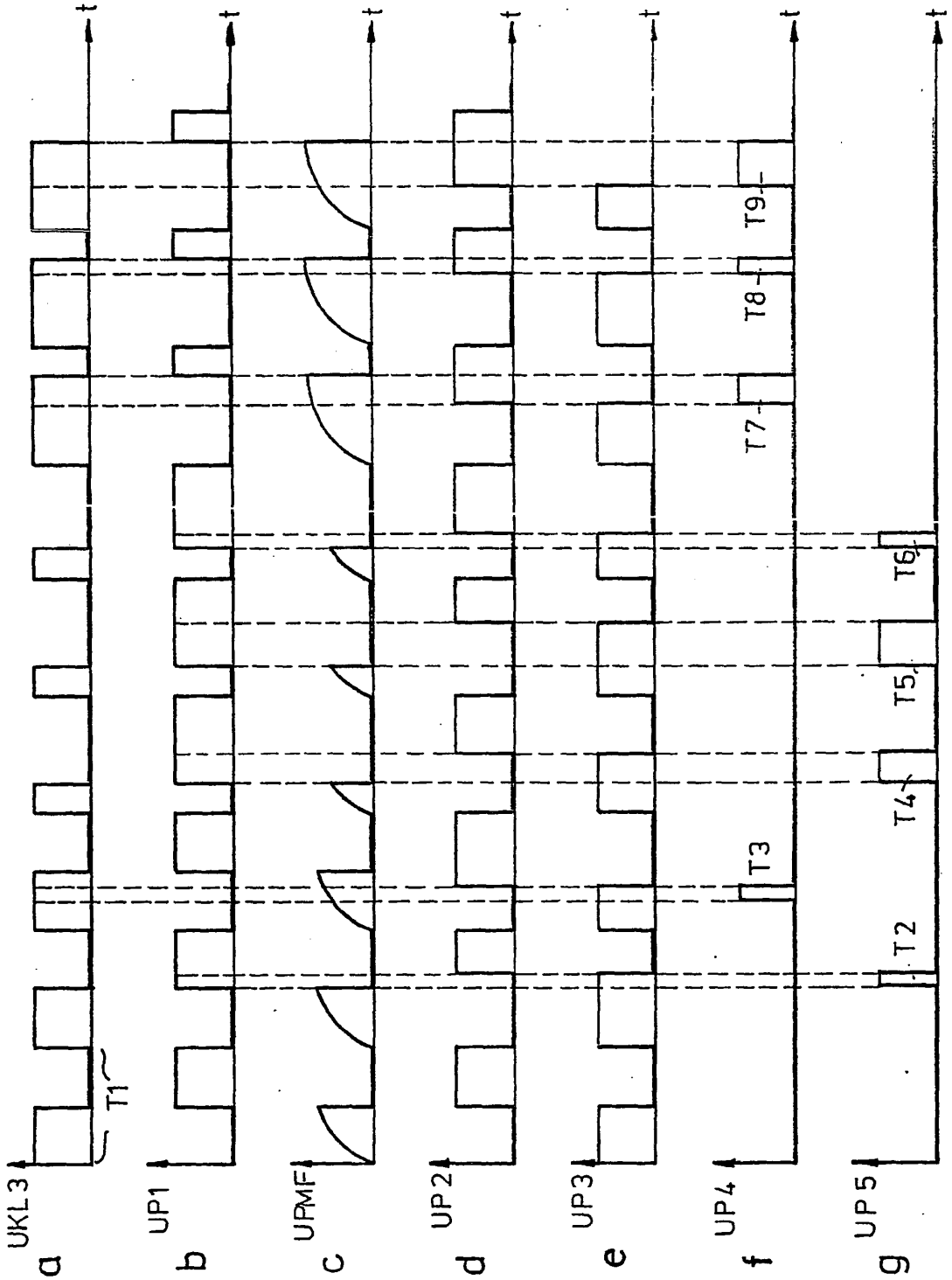


FIG2

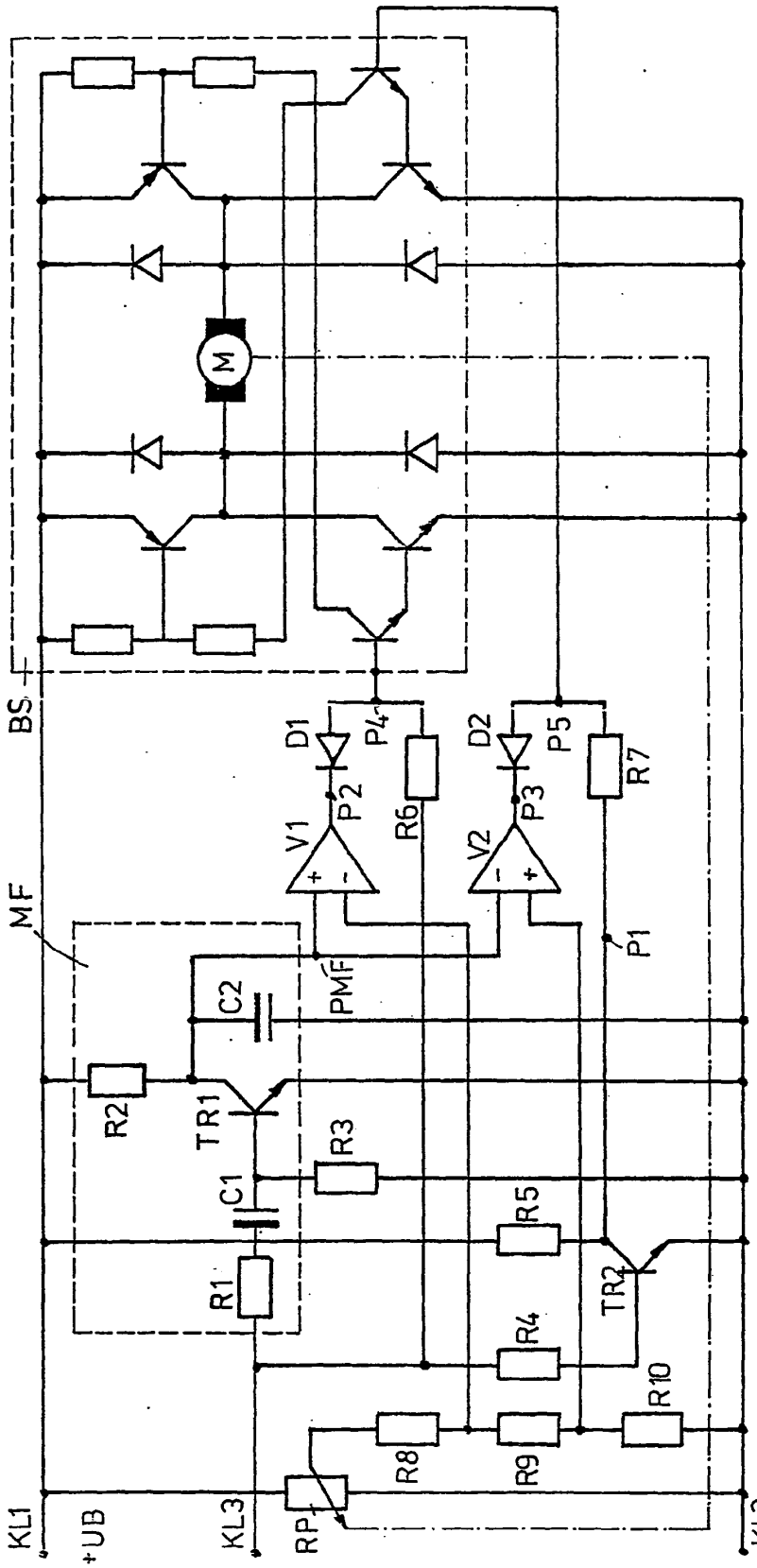
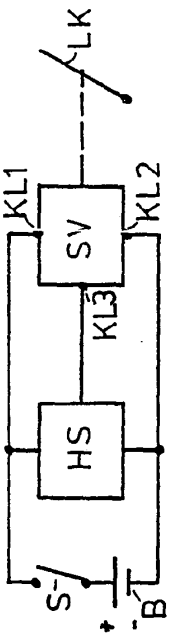

M
BS
D1
P4
D2
P5
R7
P2
R6
V1
V2
P3
MF
P1
PMF
C2
R2
TR1
R3
C1
R5
R1
TR2
R4
R10
R8
R9
KL1
+UB
KL3
RP1
KL2
-UB

FIG1


LK
KL1
SV
KL2
KL3
HS
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27210 7590 12/23/2003

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EXAMINER	
ALAVI, ALI	

ART UNIT	PAPER NUMBER
2875	

DATE MAILED: 12/23/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Office Action Summary	Application No.	Applicant(s)	
	10/285,312	SMITH ET AL.	
	Examiner	Art Unit	
	Ali Alavi	2875	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *31 October 2002*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-13* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-13* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

13)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

a) ☐ The translation of the foreign language provisional application has been received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *10/02*.
4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

Information Disclosure Statement

1. The references on PTO 1499 submitted on 10/31/2002 are acknowledged. All the cited references have been considered. However the foreign patents and documents cited by applicant are considered to the extent that could be understood from the abstract and drawings. Patent applicant has duty not just to disclose pertinent prior art references but to make the disclosure in such way as not to "bury" it within other disclosures of less relevant prior art; See Golden Valley Microwave Foods Inc. v. Weaver Popcorn Co. Inc., 24 USPQ2d 1801 (N.D.I. 1992); Molins PLC v. Textron Inc., 26 USPQ2d 1889, at 1899 (D. Del. 1992); Penn Yan Boats, Inc. v. Sea Lark Boats, Inc. et al., 175 USPQ 260, at 272 (S.D. Fl. 1972).

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-2, 4-8, 10-13 are rejected under 35 U.S.C. 102(e) as being anticipated by Toda et al (U.S. Pat. No 6,305,823).

Toda et al discloses an automatic directional control system for a vehicle headlight comprising: a sensor (12, 14) that is adapted to generate a signal that is

representative of a condition of the vehicle, said sensed condition includes one or more of road speed (12), and suspension height (14) of the vehicle; a controller (16) that is responsive to said sensor signal for generating an output signal; and an actuator (10) that is adapted to be connected to the headlight to effect movement thereof in accordance with said output signal, wherein said sensor generates a signal that is representative of the road speed of the vehicle (see abstract), speed sensor (12), Height sensor (14).

Claims 1-2, 4-8, 10-13 are rejected under 35 U.S.C. 102(e) as being anticipated by Okuchi et al (U.S. Pat. No 6,193,398).

Okuchi et al discloses an automatic directional control system for a vehicle headlight comprising: a sensor (12) that is adapted to generate a signal that is representative of a condition of the vehicle, said sensed condition includes one or more of road speed (12) a controller (20) that is responsive to said sensor signal for generating an output signal; and an actuator (35) that is adapted to be connected to the headlight to effect movement thereof in accordance with said output signal, wherein said sensor generates a signal that is representative of the road speed of the vehicle (see abstract), speed sensor (12), pitch angle (2103, fig. 9), suspension height (2201, 2203, fig. 14).

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-3 and 9 are rejected under 35 U.S.C. 102(b) as being anticipated by Gotoh (US Pat. No 5,909,949).

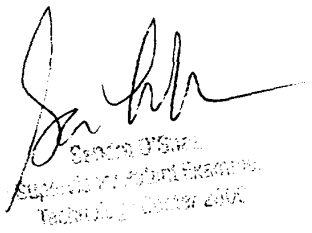
Gotoh discloses an automatic directional control system for a vehicle headlight comprising: a sensor (22) that is adapted to generate a signal that is representative of a condition of the vehicle, said sensed condition includes one or more of road speed (22), and steering angle (21) and a controller (10) that is responsive to said sensor signal for generating an output signal; and an actuator (24) that is adapted to be connected to the headlight to effect movement thereof in accordance with said output signal, wherein said sensor generates a signal that is representative of the road speed of the vehicle (see abstract).

Conclusion

4. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Kobayashi (US Pat. No 6,049,749) discloses a lighting device for a vehicle light including a road profile calculation (2) and vehicle advancing direction predicting means (3), and vehicle speed sensor (7) is cited of interest.

5. Any inquiry concerning this communication or earlier communication from the examiner should be directed to Ali Alavi whose telephone number is (703) 305-0522. The examiner can normally be reached between 8:00 A.M. to 6:30 P.M. Tuesday to Friday. If attempts to reach the examiner by phone are unsuccessful, the examiner's supervisor, Sandy O'Shea can be reached at (703) 305-4939 or you may fax your inquiry to the **Central Fax** at (703) 872-9306.

Ali Alavi



U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

ATTY. DOCKET NO.	SERIAL NO.
1-23649	10/285,312
APPLICANT: JAMES E. SMITH et al.	
FILING DATE: October 31, 2002	GROUP: 2875

U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
		3,634,677	1/1972	Stuttgart et al.	362	467	
		3,939,339	2/1976	Alphen	362	467	
		3,953,726	4/1976	Scarritt, Sr.	362	465	
		4,024,388	5/1977	Skoff	362	467	
		4,066,886	1/1978	Martin	362	465	
		4,162,424	7/1979	Zillgitt et al.	362	467	
		4,186,428	1/1980	Deverrewaere	362	466	
		4,204,270	5/1980	d'Orsay	362	466	
		4,217,631	8/1980	Bergkvist	362	466	
		4,225,902	9/1980	Ishikawa et al.	318	696	
		4,310,172	1/1982	Claude et al.	362	466	
		4,583,152	4/1986	Kawai et al.	280	6.158	
		4,768,135	8/1988	Kretschmer et al.	362	40	
		4,791,343	12/1988	Ahrendt	362	348	
		4,833,573	5/1989	Miyauchi et al.	362	466	
		4,868,720	9/1989	Miyauchi et al.	362	466	
		4,868,721	9/1989	Soardo	362	466	
		4,870,545	9/1989	Hatanaka et al.	315	82	
		4,891,559	1/1990	Matsumoto et al.	356	121	
		4,907,877	3/1990	Fukuda et al.	318	603	

FOREIGN PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
		EP0306611	3/1989	E.P.O.			(abstract)	

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

DATE CONSIDERED 12/12/03

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

ATTY. DOCKET NO.	SERIAL NO.
1-23649	10/285,312
APPLICANT: JAMES E. SMITH et al.	
FILING DATE: October 31, 2002	GROUP: 2875

U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
AM		4,908,560	3/1990	Shibata et al.	318	603	
		4,916,587	4/1990	Hirose et al.	362	460	
		4,943,893	7/1990	Shibata et al.	362	37	
		4,948,249	8/1990	Hopkins et al.	356	121	
		5,060,120	10/1991	Kobayashi et al.	362	465	
		5,099,400	3/1992	Lee	362	37	
		5,158,352	10/1992	Ikegami et al.	362	359	
		5,164,785	11/1992	Hopkins et al	356	121	
		5,181,429	1/1993	Sieber	74	89.42	
		5,193,894	3/1993	Lieter et al.	362	466	
		5,331,393	7/1994	Hopkins et al.	356	121	
		5,373,357	12/1994	Hopkins et al.	356	121	
		5,392,111	2/1995	Murata et al.	356	121	
		5,404,278	4/1995	Shibata et al.	362	464	
		5,426,571	6/1995	Jones	362	466	
		5,428,512	6/1995	Mouzas	362	464	
		5,485,265	1/1996	Hopkins	356	121	
		5,526,242	6/1996	Takahashi et al.	362	466	
		5,550,717	8/1996	Liao	362	467	
AM		5,633,710	5/1997	Kumra	362	464	

FOREIGN PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

DATE CONSIDERED 12/12/03

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

OIPE SEP 2 5 2003 PATENT & TRADEMARK OFFICE

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

ATTY. DOCKET NO.	SERIAL NO.
1-23649	10/285,312
APPLICANT	
JAMES E. SMITH et al.	
FILING DATE	**GROUP**
October 31, 2002	2875

U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
AS		5,660,454	8/1997	Mori et al.			
		5,707,129	1/1998	Kobayashi	362	464	
		5,751,832	5/1998	Panter et al.	362	104	
		5,779,342	7/1998	Kluge	362	507	
		5,781,105	7/1998	Bitar et al.	340	468	
		5,785,405	7/1998	Huhn	362	459	
		5,868,488	2/1999	Speak et al.	362	37	
		5,877,680	3/1999	Okuchi et al.	340	468	
		5,896,011	4/1999	Zillgitt	340	468	
		5,907,196	5/1999	Hayami et al.	307	10.8	
		5,920,386	7/1999	Panter et al.	356	121	
		5,938,319	8/1999	Hege	362	459	
		5,977,678	11/1999	Miller et al.	310	103	
		6,010,237	1/2000	Gotou	362	460	
		6,049,749	4/2000	Kobayashi	701	49	
		6,097,156	8/2000	Diep	315	82	
		6,118,113	9/2000	Hibbard et al.	250	205	
		6,142,655	11/2000	Zillgitt et al.	362	466	
		6,144,159	11/2000	Lopez et al.	315	82	
CH		6,176,590	1/2001	Prevost et al.	362	37	

FOREIGN PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

	DATE CONSIDERED	12/12/03

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE

ATTY. DOCKET NO.	SERIAL NO.
1-23649	10/285,312

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

APPLICANT: JAMES E. SMITH et al.

FILING DATE	GROUP
October 31, 2002	2875

U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
AH		6,183,118	2/2001	Toda et al.	362	465	
		6,193,398	2/2001	Okuchi et al.	362	466	
		6,227,691	5/2001	Hogrefe et al.	362	539	
		6,231,216	5/2001	Frasch	362	464	
		6,234,654	5/2001	Okuchi et al.	362	466	
		6,281,632	8/2001	Stam et al.	315	82	
		6,293,686	9/2001	Hayami et al.	362	465	
AH		2001/0019225	9/2001	Toda et al.			

FOREIGN PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

Ali Ola	DATE CONSIDERED	12/12/03

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

Notice of References Cited	Application/Control No. 10/285,312	Applicant(s)/Patent Under Reexamination SMITH ET AL.	
	Examiner Ali Alavi	Art Unit 2875	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
	A	US-6,305,823	10-2001	Toda et al.	362/276
	B	US-6,193,398	02-2001	Okuchi et al.	362/466
	C	US-6,049,749	04-2000	Kobayashi, Shoji	701/49
	D	US-5,909,949	06-1999	Gotoh, Shinichiro	362/37
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
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	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Index of Claims

Application No.	Applicant(s)
10/285,312	SMITH ET AL.
Examiner	**Art Unit**
Ali Alavi	2875

√	Rejected	–	(Through numeral) Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

Claim		Date
Final	Original	
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Claim		Date
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Search Notes	Application No.	Applicant(s)	
	10/285,312	SMITH ET AL.	
	Examiner	Art Unit	
	Ali Alavi	2875	

SEARCHED			
Class	Subclass	Date	Examiner
362	37	12/12/2003	AA
	465		
	466		
315	82		
701	49	12/12/03	AA

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
EAST/BRS IS & R Databases: USPAT; PGPUB; JP; EP Search report attached.	12/12/2003	AA

Image

2875

AMENDMENT TRANSMITTAL LETTER (Large Entity) Applicant(s): James E. Smith and Anthony B. McDonald				Docket No. 1-23649
Serial No. 10/285,312	Filing Date October 31, 2002		Examiner Ali Alavi	Group Art Unit 2875

Invention:

AUTOMATIC DIRECTIONAL CONTROL SYSTEM FOR VEHICLE HEADLIGHTS

TO THE COMMISSIONER FOR PATENTS:

Transmitted herewith is an amendment in the above-identified application.

The fee has been calculated and is transmitted as shown below.

CLAIMS AS AMENDED

	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST # PREV. PAID FOR		NUMBER EXTRA CLAIMS PRESENT	RATE	ADDITIONAL FEE
TOTAL CLAIMS	12	-	20	=	0	x $18.00	$0.00
INDEP. CLAIMS	2	-	3	=	0	x $86.00	$0.00
Multiple Dependent Claims (check if applicable) ☐							$0.00
TOTAL ADDITIONAL FEE FOR THIS AMENDMENT							$0.00

☒ No additional fee is required for amendment.

☐ Please charge Deposit Account No. in the amount of

☐ A check in the amount of to cover the filing fee is enclosed.

☒ The Director is hereby authorized to charge payment of the following fees associated with this communication or credit any overpayment to Deposit Account No. **13-0005**

- ☒ Any additional filing fees required under 37 C.F.R. 1.16.
- ☒ Any patent application processing fees under 37 CFR 1.17.

Richard S. MacMillan

Signature

Dated: **March 23, 2004**

Richard S. MacMillan, Reg. No. 30,085
MacMillan, Sobanski & Todd, LLC
One Maritime Plaza, Fourth Floor
720 Water Street
Toledo, OH 43604
Telephone: (419) 255-5900
Facsimile: (419) 255-9639

cc:

I certify that this document and fee is being deposited on **March 23, 2004** with the U.S. Postal Service as first class mail under 37C.F.R. 1.8 and is addressed to the for Patents, P.O. Box 1450, ALexandria, VA 22313-1450.

Toni Bosch

Signature of Person Mailing Correspondence

Toni Bosch

Typed or Printed Name of Person Mailing Correspondence

P11LARGE/REV06

PATENT

CERTIFICATE OF MAILING BY FIRST CLASS MAIL

I hereby certify that this document is being deposited with the United States Postal Service as first class mail in an envelope addressed to the Commissioner For Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450 on the date set forth below.

Joni BOSCH
(signature)

Date of signature and deposit - March 23, 2004

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	)	
JAMES E. SMITH et al.	)	Group Art Unit 2875
	)	
Serial No. 10/285,312	)	
	)	Examiner Ali Alavi
Filed: October 31, 2002	)	
	)	
For: AUTOMATIC DIRECTIONAL CONTROL SYSTEM FOR VEHICLE HEADLIGHTS	)	Attorney Docket 1-23649

Commissioner For Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

AMENDMENT

Honorable Sir:

Please amend the above-identified application as indicated on the following pages.

AMENDMENTS TO THE CLAIMS

1. (Currently Amended) An automatic directional control system for a vehicle headlight comprising:

a sensor that is adapted to generate a signal that is representative of a condition of the vehicle, said sensed condition includes one or more of road speed, steering angle, pitch, and suspension height of the vehicle;

a controller that is responsive to said sensor signal for generating an output signal only when said sensor signal changes by more than a predetermined amount; and

an actuator that is adapted to be connected to the headlight to effect movement thereof in accordance with said output signal.

2. (Original) The automatic directional control system defined in Claim 1 wherein said sensor generates a signal that is representative of the road speed of the vehicle.

3. (Original) The automatic directional control system defined in Claim 1 wherein said sensor generates a signal that is representative of the steering angle of the vehicle.

4. (Original) The automatic directional control system defined in Claim 1 wherein said sensor generates a signal that is representative of the pitch of the vehicle.

5. (Original) The automatic directional control system defined in Claim 1 wherein said sensor generates a signal that is representative of the suspension height of the vehicle.

6. (Cancelled).

7. (Currently Amended) An ~~The~~ automatic directional control system ~~defined in Claim 1 wherein said~~ for a vehicle headlight comprising:

a sensor that is adapted to generate a signal that is representative of a condition of the vehicle, said sensed condition includes one or more of road speed, steering angle, pitch, and suspension height of the vehicle;

a controller that is responsive to a rate of change of said sensor signal for generating said output signal; and

an actuator that is adapted to be connected to the headlight to effect movement thereof in accordance with said output signal.

8. (Original) The automatic directional control system defined in Claim 7 wherein said sensor generates a signal that is representative of the rate of change of the road speed of the vehicle.

9. (Original) The automatic directional control system defined in Claim 7 wherein said sensor generates a signal that is representative of the rate of change of the steering angle of the vehicle.

10. (Original) The automatic directional control system defined in Claim 7 wherein said sensor generates a signal that is representative of the rate of change of the pitch of the vehicle.

11. (Original) The automatic directional control system defined in Claim 7 wherein said sensor generates a signal that is representative of the rate of change of the suspension height of the vehicle.

12. (Original) The automatic directional control system defined in Claim 7 wherein said controller generates said output signal only when the rate of change of said sensor signal changes by more than a predetermined threshold amount.

13. (Original) The automatic directional control system defined in Claim 1 further including a plurality of sensors adapted to generate a respective plurality of signals that are representative of a respective plurality of conditions of the vehicle, and wherein said controller is responsive to said plurality of sensor signals for generating said output signal.

REMARKS

Independent Claim 1 has been amended to include the salient limitation of Claim 6. Claim 1 now defines the invention as an automatic directional control system for a vehicle headlight that includes a sensor that is adapted to generate a signal that is representative of a condition of the vehicle, wherein the sensed condition includes one or more of road speed, steering angle, pitch, and suspension height of the vehicle. A controller is responsive to the sensor signal for generating an output signal only when the sensor signal changes by more than a predetermined amount. Lastly, an actuator is adapted to be connected to the headlight to effect movement thereof in accordance with the output signal. None of the art of record is believed to show or suggest a controller that is responsive to the sensor signal for generating an output signal only when the sensor signal changes by more than a predetermined amount.

Claim 7 has been re-written in independent form. Claim 7 defines the invention as an automatic directional control system for a vehicle headlight including a sensor that is adapted to generate a signal that is representative of a condition of the vehicle, wherein the sensed condition includes one or more of road speed, steering angle, pitch, and suspension height of the vehicle. A controller is responsive to a rate of change of the sensor signal for generating the output signal. Lastly, an actuator is adapted to be connected to the headlight to effect movement thereof in accordance with the output signal. None of the art of record is believed to show or suggest a controller that is responsive to a rate of change of the sensor signal for generating the output signal.

Respectfully submitted,

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Reg. No. 30,085

MacMillan, Sobanski & Todd, LLC
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(419) 255-5900

PATENT APPLICATION FEE DETERMINATION RECORD
Effective October 1, 2001

Application or Docket Number: 10/285312

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)
TOTAL CLAIMS	13	
FOR	NUMBER FILED	NUMBER EXTRA
TOTAL CHARGEABLE CLAIMS	13 minus 20=	*
INDEPENDENT CLAIMS	1 minus 3 =	*
MULTIPLE DEPENDENT CLAIM PRESENT		☐

* If the difference in column 1 is less than zero, enter "0" in column 2

SMALL ENTITY TYPE ☐		OR	OTHER THAN SMALL ENTITY	
RATE	FEE		RATE	FEE
BASIC FEE	370.00	OR	BASIC FEE	740.00
X$ 9=		OR	X$18=	
X42=		OR	X84=	
+140=		OR	+280=	
TOTAL		OR	TOTAL	

CLAIMS AS AMENDED - PART II

AMENDMENT A

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	* 12	Minus	** 20	=
Independent	* 2	Minus	*** 3	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
~~X$ 9=~~		OR	X$18=	
X42=		OR	~~X84=~~	
+140=		OR	+280=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT B

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X42=		OR	X84=	
+140=		OR	+280=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT C

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X42=		OR	X84=	
+140=		OR	+280=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20."
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3."
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

L Number	Hits	Search Text	DB	Time stamp
15	332	(362/507).CCLS.	USPAT; US-PGPUB; EPO; JPO; DERWENT	2004/06/12 11:13
16	174	(362/526).CCLS.	USPAT; US-PGPUB; EPO; JPO; DERWENT	2004/06/12 11:13
17	55	(362/446).CCLS.	USPAT; US-PGPUB; EPO; JPO; DERWENT	2004/06/12 11:14
18	192	(362/466).CCLS.	USPAT; US-PGPUB; EPO; JPO; DERWENT	2004/06/12 11:14
19	712	(362/802).CCLS.	USPAT; US-PGPUB; EPO; JPO; DERWENT	2004/06/12 11:14
20	680	(362/276).CCLS.	USPAT; US-PGPUB; EPO; JPO; DERWENT	2004/06/12 11:15
-	0	("lightnear3(guideplate)near3increas$4near5(sensit$).PN.	USPAT; US-PGPUB; EPO; JPO; DERWENT	2004/06/12 11:12
-	0	headlight and sensor and contrl$4 and actua$4	USPAT; US-PGPUB; EPO; JPO; DERWENT	2004/06/12 11:13
-	1660	headlight and sensor and control$4 and actua$4	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/12/11 14:55
-	160	362/$.ccls. and (headlight and sensor and control$4 and actua$4)	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/12/11 14:55
-	0	((362/$.ccls. and (headlight and sensor and control$4 and actua$4)) and (angle pitch speed height)) and atomatic near2 direct$5 near3 control	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/12/11 14:58
-	0	((362/$.ccls. and (headlight and sensor and control$4 and actua$4)) and (angle pitch speed height)) and atomatic near2 direct$5	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/12/11 14:57
-	2	((362/$.ccls. and (headlight and sensor and control$4 and actua$4)) and (angle pitch speed height)) and automatic near2 direct$5 near3 control	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/12/11 14:58
-	140	(362/$.ccls. and (headlight and sensor and control$4 and actua$4)) and (angle pitch speed height)	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/12/11 15:19
-	16	((362/$.ccls. and (headlight and sensor and control$4 and actua$4)) and (angle pitch speed height)) and 362/465.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/12/11 15:19
-	14	(("6,183,118") or ("6,193,398") or ("6,227,691") or ("6,231,216") or ("6,234,654") or ("6,281,632") or ("6,293,686")).PN. or (2001/0019225).CCLS.	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/12/12 09:34

-	89	(("6,183,118") or ("6,193,398") or ("6,227,691") or ("6,231,216") or ("6,234,654") or ("6,281,632") or ("6,293,686") or ("5,707,129") or ("5,751,832") or ("5,779,342") or ("5,781,105") or ("5,785,405") or ("5,868,488") or ("5,877,680") or ("5,896,011") or ("5,907,196") or ("5,920,386") or ("5,938,319") or ("5,977,678") or ("6,010,237") or ("6,049,749") or ("6,097,156") or ("6,118,113") or ("6,142,655") or ("6,144,159") or ("6,176,590") or ("4,908,560") or ("4,916,587") or ("4,943,893") or ("4,948,249") or ("5,060,120") or ("5,099,400") or ("5,158,352") or ("5,164,785") or ("5,181,429") or ("5,193,894") or ("5,331,393") or ("5,373,357") or ("5,392,111") or ("5,404,278") or ("5,426,571") or ("5,428,512") or ("5,485,265") or ("5,526,242") or ("5,550,717") or ("5,633,710")).PN. or (2001/0019225).CCLS.	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/12/12 09:43
-	129	(("6,183,118") or ("6,193,398") or ("6,227,691") or ("6,231,216") or ("6,234,654") or ("6,281,632") or ("6,293,686") or ("5,707,129") or ("5,751,832") or ("5,779,342") or ("5,781,105") or ("5,785,405") or ("5,868,488") or ("5,877,680") or ("5,896,011") or ("5,907,196") or ("5,920,386") or ("5,938,319") or ("5,977,678") or ("6,010,237") or ("6,049,749") or ("6,097,156") or ("6,118,113") or ("6,142,655") or ("6,144,159") or ("6,176,590") or ("4,908,560") or ("4,916,587") or ("4,943,893") or ("4,948,249") or ("5,060,120") or ("5,099,400") or ("5,158,352") or ("5,164,785") or ("5,181,429") or ("5,193,894") or ("5,331,393") or ("5,373,357") or ("5,392,111") or ("5,404,278") or ("5,426,571") or ("5,428,512") or ("5,485,265") or ("5,526,242") or ("5,550,717") or ("5,633,710") or ("3,634,677") or ("3,939,339") or ("3,953,726") or ("4,024,388") or ("4,066,886") or ("4,162,424") or ("4,186,428") or ("4,204,270") or ("4,217,631") or ("4,225,902") or ("4,310,172") or ("4,583,152") or ("4,768,1.35") or ("4,791,343") or ("4,833,573") or ("4,868,720") or ("4,868,721") or ("4,870,545") or ("4,891,559") or ("4,907,877")).PN. or (2001/0019225).CCLS.	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/12/12 10:54
-	2	("6305823").PN.	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/12/12 10:56

-	24	((("6,183,118") or ("6,193,398") or ("6,227,691") or ("6,231,216") or ("6,234,654") or ("6,281,632") or ("6,293,686") or ("5,707,129") or ("5,751,832") or ("5,779,342") or ("5,781,105") or ("5,785,405") or ("5,868,488") or ("5,877,680") or ("5,896,011") or ("5,907,196") or ("5,920,386") or ("5,938,319") or ("5,977,678") or ("6,010,237") or ("6,049,749") or ("6,097,156") or ("6,118,113") or ("6,142,655") or ("6,144,159") or ("6,176,590") or ("4,908,560") or ("4,916,587") or ("4,943,893") or ("4,948,249") or ("5,060,120") or ("5,099,400") or ("5,158,352") or ("5,164,785") or ("5,181,429") or ("5,193,894") or ("5,331,393") or ("5,373,357") or ("5,392,111") or ("5,404,278") or ("5,426,571") or ("5,428,512") or ("5,485,265") or ("5,526,242") or ("5,550,717") or ("5,633,710") or ("3,634,677") or ("3,939,339") or ("3,953,726") or ("4,024,388") or ("4,066,886") or ("4,162,424") or ("4,186,428") or ("4,204,270") or ("4,217,631") or ("4,225,902") or ("4,310,172") or ("4,583,152") or ("4,768,1.35") or ("4,791,343") or ("4,833,573") or ("4,868,720") or ("4,868,721") or ("4,870,545") or ("4,891,559") or ("4,907,877")).PN. or (2001/0019225).CCLS.) and steer$4 near2 angle	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/12/12 10:56
-	18	((((("6,183,118") or ("6,193,398") or ("6,227,691") or ("6,231,216") or ("6,234,654") or ("6,281,632") or ("6,293,686") or ("5,707,129") or ("5,751,832") or ("5,779,342") or ("5,781,105") or ("5,785,405") or ("5,868,488") or ("5,877,680") or ("5,896,011") or ("5,907,196") or ("5,920,386") or ("5,938,319") or ("5,977,678") or ("6,010,237") or ("6,049,749") or ("6,097,156") or ("6,118,113") or ("6,142,655") or ("6,144,159") or ("6,176,590") or ("4,908,560") or ("4,916,587") or ("4,943,893") or ("4,948,249") or ("5,060,120") or ("5,099,400") or ("5,158,352") or ("5,164,785") or ("5,181,429") or ("5,193,894") or ("5,331,393") or ("5,373,357") or ("5,392,111") or ("5,404,278") or ("5,426,571") or ("5,428,512") or ("5,485,265") or ("5,526,242") or ("5,550,717") or ("5,633,710") or ("3,634,677") or ("3,939,339") or ("3,953,726") or ("4,024,388") or ("4,066,886") or ("4,162,424") or ("4,186,428") or ("4,204,270") or ("4,217,631") or ("4,225,902") or ("4,310,172") or ("4,583,152") or ("4,768,1.35") or ("4,791,343") or ("4,833,573") or ("4,868,720") or ("4,868,721") or ("4,870,545") or ("4,891,559") or ("4,907,877")).PN. or (2001/0019225).CCLS.) and steer$4 near2 angle) and sensor	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/12/12 10:57

-	2	(((((("6,183,118") or ("6,193,398") or ("6,227,691") or ("6,231,216") or ("6,234,654") or ("6,281,632") or ("6,293,686") or ("5,707,129") or ("5,751,832") or ("5,779,342") or ("5,781,105") or ("5,785,405") or ("5,868,488") or ("5,877,680") or ("5,896,011") or ("5,907,196") or ("5,920,386") or ("5,938,319") or ("5,977,678") or ("6,010,237") or ("6,049,749") or ("6,097,156") or ("6,118,113") or ("6,142,655") or ("6,144,159") or ("6,176,590") or ("4,908,560") or ("4,916,587") or ("4,943,893") or ("4,948,249") or ("5,060,120") or ("5,099,400") or ("5,158,352") or ("5,164,785") or ("5,181,429") or ("5,193,894") or ("5,331,393") or ("5,373,357") or ("5,392,111") or ("5,404,278") or ("5,426,571") or ("5,428,512") or ("5,485,265") or ("5,526,242") or ("5,550,717") or ("5,633,710") or ("3,634,677") or ("3,939,339") or ("3,953,726") or ("4,024,388") or ("4,066,886") or ("4,162,424") or ("4,186,428") or ("4,204,270") or ("4,217,631") or ("4,225,902") or ("4,310,172") or ("4,583,152") or ("4,768,1.35") or ("4,791,343") or ("4,833,573") or ("4,868,720") or ("4,868,721") or ("4,870,545") or ("4,891,559") or ("4,907,877")).PN. or (2001/0019225).CCLS.) and steer$4 near2 angle) and sensor) and pitch$3	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/12/12 15:05
-	8746	switch near4 circuit near3 board	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/12/12 15:06
-	560	(switch near4 circuit near3 board) and pushbutton	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/12/12 15:07
-	137	(362/37).CCLS.	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/12/13 14:40
-	2	("6193398").PN.	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/12/13 14:41

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/285,312	10/31/2002	James E. Smith	1-23649	1413

27210 7590 06/15/2004

MACMILLAN, SOBANSKI & TODD, LLC
ONE MARITIME PLAZA - FOURTH FLOOR
720 WATER STREET
TOLEDO, OH 43604

EXAMINER	
ALAVI, ALI	

ART UNIT	PAPER NUMBER
2875	

DATE MAILED: 06/15/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Office Action Summary	Application No.	Applicant(s)	
	10/285,312	SMITH ET AL.	
	Examiner	Art Unit	
	Ali Alavi	2875	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *28 March 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _____ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-5, 7-13* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. Applicant's amendment filed on 3/28/04 has been entered. Accordingly, claim 1 has been amended and claim 6 has been canceled. Claims 1-5 and 7-13 are still pending in this application.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-2, 4-5, 7-8, 10-13 are rejected under 35 U.S.C. 102(e) as being anticipated by Toda et al (U.S. Pat. No 6,305,823).

Toda et al discloses an automatic directional control system for a vehicle headlight comprising: a sensor (12, 14) that is adapted to generate a signal that is representative of a condition of the vehicle, said sensed condition includes one or more of road speed (12), and suspension height (14) of the vehicle; a controller (16) that is responsive to said sensor signal for generating an output signal; and an actuator (10) that is adapted to be connected to the headlight to effect movement thereof in accordance with said output signal, wherein said sensor generates a signal that is representative of the road speed of the vehicle (see abstract), speed sensor (12), Height sensor (14).

Claims 1-2, 4-5, 7-8, 10-13 are rejected under 35 U.S.C. 102(e) as being anticipated by Okuchi et al (U.S. Pat. No 6,193,398).

Okuchi et al discloses an automatic directional control system for a vehicle headlight comprising: a sensor (12) that is adapted to generate a signal that is representative of a condition of the vehicle, said sensed condition includes one or more of road speed (12) a controller (20) that is responsive to said sensor signal for generating an output signal; and an actuator (35) that is adapted to be connected to the headlight to effect movement thereof in accordance with said output signal, wherein said sensor generates a signal that is representative of the road speed of the vehicle (see abstract), speed sensor (12), pitch angle (2103, fig. 9), suspension height (2201, 2203, fig. 14).

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-3 and 9 are rejected under 35 U.S.C. 102(b) as being anticipated by Gotoh (US Pat. No 5,909,949).

Gotoh discloses an automatic directional control system for a vehicle headlight comprising: a sensor (22) that is adapted to generate a signal that is representative of a condition of the vehicle, said sensed condition includes one or more of road speed (22), and steering angle (21) and a controller (10) that is responsive to said sensor signal for

generating an output signal; and an actuator (24) that is adapted to be connected to the headlight to effect movement thereof in accordance with said output signal, wherein said sensor generates a signal that is representative of the road speed of the vehicle.

Response to Arguments

4. Applicant's arguments filed on March 28, 2004 have been considered but they are not persuasive. Since applicant failed to discuss the references applied against the claims, explaining how the claims avoid the references or distinguish from them. Therefore, claims 1-5, 7-13 rejection stand.

Conclusion

5. THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

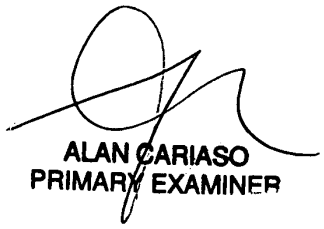
A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

6. Any inquiry concerning this communication or earlier communication from the examiner should be directed to Ali Alavi whose telephone number is (571) 272-2365.

The examiner can normally be reached between 7:00 A.M. to 5:30 P.M. Tuesday to Friday. If attempts to reach the examiner by phone are unsuccessful, the examiner's supervisor, Sandy O'Shea can be reached at (571) 272-2378 or you may fax your inquiry to the **Central Fax** at (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application should be directed to the receptionist whose telephone number is (703) 308-2956.

Ali Alavi



Index of Claims

Applicati n No.	Applicant(s)
10/285,312	SMITH ET AL.
Examiner	**Art Unit**
Ali Alavi	2875

√	Rejected	–	(Through numeral) Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

Claim		Date								
Final	Original	12/12/03	4/10/04							
	1	√	√							
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Search Notes	Application No.	Applicant(s)	
	10/285,312	SMITH ET AL.	
	Examiner	Art Unit	
	Ali Alavi	2875	

SEARCHED			
Class	Subclass	Date	Examiner
362	37	12/12/2003	AA
	465		
	466		
315	82		
701	49	12/12/03	AA

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
EAST/BRS IS & R Databases: USPAT; PGPUB; JP; EP Search report attached.	12/12/2003	AA

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Joni Bosch
(signature)

Date of signature and deposit - Sept. 15, 2004

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: JAMES E. SMITH et al.	)	Group Art Unit 2875
Serial No. 10/285,312	)	Examiner Ali Alavi
Filed: October 31, 2002	)	
For: AUTOMATIC DIRECTIONAL CONTROL SYSTEM FOR VEHICLE HEADLIGHTS	)	Attorney Docket 1-23649

Commissioner For Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

NOTICE OF APPEAL

Honorable Sir:

The applicant respectfully appeals from the Final Rejection of the Examiner dated June 15, 2004 in the above-identified application. Please charge Deposit Account No. 13-0005 in the amount of $330.00 to cover the fee pursuant to 37 C.F.R. 1.17(b). A duplicate copy of this sheet is enclosed.

Respectfully submitted,

Richard S. MacMillan
Reg. No. 30,085

MacMillan, Sobanski & Todd, LLC
One Maritime Plaza, Fourth Floor
720 Water Street
Toledo, Ohio 43604
(419) 255-5900

09/20/2004 SSESHE1 00000009 130005 10285312
01 FC:1401 330.00 DA

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Richard A. MacMillan
(signature)

Richard S. MacMillan
(name of person signing certificate)

Date: November 17, 2004 No. of Pages: 2

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: JAMES E. SMITH et al.	Group Art Unit 2875
Serial No. 10/285,312	Examiner Ali Alavi
Filed: October 31, 2002	
For: AUTOMATIC DIRECTIONAL CONTROL SYSTEM FOR VEHICLE HEADLIGHTS	Attorney Docket 1-23649

Commissioner For Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

REQUEST FOR RECONSIDERATION

Honorable Sir:

Reconsideration of the above-identified application is respectfully requested in light of the following remarks.

REMARKS

In his Final Rejection, the Examiner stated that the "applicant failed to discuss the references applied against the claims, explaining how the claims avoid the references or distinguish from them." This statement is simply incorrect.

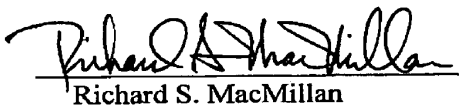
In the Office Action preceding the Final Rejection, independent Claim 1 was amended to recite that the controller "is responsive to said sensor signal for generating an output signal only when said sensor signal changes by more than a predetermined amount." Furthermore, in the remarks accompanying that amendment, it was stated

1

that "[n]one of the art of record is believed to show or suggest a controller that is responsive to the sensor signal for generating an output signal only when the sensor signal changes by more than a predetermined amount." In his Final Rejection, the Examiner failed to discuss this limitation of Claim 1, much less provide any specific teaching in any of the references disclosing this limitation. Thus, it is respectfully requested that the Examiner withdraw the finality of the Final Rejection and either allow Claim 1 as written or issue a non-final Office Action that specifies the basis for the rejection of Claim 1, as required under the rules of practice.

Similarly, in the Office Action preceding the Final Rejection, dependent Claim 7 was re-written in independent form to define the controller as being "responsive to a rate of change of said sensor signal for generating said output signal." Furthermore, in the remarks accompanying that amendment, it was stated that "[n]one of the art of record is believed to show or suggest a controller that is responsive to a rate of change of the sensor signal for generating the output signal." In his Final Rejection, the Examiner failed to discuss this limitation of Claim 7, much less provide any specific teaching in any of the references disclosing this limitation. Thus, it is respectfully requested that the Examiner also withdraw the finality of the Final Rejection and either allow Claim 7 as written or issue a non-final Office Action that specifies the basis for the rejection of Claim 7, as required under the rules of practice.

Respectfully submitted,



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/285,312	10/31/2002	James E. Smith	1-23649	1413

27210 7590 12/28/2004

MACMILLAN, SOBANSKI & TODD, LLC
ONE MARITIME PLAZA - FOURTH FLOOR
720 WATER STREET
TOLEDO, OH 43604

EXAMINER	
ALAVI, ALI	

ART UNIT	PAPER NUMBER
2875	

DATE MAILED: 12/28/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO 90C (Rev 10/03)

Advisory Action	Application No.	Applicant(s)	
	10/285,312	SMITH ET AL.	
	Examiner	Art Unit	
	Ali Alavi	2875	

--The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

THE REPLY FILED 17 November 2004 FAILS TO PLACE THIS APPLICATION IN CONDITION FOR ALLOWANCE. Therefore, further action by the applicant is required to avoid abandonment of this application. A proper reply to a final rejection under 37 CFR 1.113 may only be either: (1) a timely filed amendment which places the application in condition for allowance; (2) a timely filed Notice of Appeal (with appeal fee); or (3) a timely filed Request for Continued Examination (RCE) in compliance with 37 CFR 1.114.

PERIOD FOR REPLY [check either a) or b)]

a) ☒ The period for reply expires 3 months from the mailing date of the final rejection.

b) ☐ The period for reply expires on: (1) the mailing date of this Advisory Action, or (2) the date set forth in the final rejection, whichever is later. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of the final rejection.
ONLY CHECK THIS BOX WHEN THE FIRST REPLY WAS FILED WITHIN TWO MONTHS OF THE FINAL REJECTION. See MPEP 706.07(f).

Extensions of time may be obtained under 37 CFR 1.136(a). The date on which the petition under 37 CFR 1.136(a) and the appropriate extension fee have been filed is the date for purposes of determining the period of extension and the corresponding amount of the fee. The appropriate extension fee under 37 CFR 1.17(a) is calculated from: (1) the expiration date of the shortened statutory period for reply originally set in the final Office action; or (2) as set forth in (b) above, if checked. Any reply received by the Office later than three months after the mailing date of the final rejection, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

1. ☒ A Notice of Appeal was filed on *17 September 2004*. Appellant's Brief must be filed within the period set forth in 37 CFR 1.192(a), or any extension thereof (37 CFR 1.191(d)), to avoid dismissal of the appeal.

2. ☐ The proposed amendment(s) will not be entered because:

   (a) ☐ they raise new issues that would require further consideration and/or search (see NOTE below);

   (b) ☐ they raise the issue of new matter (see Note below);

   (c) ☐ they are not deemed to place the application in better form for appeal by materially reducing or simplifying the issues for appeal; and/or

   (d) ☐ they present additional claims without canceling a corresponding number of finally rejected claims.

   NOTE: _____.

3. ☐ Applicant's reply has overcome the following rejection(s): _____.

4. ☐ Newly proposed or amended claim(s) _____ would be allowable if submitted in a separate, timely filed amendment canceling the non-allowable claim(s).

5. ☒ The a)☐ affidavit, b)☐ exhibit, or c)☒ request for reconsideration has been considered but does NOT place the application in condition for allowance because: *See Continuation Sheet*.

6. ☐ The affidavit or exhibit will NOT be considered because it is not directed SOLELY to issues which were newly raised by the Examiner in the final rejection.

7. ☐ For purposes of Appeal, the proposed amendment(s) a)☐ will not be entered or b)☐ will be entered and an explanation of how the new or amended claims would be rejected is provided below or appended.

   The status of the claim(s) is (or will be) as follows:

   Claim(s) allowed: _____.

   Claim(s) objected to: _____.

   Claim(s) rejected: _____.

   Claim(s) withdrawn from consideration: _____.

8. ☐ The drawing correction filed on _____ is a)☐ approved or b)☐ disapproved by the Examiner.

9. ☐ Note the attached Information Disclosure Statement(s)(PTO-1449) Paper No(s). _____.

10. ☐ Other: _____

Sandra O'Shea
Supervisory Patent Examiner
Technology Center 2800

Continuation of 5. does NOT place the application in condition for allowance because: The prior art of record including Toda et al in particular reads on independent claims 1 and 7.

Regarding claims 1 and 7, Toda discloses an auotomatic leveling device for vehicle headlamps including a sensor (speed sensor12 and height sensor 14 fig. 1), a controller (CPU 16), an actuator (motor driver 18, and 20). Therefore, Toda meets the limitation of claims 1 and 7 and thus rejection of claims 1-5, and 7-13 are maintained.

PATENT

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I hereby certify that this paper is being facsimile transmitted to the U.S. Patent and Trademark Office on the date shown below.

Richard A. MacMillan
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Richard S. MacMillan
(name of person signing certificate)

Date: November 17, 2004 No. of Pages: 2

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: JAMES E. SMITH et al.	Group Art Unit 2875
Serial No. 10/285,312	Examiner Ali Alavi
Filed: October 31, 2002	
For: AUTOMATIC DIRECTIONAL CONTROL SYSTEM FOR VEHICLE HEADLIGHTS	Attorney Docket 1-23649

Commissioner For Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

REQUEST FOR RECONSIDERATION

DO NOT ENTER

Honorable Sir:

Reconsideration of the above-identified application is respectfully requested in light of the following remarks.

REMARKS

In his Final Rejection, the Examiner stated that the "applicant failed to discuss the references applied against the claims, explaining how the claims avoid the references or distinguish from them." This statement is simply incorrect.

In the Office Action preceding the Final Rejection, independent Claim 1 was amended to recite that the controller "is responsive to said sensor signal for generating an output signal only when said sensor signal changes by more than a predetermined amount." Furthermore, in the remarks accompanying that amendment, it was stated

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/285,312	10/31/2002	James E. Smith	1-23649	1413

27210 7590 02/22/2005

MACMILLAN, SOBANSKI & TODD, LLC
ONE MARITIME PLAZA - FOURTH FLOOR
720 WATER STREET
TOLEDO, OH 43604

EXAMINER	
ALAVI, ALI	

ART UNIT	PAPER NUMBER
2875	

DATE MAILED: 02/22/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

AK

Notice of Abandonment	Application No.	Applicant(s)	
	10/285,312	SMITH ET AL.	
	Examiner	Art Unit	
	Ali Alavi	2875	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

This application is abandoned in view of:

1. ☒ Applicant's failure to timely file a proper reply to the Office letter mailed on *28 December 2004*.
   (a) ☐ A reply was received on _____ (with a Certificate of Mailing or Transmission dated _____), which is after the expiration of the period for reply (including a total extension of time of _____ month(s)) which expired on _____.
   (b) ☐ A proposed reply was received on _____, but it does not constitute a proper reply under 37 CFR 1.113 (a) to the final rejection.
   (A proper reply under 37 CFR 1.113 to a final rejection consists only of: (1) a timely filed amendment which places the application in condition for allowance; (2) a timely filed Notice of Appeal (with appeal fee); or (3) a timely filed Request for Continued Examination (RCE) in compliance with 37 CFR 1.114).
   (c) ☐ A reply was received on _____ but it does not constitute a proper reply, or a bona fide attempt at a proper reply, to the non-final rejection. See 37 CFR 1.85(a) and 1.111. (See explanation in box 7 below).
   (d) ☒ No reply has been received.

2. ☐ Applicant's failure to timely pay the required issue fee and publication fee, if applicable, within the statutory period of three months from the mailing date of the Notice of Allowance (PTOL-85).
   (a) ☐ The issue fee and publication fee, if applicable, was received on _____ (with a Certificate of Mailing or Transmission dated _____), which is after the expiration of the statutory period for payment of the issue fee (and publication fee) set in the Notice of Allowance (PTOL-85).
   (b) ☐ The submitted fee of $_____ is insufficient. A balance of $_____ is due.
   The issue fee required by 37 CFR 1.18 is $_____. The publication fee, if required by 37 CFR 1.18(d), is $_____.
   (c) ☐ The issue fee and publication fee, if applicable, has not been received.

3. ☐ Applicant's failure to timely file corrected drawings as required by, and within the three-month period set in, the Notice of Allowability (PTO-37).
   (a) ☐ Proposed corrected drawings were received on _____ (with a Certificate of Mailing or Transmission dated _____), which is after the expiration of the period for reply.
   (b) ☐ No corrected drawings have been received.

4. ☐ The letter of express abandonment which is signed by the attorney or agent of record, the assignee of the entire interest, or all of the applicants.

5. ☐ The letter of express abandonment which is signed by an attorney or agent (acting in a representative capacity under 37 CFR 1.34(a)) upon the filing of a continuing application.

6. ☐ The decision by the Board of Patent Appeals and Interference rendered on _____ and because the period for seeking court review of the decision has expired and there are no allowed claims.

7. ☐ The reason(s) below:

Petitions to revive under 37 CFR 1.137(a) or (b), or requests to withdraw the holding of abandonment under 37 CFR 1.181, should be promptly filed to minimize any negative effects on patent term.

RCE/2875

PTO/SB/30 (09-04)
Approved for use through 07/31/2006. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Request for Continued Examination (RCE) Transmittal

Address to:
Mail Stop RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Application Number	10/285,312
Filing Date	October 31, 2002
First Named Inventor	JAMES E. SMITH et al.
Art Unit	2875
Examiner Name	Ali Alavi
Attorney Docket Number	1-23649

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. See Instruction Sheet for RCEs (not to be submitted to the USPTO) on page 2.

1. Submission required under 37 CFR 1.114 Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

   a. ☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

      i. ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____

      ii. ☐ Other _____

   b. ☑ Enclosed

      i. ☑ Amendment/Reply

      ii. ☐ Affidavit(s)/ Declaration(s)

      iii. ☐ Information Disclosure Statement (IDS)

      iv. ☐ Other _____

2. Miscellaneous

   a. ☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of _____ months. (Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

   b. ☐ Other _____

3. Fees The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.

   a. ☑ The Director is hereby authorized to charge the following fees, or credit any overpayments, to Deposit Account No. _____. I have enclosed a duplicate copy of this sheet.

      i. ☑ RCE fee required under 37 CFR 1.17(e)

      ii. ☑ Extension of time fee (37 CFR 1.136 and 1.17)

      iii. ☐ Other _____

   b. ☐ Check in the amount of $ _____ enclosed

   c. ☐ Payment by credit card (Form PTO-2038 enclosed)

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

Signature	Richard S. MacMillan	Date	2/17/2005
Name (Print/Type)	Richard S. MacMillan	Registration No.	30,085

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Signature	Richard S. MacMillan		
Name (Print/Type)	Richard S. MacMillan	Date	2/17/2005

This collection of information is required by 37 CFR 1.114. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Mail Stop RCE, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: JAMES E. SMITH et al.	)	Group Art Unit 2875
Serial No. 10/285,312	)	Examiner Ali Alavi
Filed: October 31, 2002	)	
For: AUTOMATIC DIRECTIONAL CONTROL SYSTEM FOR VEHICLE HEADLIGHTS	)	Attorney Docket 1-23649

Commissioner For Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

PRELIMINARY REMARKS

Honorable Sir:

Reconsideration of the above-identified application is respectfully requested in light of the following remarks.

REMARKS

The courtesy of the Examiner in granting the undersigned attorney a personal interview on January 26, 2005 is gratefully acknowledged. During that interview, the language of the independent claims was discussed in light of the applied references. Specifically, it was discussed that independent Claim 1 did not show or suggest a controller that is responsive to the sensor signal for generating an output signal only when the sensor signal changes by more than a predetermined amount. It was further discussed that independent Claim 7 did not show or suggest a controller that is responsive to a rate of change of the sensor signal for generating the output signal. It

was agreed that the Examiner would reconsider the rejections in a request for continued examination.

Independent Claim 1 defines the invention as an automatic directional control system for a vehicle headlight that includes a sensor that is adapted to generate a signal that is representative of a condition of the vehicle, wherein the sensed condition includes one or more of road speed, steering angle, pitch, and suspension height of the vehicle. A controller is responsive to the sensor signal for generating an output signal only when the sensor signal changes by more than a predetermined amount. Lastly, an actuator is adapted to be connected to the headlight to effect movement thereof in accordance with the output signal. None of the art of record is believed to show or suggest a controller that is responsive to the sensor signal for generating an output signal only when the sensor signal changes by more than a predetermined amount.

The Toda et al. reference does not show or suggest the structure recited in Claim 1. Specifically, the Toda et al. reference does not show or suggest a controller that is responsive to the sensor signal for generating an output signal only when the sensor signal changes by more than a predetermined amount. Rather, the Toda et al. reference discloses an automatic leveling device that changes the direction of the headlights in response to any changes in the sensor signal. Thus, as discussed during the interview, the Toda et al. reference does not show or suggest the structure recited in Claim 1.

Similarly, the Okuchi et al. reference does not show or suggest the structure recited in Claim 1. Specifically, the Okuchi et al. reference does not show or suggest a controller that is responsive to the sensor signal for generating an output signal only when the sensor signal changes by more than a predetermined amount. Rather, the Okuchi et al. reference discloses an automatic leveling device that changes the direction of the headlights in response to any changes in the sensor signal. Thus, as discussed during the interview, the Okuchi et al. reference does not show or suggest the structure recited in Claim 1.

Lastly, the Gotoh reference does not show or suggest the structure recited in Claim 1. Specifically, the Gotoh reference does not show or suggest a controller that is responsive to the sensor signal for generating an output signal only when the sensor signal changes by more than a predetermined amount. Rather, the Gotoh reference discloses an automatic leveling device that changes the direction of the headlights in response to any changes in the sensor signal. Thus, as discussed during the interview, the Gotoh reference does not show or suggest the structure recited in Claim 1.

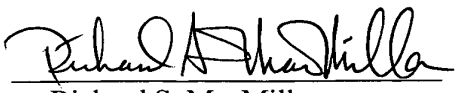
Independent Claim 7 defines the invention as an automatic directional control system for a vehicle headlight including a sensor that is adapted to generate a signal that is representative of a condition of the vehicle, wherein the sensed condition includes one or more of road speed, steering angle, pitch, and suspension height of the vehicle. A controller is responsive to a rate of change of the sensor signal for generating the output signal. Lastly, an actuator is adapted to be connected to the headlight to effect movement thereof in accordance with the output signal. None of the art of record is believed to show or suggest a controller that is responsive to a rate of change of the sensor signal for generating the output signal.

The Toda et al. reference does not show or suggest the structure recited in Claim 7. Specifically, the Toda et al. reference does not show or suggest a controller that is responsive to a rate of change of the sensor signal for generating the output signal. Rather, the Toda et al. reference discloses an automatic leveling device that changes the direction of the headlights in response to any changes in the sensor signal. Thus, as discussed during the interview, the Toda et al. reference does not show or suggest the structure recited in Claim 7.

The Okuchi et al. reference does not show or suggest the structure recited in Claim 7. Specifically, the Okuchi et al. reference does not show or suggest a controller that is responsive to a rate of change of the sensor signal for generating the output signal. Rather, the Okuchi et al. reference discloses an automatic leveling device that changes the direction of the headlights in response to any changes in the

sensor signal. Thus, as discussed during the interview, the Okuchi et al. reference does not show or suggest the structure recited in Claim 7.

Respectfully submitted,



Richard S. MacMillan
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One Maritime Plaza, Fourth Floor
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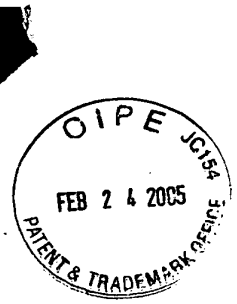
Toledo, Ohio 43604
(419) 255-5900



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Richard S. MacMillan
(signature)

Date of signature and deposit - 2/17/05

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	)	
JAMES E. SMITH et al.	)	Group Art Unit 2875
	)	
Serial No. 10/285,312	)	
	)	Examiner Ali Alavi
Filed: October 31, 2002	)	
	)	
For: AUTOMATIC DIRECTIONAL CONTROL SYSTEM FOR VEHICLE HEADLIGHTS	)	Attorney Docket 1-23649

Commissioner For Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

REQUEST FOR EXTENSION OF TIME

Honorable Sir:

Please extend the period of time in which to file the Brief Of Appeal by three months, up to and including February 17, 2005, in accordance with 37 C.F.R. 1.136(a). Please charge Deposit Account No. 13-0005 in the amount of $1,020.00 to cover the fee pursuant to 37 C.F.R. 1.17(a)(3). A duplicate copy of this sheet is enclosed.

Respectfully submitted,

Richard S. MacMillan
Reg. No. 30,085

MacMillan, Sobanski & Todd, LLC
One Maritime Plaza, Fourth Floor
720 Water Street
Toledo, Ohio 43604
(419) 255-5900

02/25/2005 SFELEKE1 00000020 130005 10285312

01 FC:1253 1020.00 DA

Yee 2875

PTO/SB/30 (09-04)
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Request for Continued Examination (RCE) Transmittal

Address to:
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P.O. Box 1450
Alexandria, VA 22313-1450

Application Number	10/285,312
Filing Date	October 31, 2002
First Named Inventor	JAMES E. SMITH et al.
Art Unit	2875
Examiner Name	Ali Alavi
Attorney Docket Number	1-23649

Fee Sheet

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. See Instruction Sheet for RCEs (not to be submitted to the USPTO) on page 2.

1. Submission required under 37 CFR 1.114 Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

   a. ☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

      i. ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____

      ii. ☐ Other _____

   b. ☑ Enclosed

      i. ☑ Amendment/Reply

      ii. ☐ Affidavit(s)/ Declaration(s)

      iii. ☐ Information Disclosure Statement (IDS)

      iv. ☐ Other _____

2. Miscellaneous

   a. ☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of _____ months. (Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

   b. ☐ Other _____

3. Fees The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.

   a. ☑ The Director is hereby authorized to charge the following fees, or credit any overpayments, to Deposit Account No. _____. I have enclosed a duplicate copy of this sheet.

      i. ☑ RCE fee required under 37 CFR 1.17(e)

      ii. ☑ Extension of time fee (37 CFR 1.136 and 1.17)

      iii. ☐ Other _____

   b. ☐ Check in the amount of $ _____ enclosed

   c. ☐ Payment by credit card (Form PTO-2038 enclosed)

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

Signature	Richard S. MacMillan	Date	2/17/2005
Name (Print/Type)	Richard S. MacMillan	Registration No.	30,085

CERTIFICATE OF MAILING OR TRANSMISSION

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Mail Stop RCE, Commissioner for Patents, P. O. Box 1450, Alexandria, VA 22313-1450 or facsimile transmitted to the U.S. Patent and Trademark Office on the date shown below.

Signature	Richard S. MacMillan		
Name (Print/Type)	Richard S. MacMillan	Date	2/17/2005

This collection of information is required by 37 CFR 1.114. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Mail Stop RCE, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

03/08/2005 ADAVID 00000001 130005 10285312

01 FC:1801 790.00 DA

PTO/SB/30 (06-04)
Approved for use through 07/31/2006. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Request for Continued Examination (RCE) Transmittal

Address to:
Mail Stop RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Application Number	10/265,312
Filing Date	October 31, 2002
First Named Inventor	JAMES E. SMITH et al.
Art Unit	2875
Examiner Name	Ali Alavi
Attorney Docket Number	1-23649

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. See Instruction Sheet for RCEs (not to be submitted to the USPTO) on page 2.

1. Submission required under 37 CFR 1.114 Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

   a. ☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.
      i. ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____
      ii. ☐ Other _____

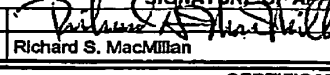
   b. ☑ Enclosed
      i. ☑ Amendment/Reply
      ii. ☐ Affidavit(s)/ Declaration(s)
      iii. ☐ Information Disclosure Statement (IDS)
      iv. ☐ Other _____

2. Miscellaneous
   a. ☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of _____ months. (Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)
   b. ☐ Other _____

3. Fees The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.
   a. ☑ The Director is hereby authorized to charge the following fees, or credit any overpayments, to Deposit Account No. _____. I have enclosed a duplicate copy of this sheet.
      i. ☑ RCE fee required under 37 CFR 1.17(e)
      ii. ☑ Extension of time fee (37 CFR 1.136 and 1.17)
      iii. ☐ Other _____
   b. ☐ Check in the amount of $ _____ enclosed
   c. ☐ Payment by credit card (Form PTO-2038 enclosed)

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

Signature		Date	2/17/2005
Name (Print/Type)	Richard S. MacMillan	Registration No.	30,085

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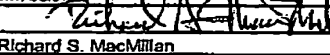
Signature			
Name (Print/Type)	Richard S. MacMillan	Date	2/17/2005

CERTIFICATE OF FACSIMILE TRANSMISSION

I hereby certify that this paper is being facsimile transmitted to the U.S. Patent and Trademark Office on the date shown below.

Richard S. MacMillan
(signature)

Richard S. MacMillan
(name of person signing certificate)

Date: February 28, 2005 No. of Pages: 9

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: JAMES E. SMITH et al.	)	Group Art Unit 2875
Serial No. 10/285,312	)	Examiner Ali Alavi
Filed: October 31, 2002	)	
For: AUTOMATIC DIRECTIONAL CONTROL SYSTEM FOR VEHICLE HEADLIGHTS	)	Attorney Docket 1-23649

Commissioner For Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

REQUEST FOR WITHDRAWAL OF HOLDING OF ABANDONMENT

Honorable Sir:

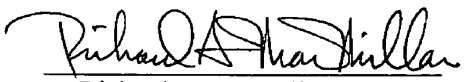
It is respectfully requested that the Notice Of Abandonment dated February 22, 2005 be withdrawn because a Request For Continued Examination, Preliminary Remarks, and Request For Extension Of Time were timely mailed to the Patent Office on February 17, 2005. Enclosed are copies of the following documents:

1. the Request For Continued Examination;
2. the Preliminary Remarks;
3. the Request For Extension Of Time; and
4. a portion of the Deposit Account records of the undersigned attorney showing that the extension of time fee was properly debited from the account.

A proper Certificate Of Mailing is provided on each of the three papers that were filed in the Patent Office. Also, the Deposit Account records confirm that such papers were, in fact received by the Patent Office.

Upon review of these three papers filed in the Patent Office, it is noted that the Request For Continued Examination requested that the filing fee be charged to the Deposit Account of the undersigned attorney, but that the number of such Deposit Account was inadvertently omitted. However, the number of such Deposit Account was properly identified in the Request For Extension Of Time that was filed therewith. It is believed that proper identification of the Deposit Account in the Request For Extension Of Time is sufficient to cure the omission contained in the Request For Continued Examination. If not, then it is respectfully requested that this paper be considered as a request for an additional one month extension of time, and that the amount of that additional one month extension of time be charged to Deposit Account No. 13-0005.

Respectfully submitted,



Richard S. MacMillan
Reg. No. 30,085

MacMillan, Sobanski & Todd, LLC
One Maritime Plaza, Fourth Floor
720 Water Street
Toledo, Ohio 43604
(419) 255-5900

PATENT

CERTIFICATE OF MAILING BY FIRST CLASS MAIL

I hereby certify that this document is being deposited with the United States Postal Service as first class mail in an envelope addressed to the Commissioner For Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450 on the date set forth below.

(signature)

Date of signature and deposit - 2/17/05

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: JAMES E. SMITH et al.	Group Art Unit 2875
Serial No. 10/285,312	Examiner Ali Alavi
Filed: October 31, 2002	
For: AUTOMATIC DIRECTIONAL CONTROL SYSTEM FOR VEHICLE HEADLIGHTS	Attorney Docket 1-23649

Commissioner For Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

PRELIMINARY REMARKS

Honorable Sir:

Reconsideration of the above-identified application is respectfully requested in light of the following remarks.

REMARKS

The courtesy of the Examiner in granting the undersigned attorney a personal interview on January 26, 2005 is gratefully acknowledged. During that interview, the language of the independent claims was discussed in light of the applied references. Specifically, it was discussed that independent Claim 1 did not show or suggest a controller that is responsive to the sensor signal for generating an output signal only when the sensor signal changes by more than a predetermined amount. It was further discussed that independent Claim 7 did not show or suggest a controller that is responsive to a rate of change of the sensor signal for generating the output signal. It

I

was agreed that the Examiner would reconsider the rejections in a request for continued examination.

Independent Claim 1 defines the invention as an automatic directional control system for a vehicle headlight that includes a sensor that is adapted to generate a signal that is representative of a condition of the vehicle, wherein the sensed condition includes one or more of road speed, steering angle, pitch, and suspension height of the vehicle. A controller is responsive to the sensor signal for generating an output signal only when the sensor signal changes by more than a predetermined amount. Lastly, an actuator is adapted to be connected to the headlight to effect movement thereof in accordance with the output signal. None of the art of record is believed to show or suggest a controller that is responsive to the sensor signal for generating an output signal only when the sensor signal changes by more than a predetermined amount.

The Toda et al. reference does not show or suggest the structure recited in Claim 1. Specifically, the Toda et al. reference does not show or suggest a controller that is responsive to the sensor signal for generating an output signal only when the sensor signal changes by more than a predetermined amount. Rather, the Toda et al. reference discloses an automatic leveling device that changes the direction of the headlights in response to any changes in the sensor signal. Thus, as discussed during the interview, the Toda et al. reference does not show or suggest the structure recited in Claim 1.

Similarly, the Okuchi et al. reference does not show or suggest the structure recited in Claim 1. Specifically, the Okuchi et al. reference does not show or suggest a controller that is responsive to the sensor signal for generating an output signal only when the sensor signal changes by more than a predetermined amount. Rather, the Okuchi et al. reference discloses an automatic leveling device that changes the direction of the headlights in response to any changes in the sensor signal. Thus, as discussed during the interview, the Okuchi et al. reference does not show or suggest the structure recited in Claim 1.

Lastly, the Gotoh reference does not show or suggest the structure recited in Claim 1. Specifically, the Gotoh reference does not show or suggest a controller that is responsive to the sensor signal for generating an output signal only when the sensor signal changes by more than a predetermined amount. Rather, the Gotoh reference discloses an automatic leveling device that changes the direction of the headlights in response to any changes in the sensor signal. Thus, as discussed during the interview, the Gotoh reference does not show or suggest the structure recited in Claim 1.

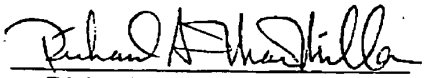
Independent Claim 7 defines the invention as an automatic directional control system for a vehicle headlight including a sensor that is adapted to generate a signal that is representative of a condition of the vehicle, wherein the sensed condition includes one or more of road speed, steering angle, pitch, and suspension height of the vehicle. A controller is responsive to a rate of change of the sensor signal for generating the output signal. Lastly, an actuator is adapted to be connected to the headlight to effect movement thereof in accordance with the output signal. None of the art of record is believed to show or suggest a controller that is responsive to a rate of change of the sensor signal for generating the output signal.

The Toda et al. reference does not show or suggest the structure recited in Claim 7. Specifically, the Toda et al. reference does not show or suggest a controller that is responsive to a rate of change of the sensor signal for generating the output signal. Rather, the Toda et al. reference discloses an automatic leveling device that changes the direction of the headlights in response to any changes in the sensor signal. Thus, as discussed during the interview, the Toda et al. reference does not show or suggest the structure recited in Claim 7.

The Okuchi et al. reference does not show or suggest the structure recited in Claim 7. Specifically, the Okuchi et al. reference does not show or suggest a controller that is responsive to a rate of change of the sensor signal for generating the output signal. Rather, the Okuchi et al. reference discloses an automatic leveling device that changes the direction of the headlights in response to any changes in the

sensor signal. Thus, as discussed during the interview, the Okuchi et al. reference does not show or suggest the structure recited in Claim 7.

Respectfully submitted,



Richard S. MacMillan
Reg. No. 30,085

MacMillan, Sobanski & Todd, LLC
One Maritime Plaza, Fourth Floor
720 Water Street
Toledo, Ohio 43604
(419) 255-5900

CERTIFICATE OF MAILING BY FIRST CLASS MAIL

I hereby certify that this document is being deposited with the United States Postal Service as first class mail in an envelope addressed to the Commissioner For Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450 on the date set forth below.

Richard S. MacMillan
(signature)

Date of signature and deposit - 2/17/05

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: JAMES E. SMITH et al.	Group Art Unit 2875
Serial No. 10/285,312	Examiner Ali Alavi
Filed: October 31, 2002	
For: AUTOMATIC DIRECTIONAL CONTROL SYSTEM FOR VEHICLE HEADLIGHTS	Attorney Docket 1-23649

Commissioner For Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

REQUEST FOR EXTENSION OF TIME

Honorable Sir:

Please extend the period of time in which to file the Brief Of Appeal by three months, up to and including February 17, 2005, in accordance with 37 C.F.R. 1.136(a). Please charge Deposit Account No. 13-0005 in the amount of $1,020.00 to cover the fee pursuant to 37 C.F.R. 1.17(a)(3). A duplicate copy of this sheet is enclosed.

Respectfully submitted,

Richard S. MacMillan
Reg. No. 30,085

MacMillan, Sobanski & Todd, LLC
One Maritime Plaza, Fourth Floor
720 Water Street
Toledo, Ohio 43604
(419) 255-5900

United States
Patent and
Trademark Office

Deposit Account Statement

Requested Statement Month:	February 2005
Deposit Account Number:	130005
Name:	MACMILLAN, SOBANSKI & TODD, LLC
Attention:	AMY M. BELL
Address:	720 WATER STREET
City:	TOLEDO
State:	OH
Zip:	43604-1853

DATE	SEQ	POSTING REF TXT	ATTORNEY DOCKET NBR	FEE CODE	AMT	BAL
02/25	30	10285312	1-23649	1253	$1,020.00	$47,924.50

UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/285,312	10/31/2002	James E. Smith	1-23649	1413

27210 7590 04/14/2005

MACMILLAN, SOBANSKI & TODD, LLC
ONE MARITIME PLAZA - FOURTH FLOOR
720 WATER STREET
TOLEDO, OH 43604

EXAMINER	
ALAVI, ALI	

ART UNIT	PAPER NUMBER
2875	

DATE MAILED: 04/14/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO 90C (Rev 10/03)

Office Action Summary	Application No.	Applicant(s)	
	10/285,312	SMITH ET AL.	
	Examiner	Art Unit	
	Ali Alavi	2875	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *17 February 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-5 and 7-13* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-5, and 7-13* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after abandonment. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the abandonment of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 2/17/05 has been entered.

Response to Arguments

Applicant's arguments filed on 2/17/05 have been considered but they are not persuasive. Applicant contends that "none of the art of record is believed to show or suggest a controller that is responsive to the sensor signal for generating an output signal only when the sensor signal changes by more than a predetermined amount." Examiner respectfully disagrees with the applicant assertion. All of the art of record including Toda etal, Okuchi et al, and Gotoh references discloses the claimed invention. For instance, Toda et al discloses a sensor (12, 14) that is adapted to generate a signal that is representative of a condition of the vehicle, said sensed condition includes one or more of road speed (12), and suspension height (14) of the vehicle; a controller (16) that is responsive to said sensor signal for generating an output signal only when said sensor signal changes by more than a predetermined amount (this limitation is considered an intended use, because the actuator would change the headlight according to the output signal generated by the sensor), and an actuator (10) that is adapted to be connected to the headlight to effect movement thereof in accordance with

said output signal, wherein said sensor generates a signal that is representative of the road speed of the vehicle.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-2, 4-5, 7-8, 10-13 are rejected under 35 U.S.C. 102(e) as being anticipated by Toda et al (U.S. Pat. No 6,305,823).

Toda et al discloses an automatic directional control system for a vehicle headlight comprising: a sensor (12, 14) that is adapted to generate a signal that is representative of a condition of the vehicle, said sensed condition includes one or more of road speed (12), and suspension height (14) of the vehicle; a controller (16) that is responsive to said sensor signal for generating an output signal only when said sensor signal changes by more than a predetermined amount (this limitation is considered an intended use, because the actuator would change the headlight according to the output signal generated by the sensor), and an actuator (10) that is adapted to be connected to the headlight to effect movement thereof in accordance with said output signal, wherein said sensor generates a signal that is representative of the road speed of the vehicle (see abstract), speed sensor (12), Height sensor (14).

Claims 1-2, 4-5, 7-8, 10-13 are rejected under 35 U.S.C. 102(e) as being anticipated by Okuchi et al (U.S. Pat. No 6,193,398).

Okuchi et al discloses an automatic directional control system for a vehicle headlight comprising: a sensor (12) that is adapted to generate a signal that is representative of a condition of the vehicle, said sensed condition includes one or more of road speed (12) a controller (20) that is responsive to said sensor signal for generating an output signal only when said sensor signal changes by more than a predetermined amount (this limitation is considered an intended use, because the actuator would change the headlight according to the output signal generated by the sensor), and an actuator (35) that is adapted to be connected to the headlight to effect movement thereof in accordance with said output signal, wherein said sensor generates a signal that is representative of the road speed of the vehicle (see abstract), speed sensor (12), pitch angle (2103, fig. 9), suspension height (2201, 2203, fig. 14).

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-3 and 9 are rejected under 35 U.S.C. 102(b) as being anticipated by Gotoh (US Pat. No 5,909,949).

Gotoh discloses an automatic directional control system for a vehicle headlight comprising: a sensor (22) that is adapted to generate a signal that is representative of a condition of the vehicle, said sensed condition includes one or more of road speed (22), and steering angle (21) and a controller (10) that is responsive to said sensor signal for generating an output signal only when said sensor signal changes by more than a predetermined amount (this limitation is considered an intended use, because the actuator would change the headlight according to the output signal generated by the sensor), and an actuator (24) that is adapted to be connected to the headlight to effect movement thereof in accordance with said output signal, wherein said sensor generates a signal that is representative of the road speed of the vehicle.

Any inquiry concerning this communication or earlier communication from the examiner should be directed to Ali Alavi whose telephone number is (571) 272-2365. The examiner can normally be reached between 7:00 A.M. to 5:30 P.M. Tuesday to Friday. If attempts to reach the examiner by phone are unsuccessful, the examiner's supervisor, Sandy O'Shea can be reached at (571) 272-2378 or you may fax your inquiry to the **Central Fax** at (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application should be directed to the receptionist whose telephone number is (703) 308-2956.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For

more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Ali Alavi
Examiner
AU 2875

Index of Claims

Application No.	Applicant(s)
10/285,312	SMITH ET AL.
Examiner	**Art Unit**
Ali Alavi	2875

√	Rejected	–	(Through numeral) Cancelled	N	Non-Elected	A	Appeal
=	Allowed	+	Restricted	I	Interference	O	Objected

Claim		Date		
Final	Original			
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Claim		Date
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2875

PATENT

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Sara Wiatt
(signature)

Date of signature and deposit - 7-14-05

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: JAMES E. SMITH et al.	)	Group Art Unit 2875
Serial No. 10/285,312	)	Examiner Ali Alavi
Filed: October 31, 2002	)	
For: AUTOMATIC DIRECTIONAL CONTROL SYSTEM FOR VEHICLE HEADLIGHTS	)	Attorney Docket 1-23649

Commissioner For Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

RESPONSE

Honorable Sir:

Reconsideration of the above-identified application is respectfully requested in light of the following remarks.

REMARKS

In the Office Action dated April 14, 2005, the Examiner stated that each of the Toda et al., Okuchi et al., and Gotoh references anticipated the invention defined in Claim 1 because each disclosed a controller that is responsive to the sensor signal for generating an output signal only when the sensor signal changes by more than a predetermined amount. The Examiner further stated that "this limitation is considered an intended use, because the actuator would change the headlight according to the output signal generated by the sensor." This statement is simply incorrect.

In independent Claim 1, the claimed controller is responsive to a sensor signal for generating an output signal only when the sensor signal changes by more than a predetermined amount. As described in the specification on Page 14, Lines 12-22:

> Next, the operating algorithm 50 enters a decision point 55, wherein it is determined whether the magnitude of the adjustment that is necessary to move the headlight 11 from its current position to the desired position is greater than a predetermined minimum threshold. This step in the operating algorithm 50 is also optional, but may be desirable to prevent the actuators 12 and 13 from being operated continuously or unduly frequently in response to relatively small variations in the sensed operating condition or conditions, such as relatively small bumps in the road. For example, if the current position of the headlight 11 is relatively close to the desired position, then it may be undesirable to effect any movement thereof. This step 55 will prevent the actuators 12 and 13 from being operated unless the current position of the headlight 11 is relatively far from the desired position."

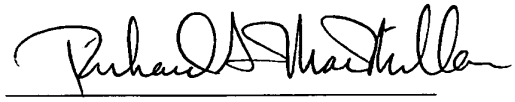
Thus, it can be seen that the claimed limitation (wherein the controller generates an output signal only when the sensor signal changes by more than a predetermined amount) is not merely a recitation of "intended use" alleged by the Examiner, but rather an important aspect of the operation of the headlight automatic directional control system. Furthermore, there is simply no disclosure contained in any of the cited references of this important aspect of the claimed invention. It is respectfully requested that the Examiner identify with specificity where this limitation is disclosed in any of the cited references. Absent this, the rejection must be withdrawn.

In independent Claim 7, the claimed controller is responsive to a rate of change of the sensor signal for generating the output signal. As described in the specification on Page 20, Lines 8-14:

> "The rate of change of the sensed condition can be calculated as the difference between the first and second readings divided by the amount of time therebetween or by any other desired means. For example, if the sensed condition is vehicle speed, then the difference between the first sensed vehicle speed and the second sensed vehicle speed, divided by the amount of time therebetween, would yield a number that is representative of the acceleration of the vehicle."

The Examiner completely failed to address the "rate of change" language of independent Claim 7 in the Office Action. Again, it is respectfully requested that the Examiner identify with specificity where this limitation is disclosed in any of the cited references. Absent this, the rejection must be withdrawn.

Respectfully submitted,



Richard S. MacMillan
Reg. No. 30,085

MacMillan, Sobanski & Todd, LLC
One Maritime Plaza, Fourth Floor
720 Water Street
Toledo, Ohio 43604
(419) 255-5900

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/285,312	10/31/2002	James E. Smith	1-23649	1413

27210 7590 10/05/2005

MACMILLAN, SOBANSKI & TODD, LLC
ONE MARITIME PLAZA - FOURTH FLOOR
720 WATER STREET
TOLEDO, OH 43604

EXAMINER	
ALAVI, ALI	

ART UNIT	PAPER NUMBER
2875	

DATE MAILED: 10/05/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Office Action Summary	Application No.	Applicant(s)	
	10/285,312	SMITH ET AL.	
	Examiner	Art Unit	
	Ali Alavi	2875	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on *18 July 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-5 and 7-13* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-5, and 7-13* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

Applicant's arguments filed on 7/18/05 have been fully considered but they are not persuasive. Applicant argues that the cited references don't teach the limitation of "the controller generates an output signal only when the sensor signal changes by more that a predetermined amount" as recited in claims 1 and 7. Examiner respectfully disagrees with this assertion. Toda et al '823 shows the limitation in figure 2 and (col. 2, lines 8-27). Okuchi et al '398 shows the limitation in figure 4, the operating algorithm 107 and in column 1, lines 30-38. Gotoh '949 shows the limitation in figure 3. The cited references teach every limitation of the invention as described as applied in the following paragraphs. Therefore, the rejection of claims 1-5 and 7-13 stand.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-2, 4-5, 7-8, 10-13 are rejected under 35 U.S.C. 102(e) as being anticipated by Toda et al (U.S. Pat. No 6,305,823).

Toda et al discloses an automatic directional control system for a vehicle headlight comprising: a sensor (12, 14) that is adapted to generate a signal that is representative of a condition of the vehicle, said sensed condition includes one or more of road speed (12), and suspension height (14) of the vehicle; a controller (16) that is responsive to said sensor signal for generating an output signal; and an actuator (10) that is adapted to be connected to the headlight to effect movement thereof in accordance with said output signal, wherein said sensor generates a signal that is representative of the road speed of the vehicle (see abstract), speed sensor (12), Height sensor (14).

Claims 1-2, 4-5, 7-8, 10-13 are rejected under 35 U.S.C. 102(e) as being anticipated by Okuchi et al (U.S. Pat. No 6,193,398).

Okuchi et al discloses an automatic directional control system for a vehicle headlight comprising: a sensor (12) that is adapted to generate a signal that is representative of a condition of the vehicle, said sensed condition includes one or more of road speed (12) a controller (20) that is responsive to said sensor signal for generating an output signal; and an actuator (35) that is adapted to be connected to the headlight to effect movement thereof in accordance with said output signal, wherein said sensor generates a signal that is representative of the road speed of the vehicle (see abstract), speed sensor (12), pitch angle (2103, fig. 9), suspension height (2201, 2203, fig. 14).

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-3 and 9 are rejected under 35 U.S.C. 102(b) as being anticipated by Gotoh (US Pat. No 5,909,949).

Gotoh discloses an automatic directional control system for a vehicle headlight comprising: a sensor (22) that is adapted to generate a signal that is representative of a condition of the vehicle, said sensed condition includes one or more of road speed (22), and steering angle (21) and a controller (10) that is responsive to said sensor signal for generating an output signal; and an actuator (24) that is adapted to be connected to the headlight to effect movement thereof in accordance with said output signal, wherein said sensor generates a signal that is representative of the road speed of the vehicle.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the

shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

6. Any inquiry concerning this communication or earlier communication from the examiner should be directed to Ali Alavi whose telephone number is (571) 272-2365. The examiner can normally be reached between 7:00 A.M. to 5:30 P.M. Tuesday to Friday. If attempts to reach the examiner by phone are unsuccessful, the examiner's supervisor, Sandy O'Shea can be reached at (571) 272-2378 or you may fax your inquiry to the **Central Fax** at (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application should be directed to the receptionist whose telephone number is (703) 308-2956.

AA

ALI ALAVI
PRIMARY EXAMINER

Index of Claims

Application No.	Applicant(s)
10/285,312	SMITH ET AL.
Examiner	**Art Unit**
Ali Alavi	2875

√	Rejected	–	(Through numeral) Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

Claim: Final	Claim: Original	Date: 12/12/03	Date: 6/10/0	Date: 3/18/0	Date: 9/30/05	Date	Date	Date	Date	Date
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Doc Code: AP.PRE.REQ

PTO/SB/33 (07-05)
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PRE-APPEAL BRIEF REQUEST FOR REVIEW

Docket Number (Optional)
1-23649

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on 1/5/2006

Signature Kathy M. Brownfield

Typed or printed name KATHY M. BROWNFIELD

Application Number	Filed
10/285,312	10/31/2002

First Named Inventor: James E. Smith

Art Unit	Examiner
2875	Ali Alavi

Applicant requests review of the final rejection in the above-identified application. No amendments are being filed with this request.

This request is being filed with a notice of appeal.

The review is requested for the reason(s) stated on the attached sheet(s).
Note: No more than five (5) pages may be provided.

I am the

- [ ] applicant/inventor.
- [ ] assignee of record of the entire interest. See 37 CFR 3.71. Statement under 37 CFR 3.73(b) is enclosed. (Form PTO/SB/96)
- [X] attorney or agent of record. Registration number 30,085
- [ ] attorney or agent acting under 37 CFR 1.34. Registration number if acting under 37 CFR 1.34 _____

Richard S. MacMillan
Signature

Richard S. MacMillan
Typed or printed name

(419) 255-5900
Telephone number

1/5/2006
Date

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*.

- [ ] *Total of _____ forms are submitted.

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Kathy M. Brownfield
(signature)

Date of signature and deposit - 1-5-2006

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: JAMES E. SMITH et al.	)	Group Art Unit 2875
Serial No. 10/285,312	)	Examiner Ali Alavi
Filed: October 31, 2002	)	
For: AUTOMATIC DIRECTIONAL CONTROL SYSTEM FOR VEHICLE HEADLIGHTS	)	Attorney Docket 1-23649

Commissioner For Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

REMARKS ACCOMPANYING REQUEST
FOR PRE-APPEAL BRIEF CONFERENCE

Honorable Sir:

These remarks are submitted with the concurrently filed Pre-Appeal Brief Request For Review and the Notice Of Appeal pursuant to the procedure specified in the Notice published in the Official Gazette on July 12, 2005.

Independent Claim 1

The Examiner rejected independent Claim 1 as being anticipated by any of the Toda et al., Okuchi et al., or Gotoh references. These rejections are clearly erroneous and should be withdrawn.

Independent Claim 1 defines the invention as an automatic directional control system for a vehicle headlight that includes a sensor that is adapted to generate a signal that is representative of a condition of the vehicle, wherein the sensed condition includes one or more of road speed, steering angle, pitch, and suspension height of the

vehicle. A controller is responsive to the sensor signal for generating an output signal only when the sensor signal changes by more than a predetermined amount. Lastly, an actuator is adapted to be connected to the headlight to effect movement thereof in accordance with the output signal. None of the art of record shows or suggests a controller that is responsive to the sensor signal for generating an output signal only when the sensor signal changes by more than a predetermined amount.

In the Final Rejection, the Examiner identifies this minimum threshold limitation as being disclosed at Column 2, Lines 8 - 27 and in Fig. 2 of the Toda et al. reference. However, the cited portion of the Toda et al. reference states only that:

> "The invention may include one or more of the following features. The automatic leveling device may include a control unit that determines, based on a signal from said failure detection means, whether or not the actuators fail, respectively, and wherein when determining that either of the actuators fails, the control unit outputs a driving stop signal to the failed actuator to stop driving the actuator. Since the control unit determines whether or not the actuators fail and stops driving the actuators, the number of constituent components of the automatic leveling device is reduced, and the construction thereof is simplified. The actuator may include a motor as an actuator main body, position detection means for detecting the driving magnitude of the motor, and a motor driver for feedback controlling the driving of the motor based on a signal from the position detection means. Since the motor driver built in the actuator feedback controls the motor, the quantity of information processed by the control unit is reduced. Therefore, the load on the control unit is reduced as well, whereby the number of functions demanded from the control unit is reduced."

There is simply nothing contained in this portion of the Toda et al. reference (or in Fig. 2 or elsewhere in the Toda et al. reference, for that matter) that shows or suggests the claimed limitation of the controller being responsive to the sensor signal for generating an output signal only when the sensor signal changes by more than a predetermined amount, as specifically claimed. Rather, the Toda et al. reference discloses an automatic leveling device that changes the direction of the headlights in response to any changes in the sensor signal. Thus, the Toda et al. reference clearly does not show or suggest, much less anticipate, the structure recited in independent Claim 1.

Regarding the Okuchi et al. reference, the Examiner identifies this minimum threshold limitation as being disclosed at Column 1, Lines 30 - 38 and in Fig. 4. The cited portion of the Okuchi et al. reference states that:

> "JP-A-9-301055 discloses a vehicle headlight optical axis control system, in which a control mode is set in accordance with acceleration, a filtering process is executed when the acceleration is smaller than a predetermined value, the filtering process is not performed so as not to delay switching of the control mode when the acceleration is equal to or larger than the predetermined value, and the optical axis direction of the headlight is adjusted on the basis of a change in the height of the vehicle on each occasion." (emphasis added).

Nothing in the cited portion of the Okuchi et al. reference (or in Fig. 4 or elsewhere in the Okuchi et al. reference, for that matter) shows or suggests the claimed limitation of the controller being responsive to the sensor signal for generating an output signal only when the sensor signal changes by more than a predetermined amount, as specifically claimed. Rather, the Okuchi et al. reference discloses an automatic leveling device that changes the direction of the headlights in response to any changes in the sensor signal. Thus, the Okuchi et al. reference clearly does not show or suggest, much less anticipate, the structure recited in independent Claim 1.

Lastly, in connection with the Gotoh reference, the Examiner identifies this minimum threshold limitation as being disclosed in Fig. 3. However, nothing in Fig. 3 (or elsewhere in the Gotoh reference, for that matter) shows or suggests the claimed limitation of the controller being responsive to the sensor signal for generating an output signal only when the sensor signal changes by more than a predetermined amount, as specifically claimed. Rather, the Gotoh reference discloses an automatic leveling device that changes the direction of the headlights in response to any changes in the sensor signal. Thus, the Gotoh reference clearly does not show or suggest, much less anticipate, the structure recited in independent Claim 1.

Independent Claim 7

The Examiner rejected independent Claim 7 under 35 U.S.C. 102(e) as being anticipated by either of the Toda et al. or Okuchi et al. references. These rejections are also clearly erroneous and should be withdrawn.

Independent Claim 7 defines the invention as an automatic directional control system for a vehicle headlight including a sensor that is adapted to generate a signal that is representative of a condition of the vehicle, wherein the sensed condition includes one or more of road speed, steering angle, pitch, and suspension height of the vehicle. A controller is responsive to a rate of change of the sensor signal for generating the output signal. Lastly, an actuator is adapted to be connected to the headlight to effect movement thereof in accordance with the output signal. As described in the specification on Page 20, Lines 8-14:

> "The rate of change of the sensed condition can be calculated as the difference between the first and second readings divided by the amount of time therebetween or by any other desired means. For example, if the sensed condition is vehicle speed, then the difference between the first sensed vehicle speed and the second sensed vehicle speed, divided by the amount of time therebetween, would yield a number that is representative of the acceleration of the vehicle."

Neither of the Toda et al. or Okuchi et al. references shows or suggests, much less anticipates, a controller that is responsive to a rate of change of the sensor signal for generating the output signal, as specifically claimed. The Examiner completely failed to address the "rate of change" language of independent Claim 7 in the Final Rejection. Absent any disclosure in the references, these rejections must also be withdrawn.

Respectfully submitted,

Richard S. MacMillan
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PATENT

AF/2875

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Kathy M. Brownfield
(signature)

Date of signature and deposit - 1-5-2006

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: JAMES E. SMITH et al.	)	Group Art Unit 2875
Serial No. 10/285,312	)	Examiner Ali Alavi
Filed: October 31, 2002	)	
For: AUTOMATIC DIRECTIONAL CONTROL SYSTEM FOR VEHICLE HEADLIGHTS	)	Attorney Docket 1-23649

Commissioner For Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

NOTICE OF APPEAL

Honorable Sir:

The applicant respectfully appeals from the Final Rejection of the Examiner dated October 5, 2005 in the above-identified application. Please charge Deposit Account No. 13-0005 in the amount of $500.00 to cover the fee pursuant to 37 C.F.R. 41.20(b)(1). A duplicate copy of this sheet is enclosed.

Respectfully submitted,

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01/10/2006 FFANAIA2 00000042 130005 10285312
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/285,312	10/31/2002	James E. Smith	1-23649	1413

27210 7590 02/03/2006

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TOLEDO, OH 43604

EXAMINER	
ALAVI, ALI	
ART UNIT	**PAPER NUMBER**
2875	

DATE MAILED: 02/03/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Application Number	Application/Control No.	Applicant(s)/Patent under Reexamination	
	10/285,312	SMITH ET AL.	
	Ali Alavi	Art Unit 2875	

Document Code - AP.PRE.DEC

Notice of Panel Decision from Pre-Appeal Brief Review

This is in response to the Pre-Appeal Brief Request for Review filed 1/9/06.

1. ☐ **Improper Request** – The Request is improper and a conference will not be held for the following reason(s):

☐ The Notice of Appeal has not been filed concurrent with the Pre-Appeal Brief Request.
☐ The request does not include reasons why a review is appropriate.
☐ A proposed amendment is included with the Pre-Appeal Brief request.
☐ Other:

The time period for filing a response continues to run from the receipt date of the Notice of Appeal or from the mail date of the last Office communication, if no Notice of Appeal has been received.

2. ☒ **Proceed to Board of Patent Appeals and Interferences** – A Pre-Appeal Brief conference has been held. The application remains under appeal because there is at least one actual issue for appeal. Applicant is required to submit an appeal brief in accordance with 37 CFR 41.37. The time period for filing an appeal brief will be reset to be one month from mailing this decision, or the balance of the two-month time period running from the receipt of the notice of appeal, whichever is greater. Further, the time period for filing of the appeal brief is extendible under 37 CFR 1.136 based upon the mail date of this decision or the receipt date of the notice of appeal, as applicable.

☒ The panel has determined the status of the claim(s) is as follows:
Claim(s) allowed: _____.
Claim(s) objected to: _____.
Claim(s) rejected: 1-13.
Claim(s) withdrawn from consideration: _____.

3. ☐ **Allowable application** – A conference has been held. The rejection is withdrawn and a Notice of Allowance will be mailed. Prosecution on the merits remains closed. No further action is required by applicant at this time.

4. ☐ **Reopen Prosecution** – A conference has been held. The rejection is withdrawn and a new Office action will be mailed. No further action is required by applicant at this time.

All participants:

(1) Ali Alavi.

(2) Sandra L. O'Shea.

(3) Cassandra Spyrou.

(4)_____.

U.S. Patent and Trademark Office

Part of Paper No. 6

UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/285,312	10/31/2002	James E. Smith	1-23649	1413

27210 7590 04/06/2006

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EXAMINER	
ALAVI, ALI	

ART UNIT	PAPER NUMBER
2875	

DATE MAILED: 04/06/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Notice of Abandonment	Application No.	Applicant(s)	
	10/285,312	SMITH ET AL.	
	Examiner	Art Unit	
	Ali Alavi	2875	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

This application is abandoned in view of:

1. ☒ Applicant's failure to timely file a proper reply to the Office letter mailed on *03 February 2006*.
   (a) ☐ A reply was received on _____ (with a Certificate of Mailing or Transmission dated _____), which is after the expiration of the period for reply (including a total extension of time of _____ month(s)) which expired on _____.
   (b) ☐ A proposed reply was received on _____, but it does not constitute a proper reply under 37 CFR 1.113 (a) to the final rejection.
   (A proper reply under 37 CFR 1.113 to a final rejection consists only of: (1) a timely filed amendment which places the application in condition for allowance; (2) a timely filed Notice of Appeal (with appeal fee); or (3) a timely filed Request for Continued Examination (RCE) in compliance with 37 CFR 1.114).
   (c) ☐ A reply was received on _____ but it does not constitute a proper reply, or a bona fide attempt at a proper reply, to the non-final rejection. See 37 CFR 1.85(a) and 1.111. (See explanation in box 7 below).
   (d) ☒ No reply has been received.

2. ☐ Applicant's failure to timely pay the required issue fee and publication fee, if applicable, within the statutory period of three months from the mailing date of the Notice of Allowance (PTOL-85).
   (a) ☐ The issue fee and publication fee, if applicable, was received on _____ (with a Certificate of Mailing or Transmission dated _____), which is after the expiration of the statutory period for payment of the issue fee (and publication fee) set in the Notice of Allowance (PTOL-85).
   (b) ☐ The submitted fee of $_____ is insufficient. A balance of $_____ is due.
   The issue fee required by 37 CFR 1.18 is $_____. The publication fee, if required by 37 CFR 1.18(d), is $_____.
   (c) ☐ The issue fee and publication fee, if applicable, has not been received.

3. ☐ Applicant's failure to timely file corrected drawings as required by, and within the three-month period set in, the Notice of Allowability (PTO-37).
   (a) ☐ Proposed corrected drawings were received on _____ (with a Certificate of Mailing or Transmission dated _____), which is after the expiration of the period for reply.
   (b) ☐ No corrected drawings have been received.

4. ☐ The letter of express abandonment which is signed by the attorney or agent of record, the assignee of the entire interest, or all of the applicants.

5. ☐ The letter of express abandonment which is signed by an attorney or agent (acting in a representative capacity under 37 CFR 1.34(a)) upon the filing of a continuing application.

6. ☐ The decision by the Board of Patent Appeals and Interference rendered on _____ and because the period for seeking court review of the decision has expired and there are no allowed claims.

7. ☐ The reason(s) below:

ALI ALAVI
PRIMARY EXAMINER

Petitions to revive under 37 CFR 1.137(a) or (b), or requests to withdraw the holding of abandonment under 37 CFR 1.181, should be promptly filed to minimize any negative effects on patent term.

PATENT

CERTIFICATE OF FACSIMILE TRANSMISSION

I hereby certify that this paper is being facsimile transmitted to the U.S. Patent and Trademark Office on the date shown below.

(signature)

Richard S. MacMillan

(name of person signing certificate)

Date: July 11, 2006 No. of Pages: 1

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: JAMES E. SMITH et al.	Group Art Unit 2875
Serial No. 10/285,312	Examiner Ali Alavi
Filed: October 31, 2002	
For: AUTOMATIC DIRECTIONAL CONTROL SYSTEM FOR VEHICLE HEADLIGHTS	Attorney Docket 1-23649

Commissioner For Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

REQUEST FOR WITHDRAWAL OF HOLDING OF ABANDONMENT

Honorable Sir:

A Notice Of Abandonment was mailed on April 6, 2006, stating that no reply had been received to the Decision on the applicants' Request For A Pre-Appeal Brief Conference dated February 3, 2006. However, the time for filing the Brief On Appeal continues to run from the filing date of the Notice Of Appeal dated January 9, 2006 (including any extensions of time that may be granted). Thus, the Notice Of Abandonment is premature and should be withdrawn.

Respectfully submitted,

Richard S. MacMillan
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TFW #2875

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Date of signature and deposit - 7-13-06

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: JAMES E. SMITH et al.	)	Group Art Unit 2875
Serial No. 10/285,312	)	Examiner Ali Alavi
Filed: October 31, 2002	)	Confirmation No. 1413
For: AUTOMATIC DIRECTIONAL CONTROL SYSTEM FOR VEHICLE HEADLIGHTS	)	Attorney Docket 1-23649

Commissioner For Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

INFORMATION DISCLOSURE STATEMENT

Honorable Sir:

Pursuant to 37 C.F.R. 1.97(b), record is hereby made of information that the Patent Office may wish to consider in connection with its examination of the above-identified application. A completed PTO-1449 form is enclosed, together with copies of the foreign patent documents and non-patent literature (if any) cited therein. Each item of information contained herein was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this statement. A copy of a corresponding European Search Report is also enclosed. Please charge Deposit Account No. 13-0005 in the amount of $180.00 pursuant to 37 C.F.R. 1.17(p). A duplicate copy of this sheet is enclosed.

Respectfully submitted,

07/18/2006 MBIZUNES 00000004 130005 10285312
01 FC:1806 180.00 DA

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U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

ATTY. DOCKET NO.	SERIAL NO.
1-23649	10/285,312
APPLICANT: JAMES E. SMITH et al.	
FILING DATE: October 31, 2002	GROUP: 2875

U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
		4,549,277	10/1985	Brunson et al.			

FOREIGN PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
		2,340,925	3/2000	U.K.				
		1,142,757	10/2001	E.P.O.				
		1,275,555	1/2003	E.P.O.				

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

		"Simulink, Dynamic System Simulation for MATLAB", pp. 8-110, 112, 114, The Mathworks, Inc. (January, 1999)

DATE CONSIDERED

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

(12) UK Patent Application (19) GB (11) 2 340 925 (13) A

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(30) Priority Data
(31) 10236937 (32) 24.08.1998 (33) JP

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B60Q 1/115

(52) UK CL (Edition R)
F4R RFT RMC R364 R518 R65Y R656 R789

(56) Documents Cited
EP 0847895 A2 EP 0845388 A1

(58) Field of Search
UK CL (Edition Q) F4R RFT RMC
INT CL[6] B60Q 1/04 1/06 1/08 1/10 1/115
ONLINE: EPODOC, JAPIO, WPI.

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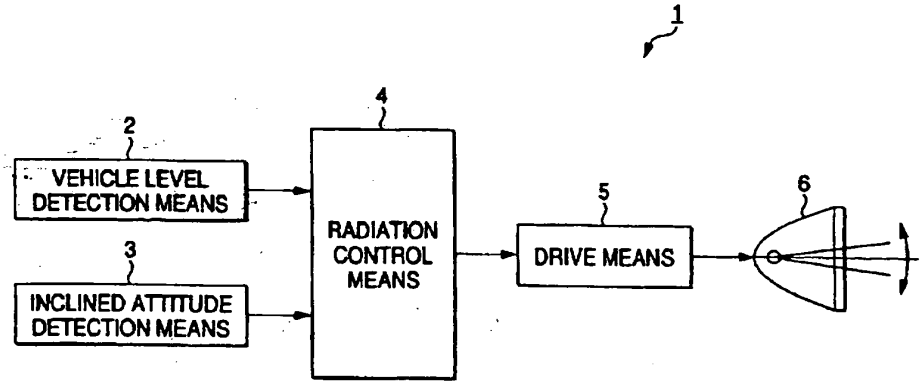
(54) Abstract Title
Radiating direction control unit for vehicle headlamps

(57) A radiating direction control unit (1) of a lighting device (6) for a vehicle controls the radiating direction of the lighting device (6) in accordance with the pitch angle of the vehicle. The radiation direction control unit includes an axle level detector (2) which detects a change in the level of a front or a rear axle of the vehicle, and a vehicle inclination detector (3) for detecting an inclination of the vehicle in the transverse direction. A pitch angle of the vehicle is determined based on respective signals emitted by the axle level detector (2) and the vehicle inclination detector (3). A radiation direction controller (4) corrects a radiating direction of the lighting device (6) only when a change in the inclination of the vehicle in the transverse direction is not detected by the inclined attitude detection means (3). Accordingly, the radiating direction of the lighting device (6) is not changed due to a change in the vehicle attitude which does not affect the pitch angle of the vehicle.

FIG. 1



At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

GB 2 340 925 A

FIG. 2

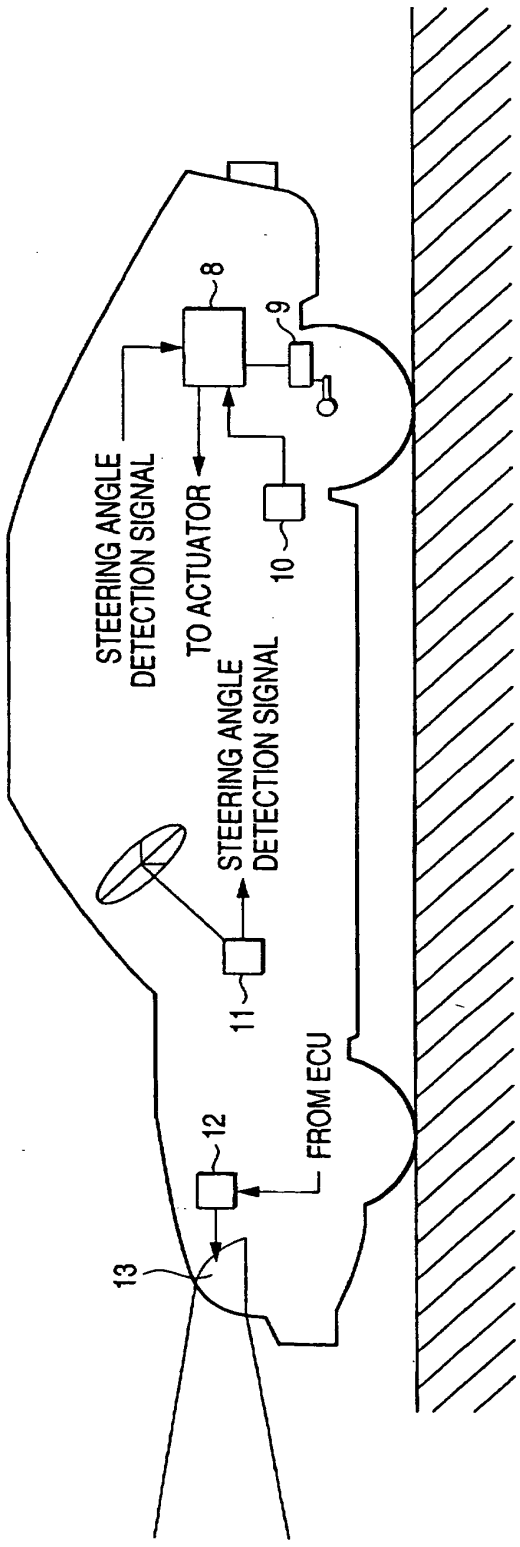


FIG. 4

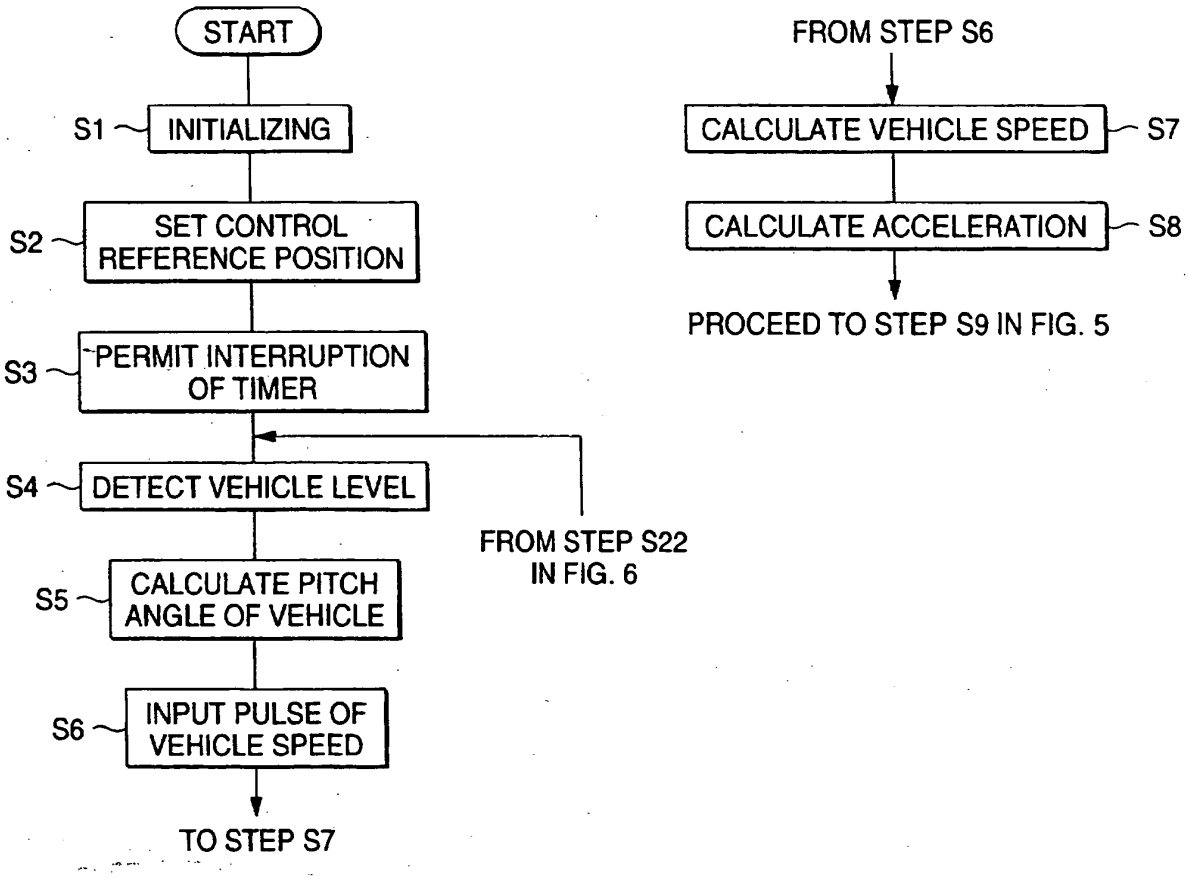


FIG. 6

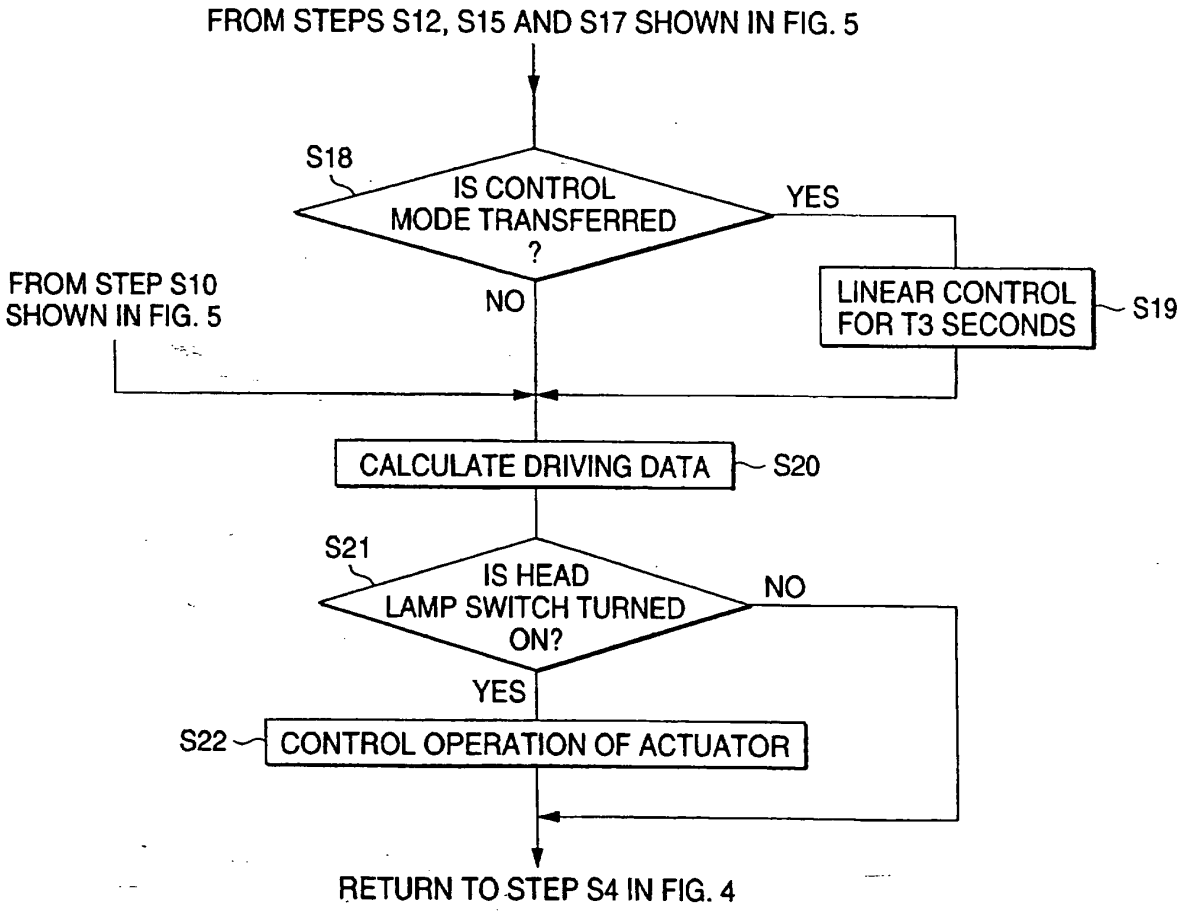
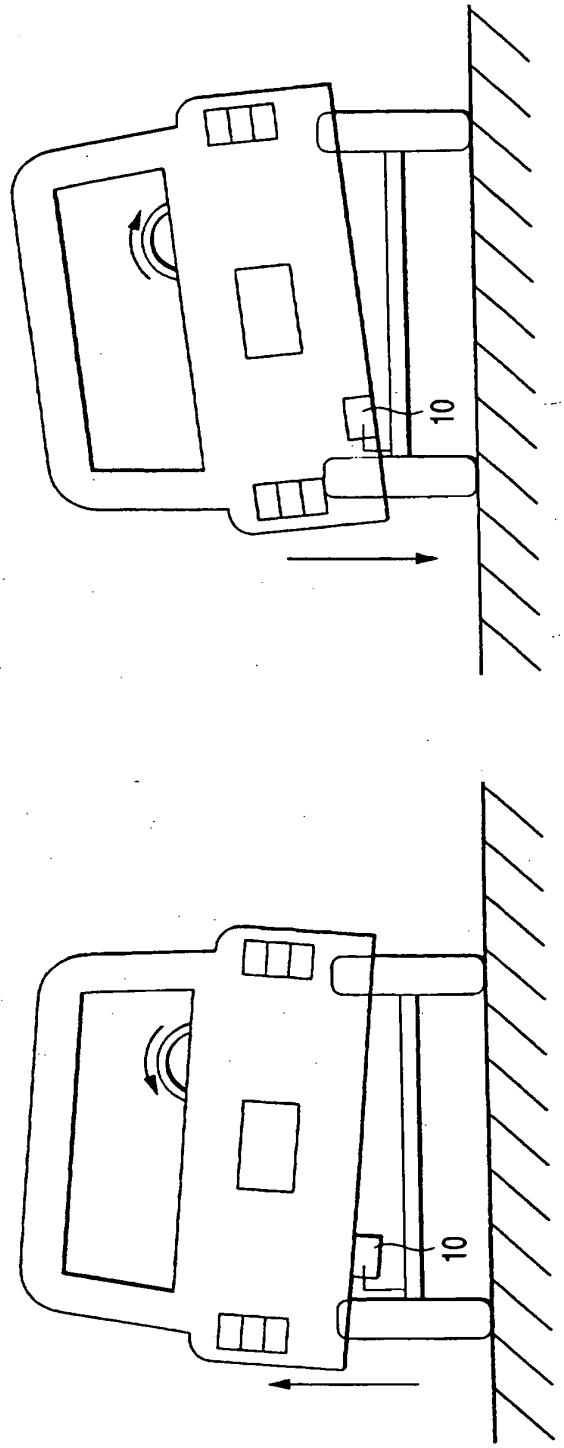


FIG. 8



dive, the radiating direction of the lighting device is controlled so that this change can be canceled. That is, the radiating direction of the lighting device is controlled so that the radiating direction of the lighting device is controlled upward with respect to a horizontal face. Accordingly, there is a possibility that a beam of light directed upward at this time causes a glare in an opposed car. When the vehicle is turning to the right, the level of the left axle is lowered. Therefore, it is erroneously recognized that this change is the same as that in the case where the front portion of the vehicle is shifted upward. In this case, the radiating direction of the lighting device is controlled downward with respect to a horizontal face. Therefore, visibility of the vehicle is lowered in this case. That is, there is a possibility that safety of driving is impaired.

It is a task of the present invention to properly conduct controlling of the radiating direction of a lighting device for vehicle use when the pitch angle of a vehicle is changed.

In order to solve the above problems, the present invention provides a radiating direction control unit of a lighting device for vehicle use comprising: a vehicle level detecting means for detecting a change in the level of an axle section of a front or a rear wheel of a vehicle, a pitch angle of the vehicle being found from a vehicle level detecting signal obtained by the vehicle level detecting means, a radiating direction of the lighting device being changed according to a change in an attitude of the vehicle; an inclined attitude detection means for detecting an inclination of the vehicle in the transverse direction; and a radiation control means for correcting a radiating direction of the lighting device according to a change in the pitch angle of the vehicle based on the vehicle level detecting signal sent from the vehicle level detecting means only when a change in the inclination in the transverse direction of the vehicle is not detected by a signal sent from the inclined attitude detection means.

According to the present invention, only when the vehicle is not inclined in the transverse direction, the radiating direction of the lighting device is corrected with respect to a change in the pitch angle of the vehicle according to the vehicle leveling signal.

A preferred embodiment of the present invention will now be described with reference to the accompanying drawings; in which:-

provided a vehicle level sensor which detects an amount of extension and contraction of the suspension.

The inclined attitude detecting means 3 is provided for detecting an inclination of the vehicle in the transverse direction. The detection signal obtained by the inclined attitude detecting means 3 is used as a piece of fundamental information for judging whether or not a change in the pitch angle of the vehicle is detected, that is, whether or not the vehicle level detecting signal is originated from a change in the vehicle level which does not affect the pitch angle of the vehicle.

For example, the inclined attitude detecting means 3 can detects whether or not the vehicle is turning by using one of the following detecting methods:

(1) the method of detecting the speeds of a right and a left wheel;

(2) the method of detecting the steering angle of a steering wheel;

(3) the method of detecting the acceleration in the transverse direction given to a vehicle; and

(4) the method of detecting a rolling angle or yawing angle of the vehicle.

First, according to method (1), a turning condition of a vehicle is grasped by detecting a difference of speed between the right and the left wheel. When a vehicle is running straight, there is no difference of speed between the right and the left wheel or there is a difference of speed which is smaller than a threshold value. When the vehicle is turning, the difference of speed between the right and the left wheel becomes larger than the threshold value. Therefore, it is possible to judge a running attitude of the vehicle.

According to method (2), a steering angle of the steering wheel is detected. When the vehicle is running straight, the steering angle is smaller than a threshold value. When the vehicle is turning, the steering angle becomes larger than the threshold value. Due to the foregoing, it is possible to judge a running attitude of the vehicle.

According to method (3), an acceleration given to the vehicle in the transverse direction is detected by an acceleration detecting means. When the vehicle is running, the acceleration given to the vehicle in the transverse direction is lower than a threshold value. When the vehicle is turning, the acceleration given to the vehicle in the transverse direction becomes higher than the threshold value by the influence of a centrifugal force. Due to the foregoing, it is possible to judge a running attitude of the vehicle.

According to method (4), in order to detect the rolling angle, the yawing angle or both of them, for example, an angular sensor or a gyro-sensor is arranged in the vehicle, and it can

expression passes through a point ($\Delta h0$, p0), value B can be determined ($B = p0 - A \cdot \Delta h0$), and inclination A is substantially constant irrespective of a condition of a load carried by the vehicle. Due to the foregoing, when Δh detected by the vehicle level detection in the case where the vehicle is running is substituted in the linear expression "$P = A \cdot \Delta h + B$", it is possible to calculate a pitch angle (P) expressing a running attitude. Due to the foregoing, when only one vehicle level detecting means is provided in one of the front and the rear axle, it is possible to calculate and estimate a pitch angle of the vehicle.

When an inclination in the transverse direction of the vehicle is detected, that is, when an inclination angle is not less than the threshold value, one of the following three items (I) to (III) may be selected.

(I) Stoppage of the control of a radiating direction or reduction in the response speed of the control;

(II) Control according to average processing of vehicle level detection signals; or

(III) Control for canceling a change in the radiating direction originated from a change in the vehicle level detecting signal.

Item (I) is described as follows. Control of the radiating direction of the lighting device 6 is stopped by the radiation control means 4, so that radiating direction control of the lighting device 6 is stopped with respect to the pitch angle found by the change in the vehicle level. Alternatively, the response property of control of the radiating direction is intentionally lowered, so that control conducted on the change in the pitch angle can be suppressed. It can be said that when the response property of control is ultimately lowered, control is finally stopped.

According to item (II), a pitch angle is found which corresponds to an average of the vehicle level detection signals obtained until that time, and the radiating direction of the lighting device 6 is corrected according to the pitch angle. In this case, "average" includes a simple time average, a moving average, and a weighted average which is multiplied by a weighting coefficient, the value of which is determined by whether the vehicle level detection signal is a close signal or the vehicle level detection signal is a remote signal from the viewpoint of time.

According to item (III), the radiating direction of the lighting device 6 is corrected so that the change in the radiating direction of the lighting device corresponding to the pitch angle of the vehicle found by the vehicle level signal, which has been obtained in the case where the vehicle is turning, can be canceled. For example, when the vehicle level sensor is

lamps or only radiating axes of two of the three lamps are changed. Alternatively, it is possible to adopt a method in which an attitude of one of the components of the lighting device is controlled or attitudes of a plurality of components of the lighting device are controlled. For example, reflecting mirrors are composed of a stationary reflecting mirror and a movable reflecting mirror, and an optical axis of the movable reflecting mirror is directed to a desired direction.

According to the present invention, even when a change in the level, which is caused by the influence of rolling in the case where the vehicle is turning, is detected in the axle arranged in the front or at the rear of a vehicle, it is possible to control in such a manner that an unnecessary radiating direction controlling operation of the lighting device can not be conducted with respect to a change which does not affect the pitch angle of the vehicle.

Figures 2 to 8 are views showing an embodiment in which the present invention is applied to a radiating direction control unit, which is an automatic leveling device of a lighting device for automobile use.

Figure 2 is a schematic illustration showing an outline of an arrangement of the radiating direction control unit 7 in a vehicle. At the rear of the vehicle, there is provided ECU (electronic control unit) 8 which is a controller for the radiating direction control unit 7. Detection signals of the vehicle level sensor 9, vehicle speed sensor 10, and steering sensor 11 are inputted into ECU 8.

The vehicle level sensor 9 corresponding to the vehicle level detecting means 2 is attached to a left rear wheel section of an automobile. A sensor provided for an electronically controlled air suspension of the rear wheel is used as the vehicle level sensor 9. A sensor provided for ABS (anti-skid brake system) of the rear wheel is used as the vehicle speed sensor (vehicle speed detecting means) 10. The steering sensor 11 corresponds to the inclined attitude detecting means 3 and detects a steering angle of the steering wheel.

A control signal of ECU 8 is sent to the actuator 12, and radiating direction control is conducted on the head lamp 13. In this connection, only the actuator and the head lamp arranged on the left of the vehicle body are shown in Fig. 2.

Figure 3 is a view showing a constitution of the radiating direction control unit 7. An indication signal of turning on and off the head lamp switch 14 is inputted into ECU 8 into which a microcomputer is incorporated, and also detection signals of the vehicle level sensor 9, vehicle speed sensor 10 and steering sensor 11 are inputted into ECU 8.

graph, straight line L0, which is parallel to the horizontal axis θ, shows a control characteristic when the vehicle speed is 0 km/h. Straight lines Li (i = 1, 2, . . .), which are rising to the right, respectively represent the control characteristics at vehicle speed Vi (i = 1, 2, . . . , and "Vi < V(i + 1)"). In this connection, the inclination angle θ is calculated by the steering angle of the steering wheel according to the detection signal sent from the steering sensor 11. A direction in which the vehicle body inclines to the left is determined to be a positive direction of θ. Concerning the correction radiation angle δ, a direction in which correction is made upward with respect to a horizontal face is determined to be a positive direction.

As shown in the drawing, all straight lines L0 and Li (i = 1, 2, . . .) pass through the origin (0, 0). Concerning straight line Li, its inclination (taper) is large when vehicle speed Vi is high.

Figure 8 is a rear view schematically showing a vehicle, the attitude of which changes when the vehicle is turning. The left view shows an attitude of the vehicle which turns to the left, and the right view shows an attitude of the vehicle which turns to the right.

When the vehicle is turning to the left, the left vehicle body goes up. In this state, it results that ECU 8 corrects the radiating direction of the head lamp upward. In order to prevent the occurrence of the above problem, as shown in Fig. 7, the correction radiation angle is set at a value δ which corresponds to θ = -θa (negative value). For example, when the vehicle speed is V3 in the case where the vehicle is turning, the correction radiation angle is set at a value δ= -δa (negative value) which corresponds to point Qa on straight line L3. That is, the radiating direction is corrected downward with respect to the horizontal face. Due to the foregoing, the occurrence of a glare, which affects a vehicle coming from the opposed side, can be prevented.

On the other hand, when the vehicle is turning to the right, the left vehicle body goes down. In this state, it results that ECU 8 corrects the radiating direction of the head lamp downward. In order to prevent the occurrence of the above problem, as shown in Fig. 7, the correction radiation angle is set at a value δ which corresponds to θ = θb (positive value). For example, when the vehicle speed is V3 in the case where the vehicle is turning, the correction radiation angle is set at a value δ = δb (positive value) which corresponds to point Qb on straight line L3. That is, the radiating direction is corrected upward with respect to the

As described above, in this embodiment, according to the intensities of vehicle speed V and acceleration A, there are provided three control modes shown in steps S12, S15 and S17. In step S18 shown in Fig. 6 succeeding to these steps, it is judged whether or not transfer has been made between the control modes. When transfer has been made between the control modes, the program proceeds to step S19, and the radiation angle of the head lamp 13, 13' is controlled over a predetermined period of time so that it can be linear with respect to the pitch angle. After that, the program proceeds to step S20. When the control mode is not transferred, the program directly proceeds to step S20.

In step S20, according to control data obtained in steps S10, S12, S15, S17 and S19, ECU 8 calculates data used for driving the actuator 12, 12'. Then, the program proceeds to step S21, and it is judge whether or not the head lamp switch 14 has been turned on. When the head lamp switch has been turned on, the program proceeds to the next step S22, and a signal corresponding to data used for driving is sent to the actuator 12, 12', so that the radiating direction of the head lamp 13, 13' is controlled. After that, the program returns to step S4 shown in Fig. 4. When the head lamp switch 14 has not been turned on, no operation is conducted and the program returns to step S4 shown in Fig. 4.

In this connection, in this embodiment, as shown in Fig. 7, the relation between the tilting angle θ and the correction radiating angle δ is approximated to a linear function. However, the relation between both of them can be generally expressed by a curve expression. For example, the relation of the correction radiating angle δ with respect to the tilting angle can be expressed by a curve expression. Accordingly, it is possible to accomplish various embodiments in which control characteristics of higher accuracy can be realized if necessary.

As described above, according to one embodiment of the present invention, the radiating direction of a lighting device can be corrected with respect to a change in the pitch angle of the vehicle while taking into account the inclination of the vehicle in the transverse direction. Therefore, it is possible to prevent the occurrence of a problem in which radiation control is conducted according to an erroneous detection of the pitch angle of the vehicle due to the transverse inclination of a vehicle. Accordingly, it is possible to prevent the occurrence of a glare to a vehicle coming from the opposed direction, and it is also possible to prevent the visibility from being impaired. As a result, the vehicle can be driven more safely.

CLAIMS

1. A radiating direction control unit of a lighting device for vehicle use comprising:

level detection means for detecting a change in a level of a vehicle axle section of one of a front and a rear wheel of a vehicle and for emitting a signal corresponding to the detected level change of the vehicle axle,

inclined attitude detection means for detecting an inclination of the vehicle in a direction transverse to a longitudinal direction of the vehicle and for emitting a signal corresponding to the detected inclination of the vehicle; and

control means for determining a pitch angle of the vehicle based on the signal corresponding to the detected level change of the vehicle axle section and for correcting a radiating direction of the lighting device in accordance with the determined pitch angle and the detected inclination of the vehicle.

2. The radiating direction control unit of a lighting device for vehicle use according to claim 1, wherein the inclined attitude detection means detects whether or not the vehicle is turning, and

when the vehicle is turning, the control means stops controlling the radiating direction of the lighting device.

3. The radiating direction control unit of a lighting device for vehicle use according to claim 1, wherein the inclined attitude detection means detects whether or not the vehicle is turning, and

when the vehicle is turning, the pitch angle of the vehicle is based on an average of vehicle level detecting signals obtained before turning of the vehicle is detected, and

wherein the radiating direction of the lighting device is corrected according to the pitch angle.

4. The radiating direction control unit of a lighting device for vehicle use according to claim 1, wherein the inclined attitude detection means detects whether or not the vehicle is turning, and

when the vehicle is turning, the radiating direction of the lighting device is corrected in accordance with an adjusted pitch angle equal to the pitch angle adjusted so as to cancel

8. A method of controlling a radiating direction of a lighting device for a vehicle, comprising the steps of:

determining a change in a level of a vehicle axle section of one of a front and a rear wheel of a vehicle and emitting a signal corresponding to the detected level change of the vehicle axle,

detecting an inclination attitude of the vehicle in a direction transverse to a longitudinal direction of the vehicle and emitting a signal corresponding to the detected inclination of the vehicle,

determining a pitch angle of the vehicle based on the signal corresponding to the detected level change of the vehicle axle section, and

correcting a radiating direction of the lighting device in accordance with the determined pitch angle and the detected inclination attitude of the vehicle

9. The method of controlling a radiating direction of a lighting device for a vehicle in accordance with claim 8, further comprising the step of correcting the radiating direction of the lighting device in accordance with an adjusted pitch angle equal to the pitch angle adjusted so as to cancel out a contributory component of the pitch angle representing the change in the level of the vehicle axle due to a turning of the vehicle.

10. A radiating direction control unit substantially as described with reference to the accompanying drawings.

11. A method of controlling the radiating direction of a lighting device substantially as described with reference to the accompanying drawings.

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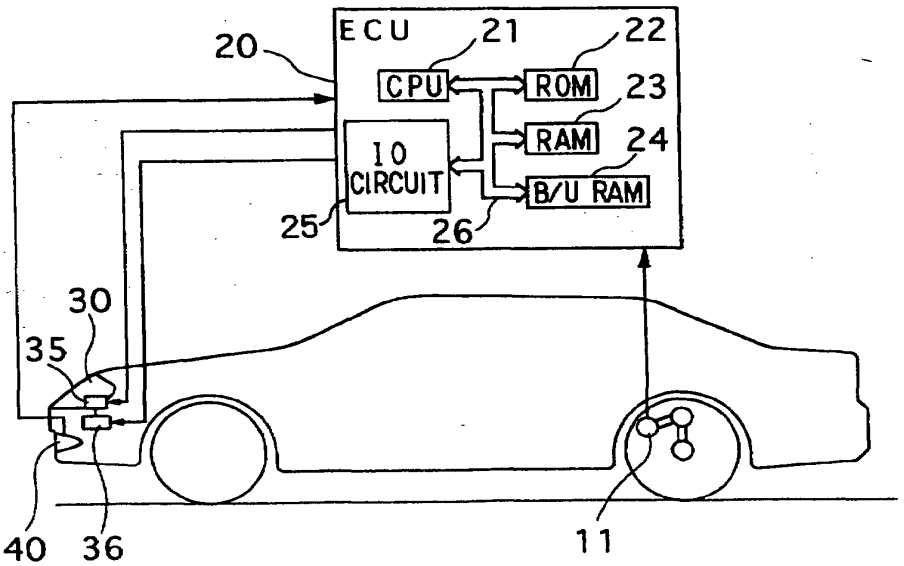
(54) Automatic headlight aiming device for vehicles

(57) The present invention changes the headlight optical axis of a vehicle in relation to an inclination angle during normal control and to properly adjust the optical axis according to information including front information about a car ahead. The headlight optical axis is adjusted based on the inclination angle of a vehicle, road information in the direction of travel, presence of a car ahead, a distance between vehicles, and the center optical axis angle corrected according to changes in horizontal and vertical behavior of the car ahead.

FIG. 1



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Description

Background.

[0001] The present invention relates to an automatic headlight aiming device, and more particularly to an automatic headlight aiming device that automatically adjusts the direction of the vehicle headlights optical axis.

[0002] In conventional vehicle headlights, oncoming vehicle drivers are blinded if the direction of the headlight optical axis is directed upward by the vehicle body inclination. Alternatively, if directed downward, the driver's distance visibility is reduced. Therefore, there is a demand for keeping the headlight optical axis fixed.

[0003] There is also conventional headlight adjusting device capable of controlling the range of light projection of the headlights according to information from a car navigation system mounted in the vehicle. This type of control device controls the headlight optical axis direction according to map information given by the car navigation system. However, it is difficult to control the headlight optical axis direction corresponding to actual road conditions because of various errors.

[0004] There is also a conventional system which recognizes a reference point on the car ahead after image processing by a CCD camera estimates conditions of the car ahead. Such a system is disclosed in JP-A-7-32936. It then controls a headlight optical axis based on the detected road conditions.

[0005] However, this system uses the largest point of illumination on the car ahead to decide the reference point. As such, sometimes this camera catches a bright street light or other illuminated object instead of the vehicle. Moreover, this system is only useful at night.

[0006] The present invention provides an automatic headlight aiming device that adjusts the vehicle's driving environment according to information including cars ahead, while allowing deviation from a control angle in ordinary control for holding the optical axis of the headlights in a fixed direction.

[0007] In one aspect of the invention, the inclination angle of the headlight optical axis from the road surface is computed by the inclination angle computing means by referencing the vehicle information detecting means which detects the inclination information of a vehicle, movement information, and acceleration information. Then, the headlight optical axis is adjusted by the optical axis adjusting means, with reference to the optical axis center angle determined by correcting and computing the inclination angle by the optical axis center angle computing means according to the front information fed from the front information detecting means. That is, road information in the direction of vehicle travel is detected by the vehicle information detecting means. The presence or absence of a car ahead, distance between vehicles, and upward and downward behavior variations are detected by the front information detecting means. Therefore, beside a normal control by the inclination angle obtained from the vehicle information, the adjustment of the optical axis is performed, when needed, by referring to road information and the optical axis center angle after correction by a behavior change of a car ahead. It is therefore possible to improve the driver's visibility of a forward road condition and a car ahead when changing to correct the normal control of the headlight optical axis direction without blinding the driver in the car ahead.

[0008] In another aspect, the center angle of the optical axis is computed by the optical axis center angle computing means after correction by using the horizontal and vertical displacement of the car ahead. When a specific threshold value is exceeded, the inclination angle is corrected to compute the center optical axis angle. Thus, the headlight optical axis direction is properly corrected without causing the driver to feel uncomfortable.

[0009] In another aspect, when the horizontal displacement of the car ahead exceeds a predetermined value, the range of light projection is changed according to the vehicle's turning direction by the horizontal adjusting means. The horizontal adjusting means adjusts the headlight optical axis in the horizontal direction.

[0010] In another aspect, when the displacement exceeding the predetermined value is detected by a horizontal change of the car ahead, the right front or left front supplementary lamp of the vehicle is lit to widen the range of light projection.

[0011] Further areas of applicability of the present invention will become apparent from the detailed description provided hereinafter. It should be understood that the detailed description and specific examples, while indicating preferred embodiments of the invention, are intended for purposes of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description. In the drawings:

Fig. 1 is a schematic view of an automatic headlight adjusting device according to the invention;

Fig. 2 is a cross-sectional view of a headlight according to the invention;

Fig. 3 is a flowchart of a control routine for controlling the headlight optical axis direction according to the invention;

Fig. 4 is a schematic view showing the computation of the headlight optical axis inclination angle with reference to a distance from a car ahead according to the invention;

Fig. 5 is a schematic view showing a reference point of the car ahead being tracked by a laser radar mechanism according to the present invention;

Fig. 6 is a table showing horizontal and vertical dead zones and surrounding ranges in relation to displacement from the reference point within a predetermined time according to the invention;

Fig. 7 is a schematic view showing the headlight optical axis tracking the behavior of the car ahead on

an uphill by the automatic headlight aiming device for vehicles according to the invention;
Fig. 8 is a schematic view showing the control of the headlight optical axis direction tracking the behavior of the car ahead downhill according to the invention;
Fig. 9 is a schematic view showing the control of the headlight optical axis direction tracking the behavior of the car ahead according to the invention;
Fig. 10 is a schematic view showing tracking of the right-turn of the car ahead according to the invention; and
Fig. 11 is a schematic view showing headlight optical axis control tracking the right-turn of the car ahead according to the invention.

[0012] In Fig. 1, a height sensor 11 is mounted on the rear wheel axle, either on the driver's or passenger's seat side of the vehicle. From the height sensor 11, the relative displacement between the rear wheel axle and the vehicle body, that is, the rear vehicle height (the displacement of the vehicle height on the rear wheel side), and signals from other sensors such as a vehicle speed sensor (not shown) and a G sensor (not shown) are input to an ECU (electronic control unit) 20 mounted on the vehicle.

[0013] The ECU 20 is a logical operation circuit comprising a CPU 21, a ROM 22 storing a control program, a RAM 23 storing various kinds of data, a B/U (backup) RAM 24, an I/O (input/output) circuit 25, and a bus line 26 for connecting these parts. An output signal from the ECU 20 is input to actuators 35 and 36 located on the headlight 30 side, thereby adjusting the headlight optical axis direction 30.

[0014] The vehicle is provided with a known laser radar mechanism 40, for instance in the front bumper section, for detecting information in front of the vehicle. This information, such as a distance from and a change in behavior in the car ahead, thus detected by the laser radar mechanism 40 are input into the ECU 20 as described later. This information is used to adjust the direction of headlight optical axis 30. Also mounted on the vehicle is a known car navigation system (not shown) for detecting road information. It is understood that an image information processing system using an EHF radar mechanism and a CCD camera may be similarly mounted in place of the laser radar mechanism 40 for detecting the information in front of a vehicle.

[0015] In Fig. 2, the headlight 30 is comprised chiefly of a lamp 31, a reflector 32 securing the lamp 31, a support section 33 which supports the reflector 32 and swings in the direction of the arrows, another movable part 34 which supports reflector 32, the actuator 35 such as a step motor for driving the movable part 34 back and forth in the directions of the arrows, and an actuator 36 including a step motor for driving an integrated assembly of these components rotationally for horizontal adjustment as indicated by the arrow. The initial setting of the headlight 30 optical axis is performed based on that only the driver is in the vehicle.

[0016] Next, Fig. 3 is a flowchart showing an optical axis adjustment control routine for adjusting the headlight optical axis direction 30 with the CPU 21 of the ECU 20. Referring to Figs. 4, 5 and 6. The control routine is repetitively executed by the CPU 21 at a predetermined time.

[0017] It is first briefly described how the position of the reference point S is determined. It is known that a laser radar mechanism calculates the distance between the present vehicle and the car ahead, and then calculates relative speed. Further, when the object is recognized as the car driving within the predetermined area based on the relative speed, the car is followed. Moreover, it is known that the position is calculated on an XYZ coordinate axis based on the bounce of the laser which is reflected by the specific position of the car ahead. Therefore, the reference point S is calculated as shown below.

[0018] At step S101 in the flowchart of Fig. 3, the vehicle information detection process, for instance the inclination angle, is executed with reference to the value of rear vehicle height supplied from the height sensor 11. Also detected for vehicle inclination attitude includes movement, acceleration and deceleration of the vehicle from the car navigation system, speed from the speed sensor, force from the G sensor, etc. Subsequently, at step S102, as shown in Fig. 4, the distance d between vehicles is detected and the inclination angle . of the headlight optical axis 30 is given by the equation below (1) to detect information in front of the vehicle by the laser radar mechanism 40. In the equation, h1 is a vehicle height above the road surface at which the driver of the car ahead will not be blinded, for example, a height to the center point (W/2) of a reflector in either stoplight as the reference point S in the car ahead as shown in Fig. 5. Furthermore, the height h2 is a height from the road surface up to the center position of the headlight 30 optical axis of the vehicle. For the heights h1 and h2, preset constants may be used. The height h1 may be changed according to the detected height of the car ahead. The height h2 may be a computed value based on the vehicle height, vehicle inclination, and a distance from the headlights 30 and the wheel axle.

Equation 1

$$. = \tan^{-1} \{(h2 - h1) / d\} \quad (1)$$

[0019] Furthermore, at step S102, the amount of horizontal displacement ?x as the amount of horizontal (H) displacement within a predetermined time of the reference point S of the car ahead, and the amount of vertical displacement ?y as the amount of vertical (V) displacement within a predetermined time at the reference point S are detected as shown in Fig. 6.

[0020] Next, at step S103, it is evaluated whether the amount of H displacement ?x of the reference point S detected at step S102 is in the horizontal dead zone. The horizontal dead zone is provided for a dull reaction to slight horizontal variations of the reference point S of the car ahead. Where the amount of horizontal displacement ?x at step s103 is within the horizontal dead zone, the displacement within the predetermined time is small. At step S104, the target horizontal optical axis ?.. is set at 0 [°]. In the meantime, where in step S103, the horizontal displacement ?x is largely in the left-turn right-turn range, out of the horizontal dead zone, a large displacement is within a predetermined period of time. Then, in step 105, the target horizontal optical axis ?.. is given by the following equation (2).

Equation 2

$$?.. = \tan^{-1}(?./d) \quad (2)$$

[0021] Subsequent to step S104 or S105, the process goes to step 106, where the target horizontal optical axis ?.. is filtered. That is, the target angle of the horizontal optical axis ?.. is smoothed so that the headlight optical axis 30 will not be suddenly horizontally changed, not making the driver uncomfortable. Next, at step S107, whether the vertical displacement ?y of reference point S detected at step S102 is involved in the vertical dead zone is determined. The vertical dead zone is provided for a dull reaction to slight vertical variations of the reference point S caused by acceleration and deceleration of the car ahead. When the vertical displacement ?y s107 is within the vertical dead zone, the process goes to step S108 because the displacement within the predetermined time is small. At step S108 the target angle of vertical optical axis ?.y is set at 0[°]. On the other hand, when step S108 is not determined, that is, when the vertical displacement ?y is largely into the upper or lower optical axis range, out of the vertical dead zone, the process goes to step S109, where the target angle of vertical optical axis ?.y is given by the following equation (3).

Equation 3

$$?.y = \tan^{-1}(?y/d) \quad (3)$$

[0022] After step S108 or S109, the process goes to step S110, where the target angle of vertical optical axis ?.y is filtered. That is, the target angle of vertical optical axis ?.y is smoothed so that the headlight optical axis 30 will not be suddenly vertically changed, thereby not causing discomfort to the driver and others. Next, at step S111, the actuators 35 and 36 are driven with reference to the inclination angle during normal control to hold the headlight 30 optical axis in a fixed direction (downward 1% [or 1.2%]) to ensure a driver's has road visibility without blinding oncoming drivers. The center optical axis angle is corrected by adding, to the inclination angle, the target horizontal optical axis ?.. filtered at step S106 and the target angle of vertical optical axis ?.y filtered at step S110, thus completing the control routine.

[0023] The horizontal dead zone width and the vertical dead zone shown in Fig. 6 may be fixed, or may be changed by the distance between vehicles or by vehicle speed. It may be set such that the farther the car ahead is forward, the narrower the horizontal dead zone and the vertical dead zone. Also, the horizontal dead zone can be narrow symmetrically in the horizontal direction, or asymmetrically in the right direction, to thereby ensure easy reaction to behavior changes of the car ahead. Furthermore the vertical dead zone also may be narrowed symmetrically in the vertical direction or asymmetrically on the downward direction, thereby enabling easy reaction to changes ahead.

[0024] An example is explained with respect to Figs. 7 to 10. As shown in Fig. 7, when a car ahead moving straightforward has begun going up a hill, a change in the reference point S on the car ahead is detected by the laser radar mechanism 40. When the displacement detected with the change in the upward behavior of the car ahead goes out of the vertical dead zone and into the upper range of optical axis (see Fig. 6), the target angle of the vertical optical axis ?.y is computed by the equation (3). Using the target angle of the vertical optical axis ?.y thus computed, the headlight optical axis direction 30 is corrected upward. This correction is performed at predetermined time intervals.

[0025] Fig. 8 is an explanatory view showing the correction of the headlight 30 optical axis of a vehicle tracking the car ahead on a downhill. As shown in Fig. 8, when the car ahead has gone downhill to a level road, a change in the upward behavior of the reference point S is detected by the laser radar mechanism 40. If the displacement detected with change in upward movement of the car ahead moves out of the vertical dead zone and into the upper range of optical axis (see Fig. 6), the target angle of vertical optical axis ?.y is computed by the equation (3). The optical axis direction of the headlight 30 is corrected upward according to the target angle of vertical optical axis ?.y thus computed. Since this correction is conducted every predetermined time increment according to a behavior change of the car ahead, the direction of the headlight 30 optical axis can be matched with a behavior change in the car running ahead.

[0026] Fig. 9 is an explanatory view showing the correction control of the headlight optical axis 30 tracking the behavior of the car running ahead near a hilltop. As shown in Fig. 9, when the car running straightforward ahead is going downhill and the other car is going uphill, a downward change of reference point S is detected.

When this displacement leaves the vertical dead zone and goes into the lower range of optical axis (see Fig. 6), the target angle of vertical optical axis ?.y is computed by the equation (3), thereby correcting the headlight 30 optical axis downward. Since correction control is carried out at predetermined times according to a behavior change of the car ahead, the headlight optical axis 30 can be matched with the change in behavior of the car ahead.

[0027] Fig. 10 is an explanatory view showing the correction control of the headlight 30 optical axis tracking the right-turn behavior of the car running ahead straightforward. As shown in Fig. 10, when the car running straightforward ahead is on a level road and has come to a right-turn curve, the behavior change of the car ahead turning to the right from the reference point S is detected as the front information of the vehicle by means of the laser radar mechanism 40. If the displacement detected with the right-turn behavior of the car ahead goes out of the horizontal dead zone and into the right-turn range (see Fig. 6), the target horizontal optical axis ?.. is computed by the equation (2). Thus the headlight optical axis direction 30 is turned to the right, thereby correcting the range of light projection.

[0028] In the correction control of the headlight 30 optical axis, the light beam may be widened to the right instead of rightward correction control of the optical axis. During left turns also, the headlight optical axis direction 30 is corrected to the left or the light can be widened to the left. Correction control is conducted at predetermined time increments, thereby making it possible to set the range of light projection of the headlights 30 correspondingly to a behavior change of the car ahead and accordingly.

[0029] The vehicle information detecting means preferably includes the height sensor 11, car navigation system, etc. for detecting various vehicle information such as the inclination, movement, acceleration and deceleration of the vehicle itself; a laser radar mechanism 40 that detects front information; the inclination angle computing means of the CPU 21 of the ECU 20 which computes the inclination angle in relation to the headlight optical axis of the vehicle to the road surface with reference to an output signal from the vehicle information detecting means; the optical axis center angle computing means of the CPU 21 of the ECU 20 which computes the center optical axis angle by correcting the inclination angle computed by the inclination angle computing means with reference to the front information detected by the laser radar mechanism 40; and the optical axis adjusting means consisting of the CPU 21 of the ECU 20, and actuators 35 and 36, for adjusting the headlight optical axis direction 30 with reference to the center optical axis angle computed by the optical axis center angle computing means. Furthermore, the center optical axis angle is computed by the optical axis center angle computing means according to the displacement detected, with horizontal and vertical changes in the behavior of a car ahead, as a front information supplied from the laser radar mechanism 40.

[0030] The vehicle inclination angle is computed according to an output from the height sensor 11. The center optical axis angle is corrected and computed according to front information given by the car navigation system and the laser radar mechanism 40. Then, the headlight optical axis direction 30 is adjusted relative to the center optical axis angle. That is, road information in the direction of travel of a vehicle is given by the car navigation system, and front information is given by the laser radar mechanism 40. Road information and front information such as the presence or absence of a car ahead, a distance between vehicles, and a change in the horizontal and vertical behavior are seen. The headlight optical axis direction 30, therefore, can be adjusted with reference to the center optical axis angle which has been corrected by a road information given by the car navigation system and a behavior change of a car ahead as occasion calls, in relation to the inclination angle indicated by normal control at which the headlight optical axis direction 30 is fixed 1% (or 1.2%) lower only by a vehicle inclination attitude as a vehicle information from the height sensor 11.

[0031] Next, by referring to Fig. 11, a correction control variation of the headlight optical axis direction 30 by the above-described control routine will be described. In Fig. 11, the headlights 30 in the present variation are vertically but not horizontally adjustable. That is, the actuator 36 is not mounted for the headlights 30 shown in Figs. 1 and 2. Supplementary lamps are mounted on the left front/right front side of the vehicle.

[0032] As shown in Fig. 11, when a car running straightforward ahead on level road approaches a right-turn curve, a rightward change from the reference point S in the behavior of the car ahead is detected by the laser radar mechanism 40 as the front information of the vehicle. If the displacement detected with the rightward behavior change of the car ahead goes out of the horizontal dead zone into the right-turn range (see Fig. 6), the supplementary lamp (not shown) mounted on the right front side of the vehicle is turned on while the range of light projection of the headlights 30 remains unchanged.

[0033] In this case, the brightness of the supplementary lamp may be changed based on horizontal displacement of the car ahead and distance between the vehicles. Also, a plurality of supplementary lamps may be lit. Similarly, in a left turn, the supplementary lamp mounted on the left front side of the vehicle is lit. Because the correction control is carried out at predetermined time intervals with a behavior change of the car ahead, the supplementary lamp is lit to widen the range of light projection corresponding to the behavior change of the car ahead without changing the range of the horizontal light projection of the headlights 30. It is therefore possible to improve the driver's ability to view to the direction of turn ahead without blinding the driver of the

car ahead.

[0034] In this embodiment, the supplementary lamps (not shown) mounted on the left front and right front sides of the vehicle are turned on to project light to a predetermined range ahead according to the right or left turn of the car ahead. When the displacement exceeding the predetermined value corresponds to a change in horizontal behavior of the car ahead has been detected as the front information by the laser radar mechanism 40 which functions as the front information detecting means, the supplementary lamp turns on corresponding to the turn direction of the vehicle by the optical axis adjusting means comprising the CPU 21 of the ECU 20 and the actuator 35.

[0035] That is, when the displacement exceeds the predetermined value corresponding to a change in the horizontal behavior of the car ahead, the corresponding right or left front supplementary lamp is lit, thereby widening the light projection range. Furthermore, control may be made by combining a headlight adjusting mechanism capable of adjusting the vehicle headlights horizontally and supplementary lamps.

[0036] It is noted that the laser radar calculates a distance between the car ahead and the present vehicle. If the distance does not change during a predetermined time period, it is determined that the targeted vehicle is actually a moving vehicle and not just an object on the side of the road.

[0037] While the above-described embodiments refer to examples of usage of the present invention, it is understood that the present invention may be applied to other usage, modifications and variations of the same, and is not limited to the disclosure provided herein.

Claims

1. An automatic headlight aiming device for a vehicle, comprising:

   a vehicle information detecting means (11) for detecting vehicle information that includes information about the inclination, movement, and acceleration and deceleration of the vehicle;
   a front information detecting means (40) for detecting information in front of the vehicle;
   an inclination angle computing means (21) for computing an inclination angle of a headlight optical axis with respect to a road surface based on output from the vehicle information detecting means (11);
   an optical axis center angle computing means (21) for computing a center angle of the headlight optical axis by correcting the inclination angle computed by the inclination angle computing means (21) based on information in front of the vehicle; and
   an optical axis adjusting means (35) for adjusting the headlight optical axis direction with reference to the center optical axis angle computed by the optical axis center angle computing means (21).

2. An automatic headlight aiming device according to claim 1, wherein the optical axis center angle computing means (21) computes the center angle based on detected horizontal and vertical displacement of a car ahead as the information in front of the vehicle.

3. An automatic headlight aiming device according to claim 1, further comprising:

   a horizontal adjusting means for horizontally adjusting the optical axis to project light within a predetermined forward range corresponding to a right or left turn of the vehicle; and
   wherein the optical axis adjusting means (35) adjusts the headlight optical axis with the horizontal adjusting means corresponding to a horizontal vehicle turn when a car ahead is displaced by a predetermined value, the horizontal vehicle turn being front information detected by the front information detecting means (40).

4. An automatic headlight aiming device for a vehicle according to claim 1, wherein said vehicle has supplemental lamps on a right front side and a left front side of the vehicle, said supplemental lamps projecting light within a predetermined forward range corresponding to a right or left turn of the vehicle;
   the optical axis adjusting means (35) turns on at least one of the supplementary lamps corresponding to a vehicle turning direction when a displacement over a predetermined value of a vehicle ahead has been detected, with a horizontal change in behavior of a car ahead, as the front information detected by the front information detecting means (40).

5. A method for aiming a vehicle headlight of a vehicle, said method comprising:

   detecting at least one of the inclination, movement, and acceleration and deceleration of the vehicle;
   tracking a point on a second vehicle located ahead of said vehicle;
   calculating an inclination angle of a headlight optical axis with respect to a road surface; and
   adjusting the headlight optical axis based on the position of the point on the second vehicle.

FIG. 1

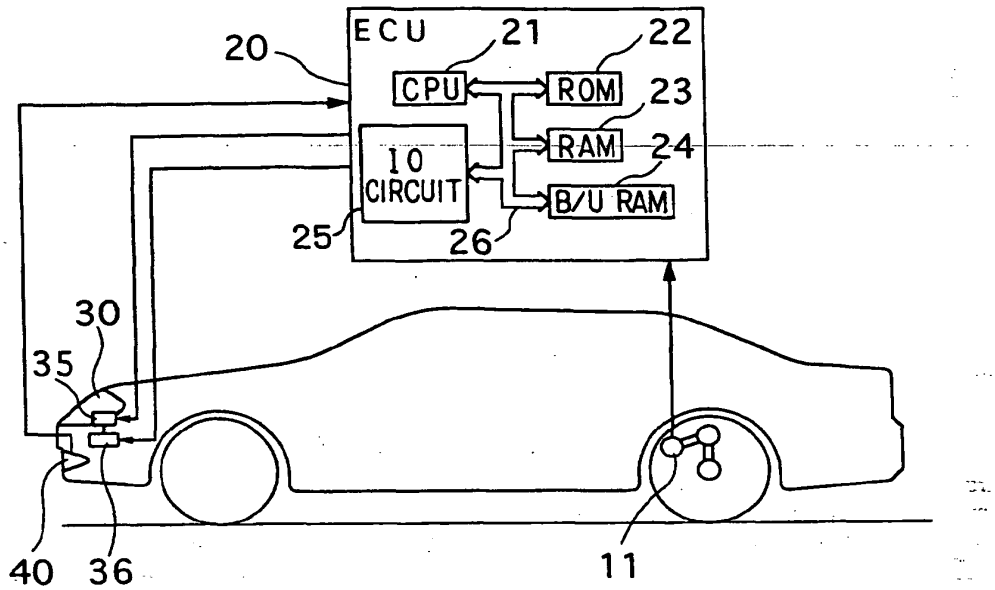


FIG. 2

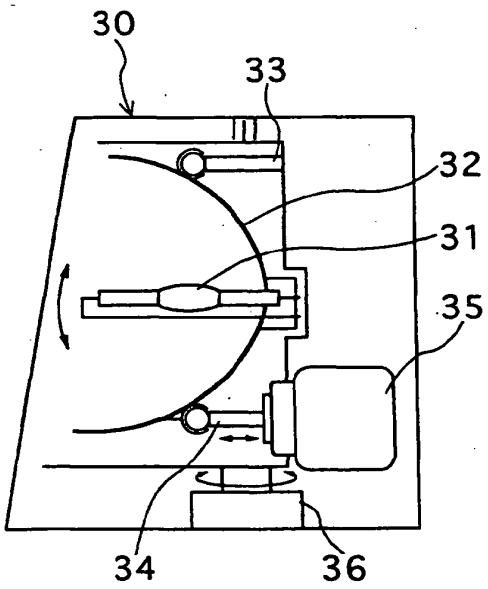


FIG. 3

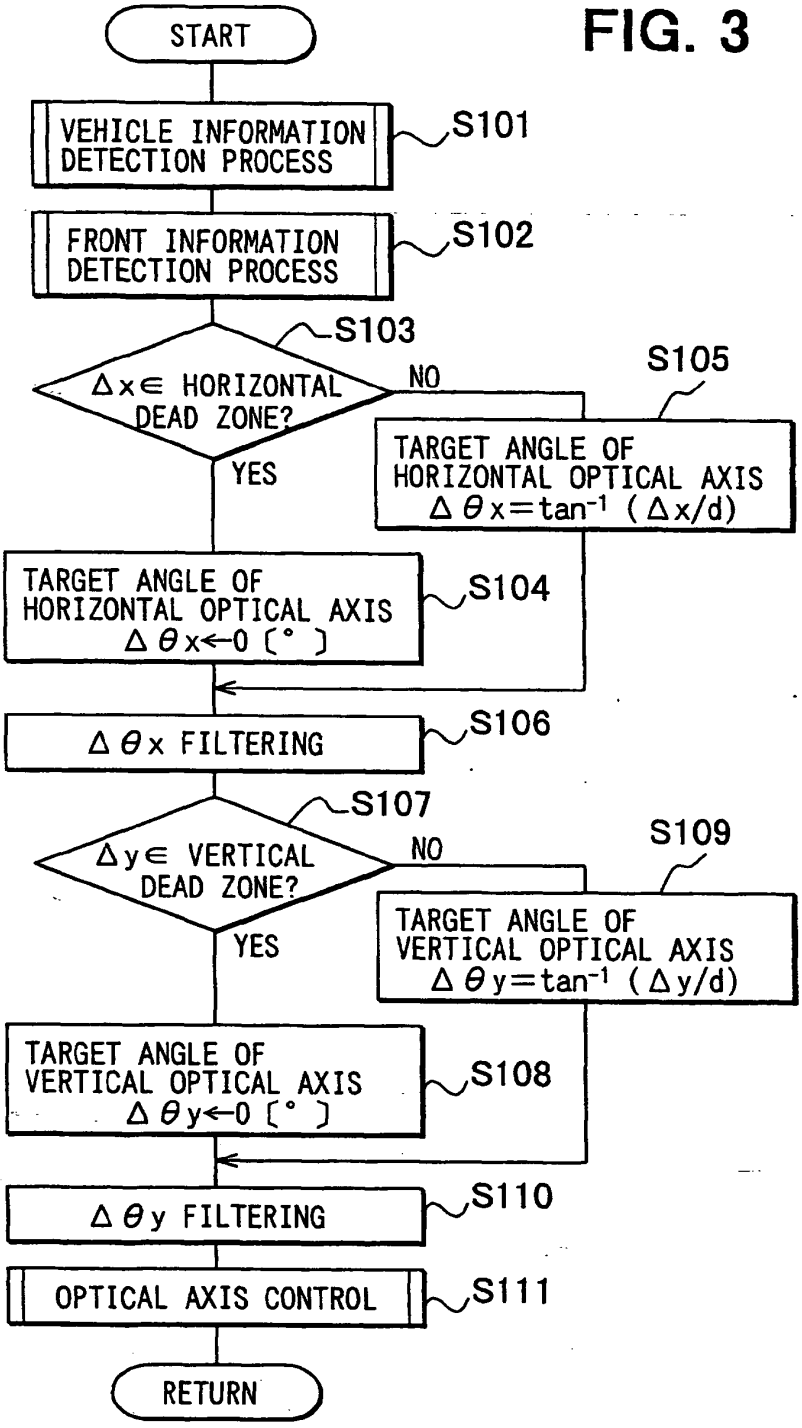


FIG. 4

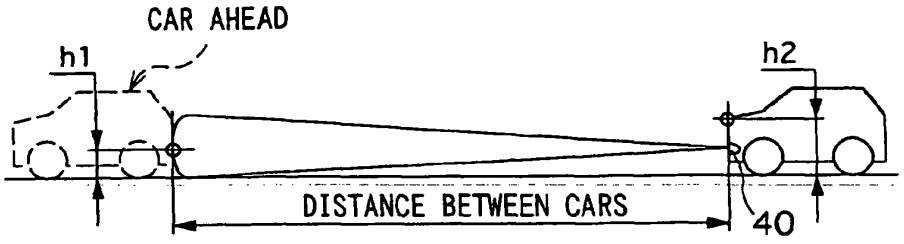


FIG. 5

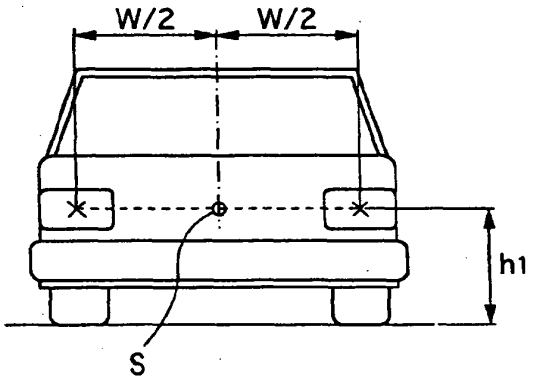


FIG. 6

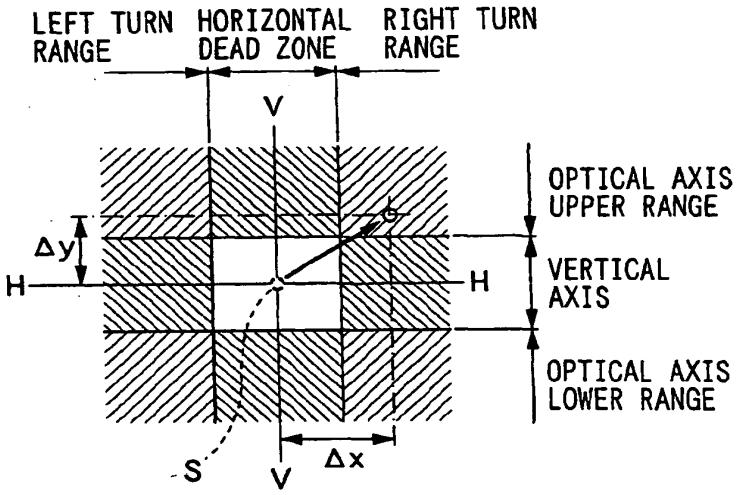


FIG. 7

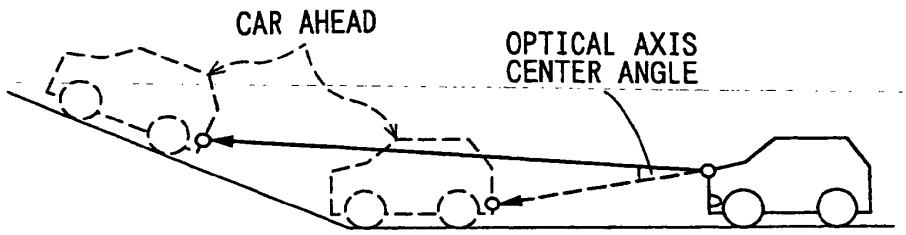


FIG. 8

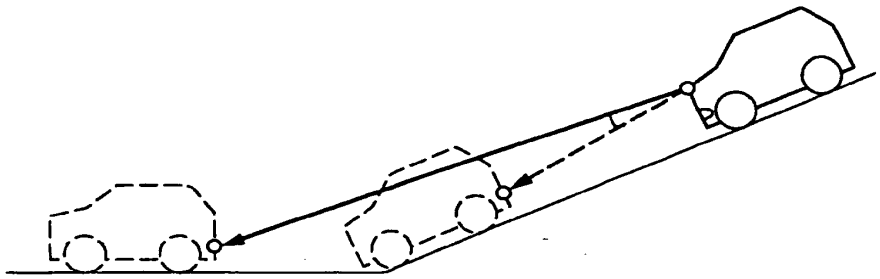


FIG. 9

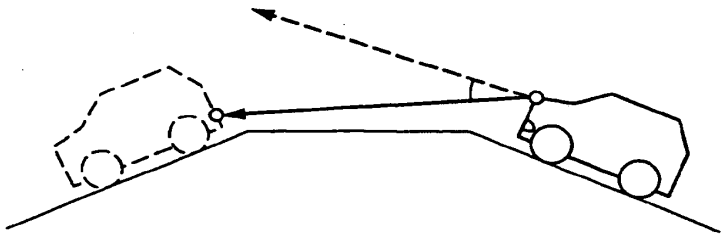


FIG. 10

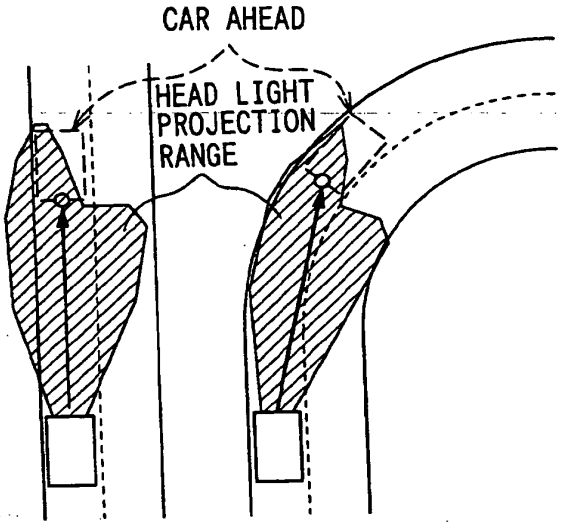
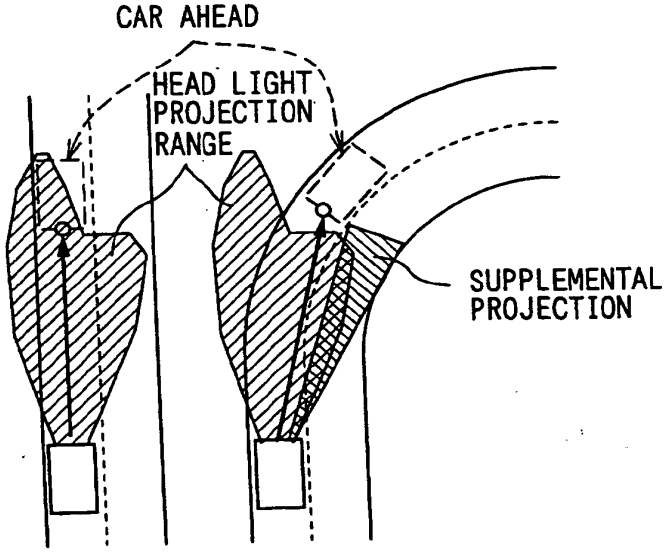


FIG. 11



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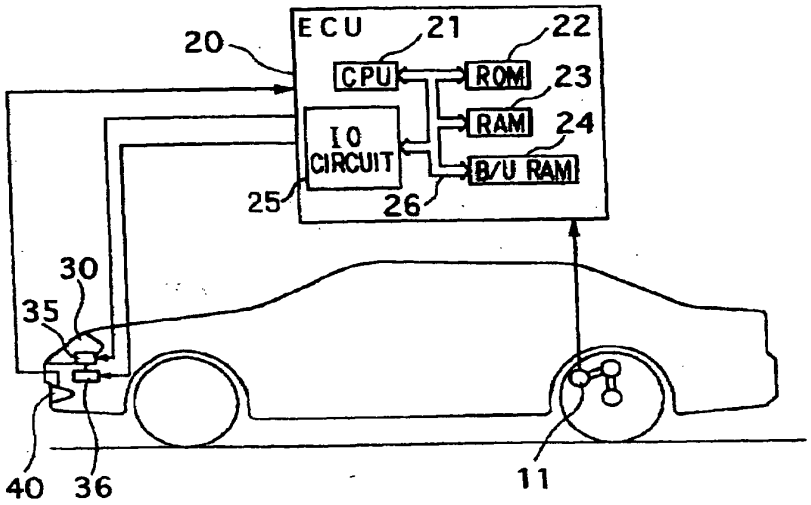
(54) Automatic headlight aiming device for vehicles

(57) The present invention changes the headlight optical axis of a vehicle in relation to an inclination angle during normal control and to properly adjust the optical axis according to information including front information about a car ahead. The headlight optical axis is adjusted based on the inclination angle of a vehicle, road information in the direction of travel, presence of a car ahead, a distance between vehicles, and the center optical axis angle corrected according to changes in horizontal and vertical behavior of the car ahead.

FIG. 1



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European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 01 10 8204

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	PATENT ABSTRACTS OF JAPAN vol. 1995, no. 05, 30 June 1995 (1995-06-30) & JP 07 047878 A (TOYOTA MOTOR CORP), 21 February 1995 (1995-02-21) * abstract *	1,5	B60Q1/115
P,X	DE 198 60 676 A (ROBERT BOSCH GMBH) 6 July 2000 (2000-07-06) * abstract; figure 1 *	1	
A	PATENT ABSTRACTS OF JAPAN vol. 1996, no. 01, 31 January 1996 (1996-01-31) & JP 07 246873 A (STANLEY ELECTRIC CO LTD), 26 September 1995 (1995-09-26) * abstract *	1,5	
A	EP 0 847 895 A (DENSO CORP; TOYOTA MOTOR CORP) 17 June 1998 (1998-06-17) * abstract; figure 1 *	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7) B60Q

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	5 September 2001	Onillon, C

CATEGORY OF CITED DOCUMENTS

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E : earlier patent document, but published on, or after the filing date
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05-09-2001

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 07047878 A	21-02-1995	JP 2861737 B	24-02-1999
DE 19860676 A	06-07-2000	JP 2000193559 A	14-07-2000
JP 07246873 A	26-09-1995	NONE	
EP 847895 A	17-06-1998	JP 10166933 A	23-06-1998
		JP 3095702 B	10-10-2000
		JP 10250462 A	22-09-1998
		JP 3095703 B	10-10-2000
		JP 10250463 A	22-09-1998
		US 5877680 A	02-03-1999

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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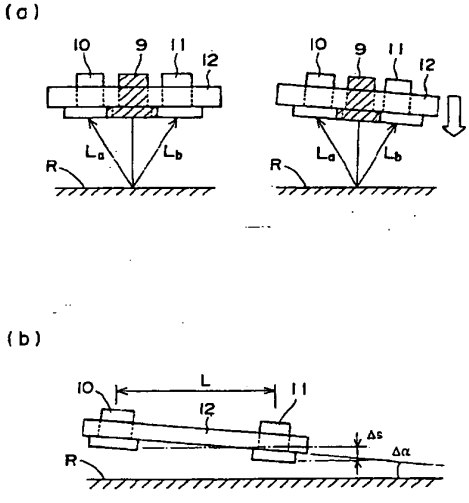
(54) Optical axis adjusting system for vehicle head lamp

(57) There is provided an optical axis adjusting system for a vehicle head lamp, which detects the inclination of the front part of a vehicle with respect to a road surface and controls an optical axis adjusting system by an ECU according to the detected inclination to adjust the optical axis of the head lamp. Therefore, the optical axis adjusting system is capable of finding the accurate inclination of the entire vehicle and properly adjusting the optical axis.

Fig. 4



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Description

[0001] This invention relates to an optical axis adjusting system that adjusts an optical axis of a vehicle head lamp according to the inclination of a vehicle, and more particularly to an optical axis adjustment system that is suitably applied to a truck with a cab and a deck provided on a frame.

[0002] When the adjustment the optical axis of the head lamp is insufficiency, the lamp may dazzle drivers of other vehicles.

[0003] To address this problem, a variety of techniques have been developed so as to adjust the optical axis of a head lamp according to the inclination of a vehicle to prevent the head lamp from dazzling drivers of other vehicles running on the opposite lane.

[0004] However, it is difficult to find the accurate inclination of the vehicle due to variations in the amount, positions, etc. of load on which the vehicle is driven.

[0005] It is therefore an object of the present invention to provide an optical axis adjusting system for a head lamp, which is capable of properly adjusting the optical axis of a head lamp by finding the accurate inclination of a vehicle. The object above can be achieved by the features defined in the claims.

[0006] Particularly, to attain the above object, the present invention provides an optical axis adjusting system for a vehicle head lamp, comprising an optical axis adjusting device that adjusts an optical axis of the head lamp; an inclination detecting device that is disposed in a front part of a vehicle to detect the inclination of the front part of the vehicle with respect to a road surface; and a control device that controls the optical axis adjusting device according to the inclination detected by the inclination detecting device. With this arrangement, the optical axis can be easily adjusted according to the inclination of the front part of the vehicle.

[0007] The invention, as well as other objects and advantages thereof, will be explained in the following with reference to the accompanying drawings, in which like reference characters designate the same or similar parts throughout the figures and wherein:

FIG 1 is a schematic diagram showing the construction of a truck having an optical axis adjusting system for a vehicle head lamp according to an embodiment of the present invention;
FIG. 2 is a plan view showing a frame;
FIG. 3 is a plan view showing an inclination sensor;
FIGS. 4A and 4B are diagrams useful in explaining the principle based on which the inclination sensor detects the inclination;
FIG. 5 is a plan view showing a head lamp provided with an optical axis adjusting device;
FIG. 6 is a view taken along an arrow VI-VI of FIG. 5;
FIG. 7 is a block diagram showing the construction of the optical axis adjusting system;
FIG. 8 is a flow chart showing the operations carried out by an ECU;
FIG. 9 is a flow chart showing the operations carried out by an ECU;
FIG. 10 is a graph showing the relationship between the angle of inclination of a vehicle with respect to an initial position and the angle of a head lamp;
FIG. 11 is a graph showing the relationship between the voltage of an actuator and the angle of the head lamp;
FIG 12 is a schematic view showing the entire frame of the truck on which is mounted an ultrasonic sensor;
FIG 13 is a sectional view taken along line IV-IV of FIG. 12;
FIG 14 is a schematic view showing the state in which the inclination sensor is mounted;
FIG 15 is a plan view showing the state in which the inclination sensor is mounted; and
FIGS. 16A and 16B are views useful in explaining a method of finding the inclination.

[0008] A description will now be given of an optical axis adjusting system for a vehicle head lamp according to a preferred embodiment of the present invention.

[0009] As shown in FIGs. 1 and 2, a pair of side frames 1 is provided with a cross member 2, and a cab 3 and a deck 4 are provided on a frame comprising the side frames 1 and the cross member 2. Head lamps 5 are provided at both sides of a cross member 2a at the front end of a vehicle in the longitudinal direction, and an inclination sensor 6 as an inclination detecting device is disposed at substantially the center of the cross member 2a. A signal from the inclination sensor 6 is inputted to an ECU 7 as a control unit, and the ECU 7 detects the inclination of the front part of the vehicle with respect to a road surface according to information supplied from the inclination sensor 6.

[0010] It should be noted that the head lamps 5 may be provided at the cab 3. Further, the inclination sensor 6 may be provided on a front axle 8 or at the front end of the vehicle other than the cross member 2a in the longitudinal direction of the vehicle (e.g. at the cab 3) insofar as the inclination sensor 6 is positioned in front of the front axle 8.

[0011] As shown in FIG 3, the inclination sensor 6 comprises a signal transmitting section (hereinafter referred to as "transmission sensor") 9 as an ultrasonic transmitters, and signal receiving sections 10, 11 as ultrasonic receiving sensors. The receiving sensors 10, 11 are disposed in the longitudinal direction of the vehicle with the transmission sensor 9 being interposed therebetween, and are offset to one side of the vehicle in the direction of the width at equal distances from the transmission sensor 9. The transmission sensor 9 and the receiving sensors 10, 11 are housed in a case 12, and the inclination sensor 6 is mounted on the vehicle by mounting the case 12 on the cross member 2a. An ultrasonic wave from the transmission sensor 9 is re-

flected on the road surface and received by the receiving sensors 10, 11, and the inclination sensor 6 detects the inclination of the vehicle according to a difference in ultrasonic wave receiving time between the receiving sensors 10, 11.

[0012] This arrangement reduces a space required for the inclination sensor 6 in the longitudinal direction of the vehicle. Further, housing the transmitting sensor 9 and the receiving sensors 10, 11 in the case 12 reduces the size of the inclination sensor 6, and makes it easier to mount the inclination sensor 6 on the cross member 2a.

[0013] It should be noted that the transmitting sensor 9 and the receiving sensors 10, 11 may be disposed in a line in the longitudinal direction of the vehicle if there is a free space. Further, a laser sensor may be used as the inclination sensor 6, and one receiving sensor or three or more receiving sensors may be provided for one transmission sensor 9.

[0014] Signals from the transmitting sensor 9 and the receiving sensors 10, 11 are inputted to the ECU 7, and the ECU 7 finds the inclination of the cross member 2a (i.e. the inclination of the front part of the vehicle) with respect to the road surface according to a difference in the ultrasonic wave receiving time between the receiving sensors 10, 11.

[0015] Referring to FIG 4, a description will now be given of the principle based on which the inclination sensor 6 detects the inclination.

[0016] As shown in FIG. 4A, if the front part of the vehicle is not inclined with respect to the road surface R, a route La of an ultrasonic wave transmitted from the transmitting sensor 9 to the front receiving sensor 10 and a route Lb of an ultrasonic wave transmitted from the transmitting sensor 9 to the rear receiving sensor correspond to each other, and thus, there is no time difference ΔT in the receiving time between the receiving sensors 10, 11. On the other hand, if the front of the vehicle is inclined rearward with respect to the road surface R, the route La of the ultrasonic wave transmitted from the transmitting sensor 9 to the front receiving sensor 10 is longer than the route Lb of the ultrasonic wave transmitted from the transmitting sensor 9 to the rear receiving sensor 11, and thus, there is a time difference ΔT in the receiving time between the receiving sensors 10, 11.

[0017] If the front part of the vehicle is inclined, there is a distance difference ΔS from the road surface R in the direction of height between the receiving sensors 10 and 11, which are apart from each other at an interval L. The distance difference ΔS from the road surface depends on the time difference ΔT in the receiving time, atmosphere temperature, and sonic speed. The angle of inclination $\Delta\alpha$ may be found from the distance difference ΔS from the road surface R and the interval L between the receiving sensors 10 and 11 in the longitudinal direction of the vehicle according to the following equation (1):

$$\Delta\alpha=\tan^{-1}(\Delta S/L) \quad (1)$$

[0018] Therefore, the ECU 7 can find the inclination of the vehicle by finding the distance difference ΔS from the road surface R according to the time difference ΔT in the receiving time between the receiving sensors 10, 11 and calculating the angle of inclination $\Delta\alpha$ according to the above equation (1).

[0019] A description will now be given of the construction of the head lamp 5 with reference to FIGs. 5 and 6.

[0020] The head lamp 5 comprises a High side lamp 15 and a Low side lamp 16. The Low side lamp 16 is a high intensity lamp, for example (e.g. discharge head lamp). The Low side lamp 16 is constructed such that a high intensity valve 18 is mounted on a reflector holder 17, and is provided with a condenser lens 19. The High side lamp 15 is provided with a halogen lamp 20, for example. The reflector holder 17 and the high intensity valve 18 are inclined by an actuator 21 as the optical axis adjusting device to adjust the optical axis in the vertical direction. The actuator 21 is operated in response to an instruction from the ECU 7 based on the inclination that is found by the ECU 7 according to the information supplied from the inclination sensor 6 to thereby adjust the optical axis of the high intensity valve 18.

[0021] As shown in FIG 6, the Low side lamp 16 is also provided with a hand-operated screw 22 for manually controlling the reflector holder 17 to adjust the optical axis of the high intensity valve 18. The hand-operated screw 22 is used for setting the position of the optical axis of the high intensity valve 18 with respect to a position represented by the initial value of the inclination sensor 6.

[0022] It should be noted that it is possible to adjust the High side lamp 15 in the vertical direction by the actuator 21 as is the case with the Low side lamp 16. Further, it is possible to use a head lamp which is provided with a reflector and a valve constructed as one integral unit. If the reflector and the valve are constructed as one integral unit, the reflector is tilted by the actuator so as to adjust the optical axis of the valve.

[0023] Referring next to FIG 7, a description will be given of the optical axis adjusting device for the head lamp according to the present invention.

[0024] The ECU 7 receives information from a vehicle speed sensor 23 and information from the transmitting sensor 9 and the receiving sensors 10, 11 via the inclination sensor 6. According to the information supplied from the vehicle speed sensor 23, the ECU 7 determines when the vehicle stops and when the vehicle starts moving, and according to the information supplied from the transmitting sensor 9 and the receiving sensors 10 and 11, the ECU 7 calculates the above-mentioned angle of inclination $\Delta\alpha$. The ECU 7 then outputs an instruction for driving the actuator (actuator for the right and left head lamps 5) 21 to tilt the reflector holder 17, so that

the optical axis of the high intensity valve 18 is adjusted to a predetermined position according to the condition and inclination of the vehicle.

[0025] The ECU 7 also has a function of storing as an initial value the angle of inclination $\Delta\alpha$ found in the case where there is no passenger in the vehicle and the vehicle lies on a flat road (initial value storing function). A detachable external instruction tool (e.g. failure diagnosis tool) 24 instructs the ECU 7 to store the initial value. The angle of inclination $\Delta\alpha$ found in the case where there is no passenger in the vehicle and the vehicle lies on a flat road is stored as the initial value, and in this state, the optical axis of the high intensity valve 18 is adjusted to a predetermined position by the manual-operated screw 22. On the basis of the stored initial value, the actuator 21 is driven according to the angle of inclination $\Delta\alpha$ calculated based on the information supplied from the transmitting sensor 9 and the receiving sensors 10, 11, so that the optical axis of the high intensity valve 18 is adjusted according to the inclination of the vehicle.

[0026] Therefore, even if there is a variation in the inclination detected by the inclination sensor 6, the optical axis of the high intensity valve 18 is adjusted according to the inclination that can be found with uniform accuracy. Further, since the failure diagnosis tool 24 instructs the ECU 7 to store the initial value, the initialization can easily be performed using the conventional device.

[0027] Referring to FIGs. 8 and 9, there will now be explained the operation of the above-described optical adjusting system in concrete terms with reference to FIGs. 8 and 9.

[0028] First, the angle of inclination $\Delta\alpha$ calculated based on the information supplied from the transmitting sensor 9 and the receiving sensors 10, 11 is stored as the initial value by operation of the ECU 7 as shown in FIG 8. Specifically, whether the setting of the initial value is complete or not is determined in a step S 1 when the ECU 7 is calculating the angle of inclination $\Delta\alpha$ based on the information supplied from the transmitting sensor 9 and the receiving sensors 10, 11. If it is determined that the setting of the initial value is incomplete, it is then determined in a step S2 whether the road surface is flat or not. If it is determined in the step S2 that the road surface is flat, a multi-use tester (MUT) instructs the ECU 7 to store the angle of inclination $\Delta\alpha$, detected on that occasion, as the initial value, and the ECU 7 stores the initial value according to the instruction. If it is determined in the step S2 that the road surface is not flat, the vehicle is placed on a flat road surface in a step S4 and the process then proceeds to the step S3. If it is determined in the step S1 that the setting of the initial value is complete, the process is terminated.

[0029] After the angle of inclination $\Delta\alpha$ of the vehicle on the flat road surface calculated based on the information supplied from the transmitting sensor 9 and the receiving sensors 10, 11 is stored as the initial value, the reflector holder 17 and the high intensity valve 18 are tilted by the manual-operated screw 22 to adjust the optical axis of the high intensity valve 18 to an optical axis of the vehicle on the flat road surface. This starts control (auto-leveling) according to the information supplied from the transmitting sensor 9 and the receiving sensors 10, 11 based on the calculated angle of inclination $\Delta\alpha$ of the vehicle lying on the flat road surface.

[0030] As shown in FIG. 9, upon start of the auto leveling, the ECU 7 determines in a step S11 whether the engine is ON or not (with a starter being OFF). If it is determined in the step S11 that the engine is OFF (with the starter being OFF), the ECU7 calculates the angle of inclination $\Delta\alpha$ at the time when the vehicle is stopped with the engine being OFF in a step S12. Thereafter, in a step S13, the ECU 7 drives the actuator 21 according to the angle of inclination $\Delta\alpha$ based on the above initial value, so that the optical axis of the high intensity valve 18 is automatically adjusted to correct the angle of inclination of the head lamp 5 at the time when the vehicle is stopped with the engine being OFF.

[0031] If it is determined in the step S11 that the engine is ON, it is then determined in a step S14 whether the vehicle speed is zero or not. If it is determined in the step S14 that the vehicle speed is zero, the angle of inclination $\Delta\alpha$ at the time when the vehicle is stopped with the engine being ON is calculated in a step S15. Thereafter, in the step S13, the ECU 7 drives the actuator 21 according to the angle of inclination $\Delta\alpha$ based on the above initial value, so that the optical axis of the high intensity valve 18 is automatically adjusted to correct the angle of inclination of the head lamp 5 at the time when the vehicle is stopped with the engine being ON.

[0032] If it is determined in the step S14 that the vehicle speed is not zero, it is then determined in a step S16 whether the vehicle speed is constant or not.

[0033] If it is determined in the step S16 that the vehicle speed is constant (the vehicle starts moving to run in a stable condition), the angle of inclination $\Delta\alpha$ at the time when the vehicle speed is constant is calculated in a step S17. Thereafter, in the step S13, the ECU 7 drives the actuator 21 according to the angle of inclination $\Delta\alpha$ based on the above initial value, so that the optical axis of the high intensity valve 18 at the time when the vehicle starts moving is automatically adjusted to correct the angle of inclination of the head lamp 5. If it is determined in the step S16 that ten pulses have been measured as vehicle speed pulses, the process is returned to the start of the operations carried out for the running vehicle.

In the above-described embodiment, the inclination of the vehicle is determined by calculating the angle of inclination $\Delta\alpha$ at the time when the vehicle is stopped with the engine being OFF (step S12), the angle of inclination $\Delta\alpha$ at the time when the vehicle is stopped with the engine being ON (step S15), and the angle of inclination $\Delta\alpha$ at the time when the vehicle starts moving (with the vehicle speed being constant) (step S17). However, it is possible to adjust the optical axis of the high intensity valve 18 by finding the inclination at the time when the vehicle is stopped with the engine being OFF or the in-

clination at the time when the vehicle starts moving. Therefore, the accurate inclination of the vehicle can be found to properly adjust the optical axis.

[0034] Further, the optical axis of the high intensity valve 18 may be adjusted based on the average of the inclination at the time when the vehicle is stopped and the inclination at the time when the vehicle starts moving. For example, in the case where the vehicle is not inclined, the angle of inclination $\Delta\alpha$ different from the initial value may be acquired if a tire is run on a stone or furrow while the vehicle is stopped. In this case, by adjusting the optical axis based on the average of the inclinations, the inclination of the vehicle at the time when the vehicle starts running (with the vehicle speed being constant) (the inclination of the vehicle that is running in a stable condition in the case where an obstacle such as a stone is considered to be eliminated) is taken into consideration to find the accurate inclination.

[0035] Although in the above-described embodiment, the actuator 21 is driven according to the angle of inclination $\Delta\alpha$ that is fixed after it is corrected, the angle of inclination $\Delta\alpha$ may be corrected while the vehicle is running or may be corrected constantly. Further, although in the above-described embodiment, whether the vehicle starts running or not is determined according to whether the vehicle speed is constant or not, it may be determined according to whether a predetermined number of pulses from the vehicle speed sensor 23 has been measured at the start of the vehicle or not (for example, ten to several tens of pulses corresponding to the maximum vehicle speed in the case where the vehicle starts running). In this case, the angle of inclination $\Delta\alpha$ is calculated before the vehicle speed pulses reaches the predetermined number of pulses, and the actuator 21 is driven according to the calculated angle of inclination $\Delta\alpha$. The actuator 21 may be driven at every angle of inclination $\Delta\alpha$ calculated until the predetermined number of pulses is measured, or the actuator 21 may be driven according to the average of the calculated angles of inclination $\Delta\alpha$.

[0036] FIG 10 shows the relationship between the angle of inclination $\Delta\alpha$ and the inclination of the high intensity valve 18. As shown in FIG. 10, the optical axis of the high intensity valve 18 is adjusted to be raised at such an angle of inclination $\Delta\alpha$ that the front part of the vehicle is lower than the rear part of the vehicle, and the optical axis of the high intensity valve 18 is adjusted to be lowered at such an angle of inclination $\Delta\alpha$ that the rear of the vehicle is lower than the front of the vehicle. The relationship between the angle of inclination $\Delta\alpha$ and the inclination of the high intensity valve 18 is determined arbitrarily (represented by a straight line or curved line).

[0037] Even if the front part of the vehicle is lower than the rear part of the vehicle, the optical axis of the high intensity valve 18 may be corrected only when the vehicle is inclined at such an angle of inclination $\Delta\alpha$ that the rear part of the vehicle is lower than the front part of the vehicle insofar as the brightness is maintained to such an extent that the field of vision is not obstructed.

[0038] FIG 11 shows the relationship between the command voltage applied to the actuator 21 and the optical axis of the high intensity valve 18. As shown in FIG 11, the optical axis of the high intensity valve 18 is continuously adjusted from a downward position to an upward position across a position represented by the initial value according to the command voltage applied to the actuator 21.

[0039] In the above-described optical axis adjusting system for the head lamp, the inclination of the vehicle is found referring to the cross member 2a at the front of the vehicle, and even if the side frame 1 is deflected, the angle of inclination $\Delta\alpha$ of the vehicle can be calculated without taking the deflection into consideration. Thus, the inclination of the head lamp 5 can be automatically corrected according to the angle of inclination $\Delta\alpha$ of the vehicle. Therefore, the accurate inclination of the vehicle can be found to property adjusts the optical axis of the high intensity lamp 18, and prevents the vehicle from dazzling drivers of vehicles running on the opposite lane.

[0040] Further, in the above-described optical adjusting system, the inclination of the head lamp 5 is corrected according to the angle of inclination $\Delta\alpha$ in the normal state, i.e. at the time when the vehicle is stopped or at the time when the vehicle starts moving. Therefore, even in the case where the inclination of the optical axis is restricted, the optical axis can be easily adjusted in conformity with the restriction.

[0041] Incidentally, if the inclination of the optical axis of the high intensity lamp 18 in the normal state, adjusted by the above-described optical axis adjusting system, can be estimated from the vehicle speed and the condition of the load, the optical axis may be corrected according to the estimated inclination based on the state of the optical axis of the high intensity lamp 18 corrected when the vehicle speed is constant.

[0042] A description will now be given of an optical axis adjusting system for a vehicle head lamp according to another embodiment of the present invention. The construction of the optical axis adjusting system for the head lamp according to this embodiment is identical with the optical axis adjusting system according to the above-described embodiment except for an inclination sensor, and therefore, a description thereof is omitted herein.

[0043] As shown in FIGs. 12 - 15, the inclination sensor 56 comprises two ultrasonic sensors 59, 60 that transmit and receive signals in the direction of the vehicle width. The two ultrasonic sensors 59, 60 comprise two transmitting sensors 59a, 60a as signal transmitters and receiving sensors 59b, 60b as signal receivers. The transmitting sensors 59a, 60a are disposed at the left side of the vehicle, and the receiving sensors 59b, 60b are disposed at the right side of the vehicle. The respective ultrasonic waves transmitted and received by the

ultrasonic sensors 59, 60 are substantially parallel to each other, and are substantially perpendicular to the longitudinal direction of the vehicle.

[0044] The ultrasonic sensors 59, 60 are housed in a box-shaped case 61 such that the transmitting and receiving bottom surfaces thereof are exposed. By mounting the case 61 on the intermediate section of the cross member 2 via a bracket 62 shaped like an alphabet C, the inclination sensor 60 is mounted on the front of the vehicle such that it is positioned opposite to the road surface R. This arrangement reduces a space required for mounting the inclination sensor 60 in the longitudinal direction of the vehicle, and housing the ultrasonic sensors 59, 60 in the case 61 reduces the size of the inclination sensor 60 and makes it easier to mount the inclination sensor 60 on the cross member 2.

[0045] Although the two ultrasonic sensors 59, 60 comprise the transmitting sensors 59a, 60a and the receiving sensors 59b, 60b constructed as separate units are provided in the longitudinal direction of the vehicle, three or more ultrasonic sensors may be provided or two ultrasonic sensors each comprising a transmitting sensor and a receiving sensor constructed as one integral unit may be provided in the longitudinal direction of the vehicle.

[0046] The inclination sensor 56 detects the inclination of the vehicle with respect to the road surface R according to a difference in ultrasonic wave receiving time between the two ultrasonic wave sensors 59, 60. The ultrasonic waves transmitted from the respective transmitting sensors 59a, 60a are reflected on the road surface R and received by the respective receiving sensors 59b, 60b, and the inclination of the vehicle with respect to the road surface R is detected according to a difference in the ultrasonic wave receiving time between the receiving sensors 59b, 60b. Namely, signals from the transmitting sensors 59a, 60a and the receiving sensors 59b, 60b are inputted to the ECU 7, and a finding section detects the inclination of the cross member 2 at the front of the vehicle (the inclination of the front part of the vehicle) with respect to the road surface according to the difference in the receiving time between the receiving sensors 59b, 60b. It should be noted that although the inclination sensor 56 detects the inclination of the vehicle with respect to the road surface R according to the difference in the receiving time, the inclination of the vehicle with respect to the road surface R may be found according to a difference in receiving phase.

[0047] Referring to FIGs. 15 and 16, a detailed description will now be given of a method for finding the inclination of the vehicle according to signals inputted from the inclination sensors 59 and 60.

[0048] As shown in FIG. 15, the respective transmitting sensors 59a, 60a of the two ultrasonic sensors 59, 60 transmit the ultrasonic waves toward the road surface R such that they are reflected on the receiving sensors 59b, 60b. When the vehicle is running, however, the positions of the receiving sensors 59b, 60b are different at the time when the transmitting sensors 59a, 60a transmit the ultrasonic waves and at the time when receiving sensors 59b, 60b receive the ultrasonic waves. Therefore, the respective transmitting sensors 59a, 60a may predict the positions of the receiving sensors 59b, 60b relative o the transmitting sensors 59a, 60a according to the vehicle speed and the ultrasonic wave speed, and transmit ultrasonic wave signals to the predicted positions of the receiving sensors 59b, 60b.

[0049] If the front part of the vehicle (the front cross member 2) is not inclined with respect to the road surface R as shown in FIG 16A, the route La of the ultrasonic wave transmitted from the front transmitting sensor 59a to the receiving sensor 59b and the route Lb of the ultrasonic wave transmitted from the rear transmitting sensor 60a to the receiving sensor 60b correspond to each other, and thus, there is no time difference ΔT in the receiving time of the ultrasonic waves received by the receiving sensors 59b, 60b. On the other hand, if the rear part of the vehicle is lowered due to load on the deck 4 and the front part of the vehicle is inclined rearward (upward) with respect to the road surface R, the route La of the ultrasonic wave transmitted from the front transmitting sensor 59a to the receiving sensor 59b is longer than the route Lb of the ultrasonic wave transmitted from the rear transmitting sensor 60a to the receiving sensor 60b, and thus, there is a time difference ΔT in the ultrasonic wave receiving time between the receiving sensors 59b, 60b.

[0050] If the front part of the vehicle is inclined rearward as mentioned above, there is a distance difference ΔS from the road surface R between the transmitting sensors 59a, 60a which are apart from each other at an interval L. This distance difference ΔS in height from the road surface R depends on the time difference ΔT in the receiving time, atmosphere temperature, and sonic velocity. The angle of inclination $\Delta\alpha$ can be found according to the following equation (1) based on the distance difference ΔS from the road surface R and the interval L between the receiving sensors 59b, 60b in the longitudinal direction:

$$\Delta\alpha=\tan^{-1}(\Delta S/L) \quad (1)$$

[0051] Therefore, the ECU7 finds the inclination of the vehicle by finding the time difference ΔT in the ultrasonic wave receiving time between the receiving sensors 59b, 60b and calculating the angle of inclination $\Delta\alpha$ according to the above equation (1).

[0052] Contrary to FIG 16B, if the front part of the vehicle is inclined to the front (downward) with respect to the road surface R due to load on the deck 4, there is a time difference ΔT in ultrasonic wave receiving time between the receiving sensors 59b, 60b, and the inclination of the vehicle can be found by calculating the angle of inclination $\Delta\alpha$ according to the above equation (1).

Claims

1. An optical axis adjusting system for a vehicle head lamp, **characterized by** comprising an optical axis adjusting device that adjusts an optical axis of the head lamp, an inclination detecting device that is disposed in a front part of a vehicle to detect an inclination of the front part of the vehicle with respect to a road surface, and a control device that controls said optical axis adjusting device according to the inclination detected by said inclination detecting device.

2. An optical axis adjusting system for a vehicle head lamp according to claim 1, **characterized in that** said inclination detecting device comprises:

   an inclination sensor comprises at least one signal transmitting section and a plurality of receiving sections for receiving respective ones of signals transmitted from said signal transmitting section; and
   a finding section that finds an inclination of the vehicle with respect to the road surface according to a time difference in signal receiving time between said signal receiving sections.

3. An optical axis adjusting system for a vehicle head lamp according to claim 2, **characterized in that**:

   said signal receiving transmitting section and said signal receiving sections are disposed in parallel in a direction of vehicle width and said signal receiving sections receive signals transmitted from said signal transmitting section via the road surface.

4. An optical axis adjusting system for a vehicle head lamp according to claim 2 or 3, **characterized in that**:

   positions of said signal receiving sections are predicted according to a vehicle speed and said signal transmitting section transmits signals to the predicted positions of said signal receiving sections.

5. An optical axis adjusting system for a vehicle head lamp according to any of claims 2 to 4, **characterized in that** said transmission signals are transmitted substantially in parallel from said signal transmitting section.

6. An optical axis adjusting system for a vehicle head lamp according to any of claims 2 to 5, **characterized in that**:

   two of said signal receiving sections are disposed with said signal transmitting section positioned therebetween in a longitudinal direction of the vehicle.

7. An optical axis adjusting system for a vehicle head lamp according to any of claims 1 to 6, **characterized in that** said control device comprises a vehicle stop determining function of determining whether the vehicle is stopped, and finds the inclination of the vehicle when the vehicle is stopped and the inclination of the vehicle when the vehicle starts moving by the vehicle stop determining function, and controls said optical axis adjusting means according to at least one of the inclination when the vehicle is stopped and the inclination when the vehicle starts moving.

8. An optical axis adjusting system for a vehicle head lamp according to claim 7, **characterized in that** said control device controls said optical axis adjusting device according to an average of the inclination when the vehicle is stopped and the inclination when the vehicle starts moving.

9. An optical axis adjusting system for a vehicle head lamp according to any of claims 1 to 8, **characterized in that** said inclination detecting device is mounted in front of a front axle.

10. An optical axis adjusting system for a vehicle head lamp according to any of claims 1 to 9, **characterized in that**:

    the vehicle comprises a pair of side frames extending in a longitudinal direction of the vehicle, and a cross member connected to front ends of said side frames in the longitudinal direction of the vehicle; and
    said inclination detecting device is disposed in a substantially central section of said cross member.

11. An optical axis adjusting system for a vehicle head lamp according to any of claims 1 to 10, **characterized in that**:

    said control device has an initial value storing function of storing as an initial value the inclination detected by said inclination detecting device when the vehicle with no passenger lies on a flat road, and controls said optical axis adjusting device according to the inclination detected by said inclination detecting device based on the initial value stored by the initial value storing function.

12. An optical axis adjusting system for a vehicle head lamp according to claim 11, **characterized in that**

said control device instructs an external instructing device detachable from a vehicle body to store the initial value by the initial value storing function.

Fig. 1

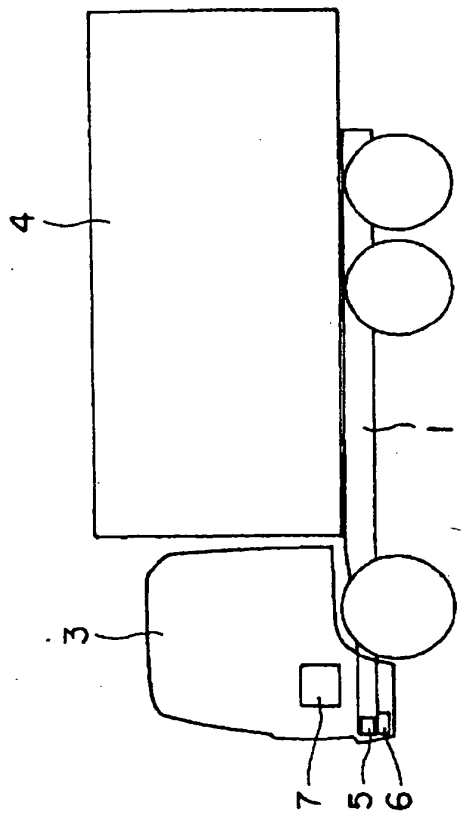


Fig. 2

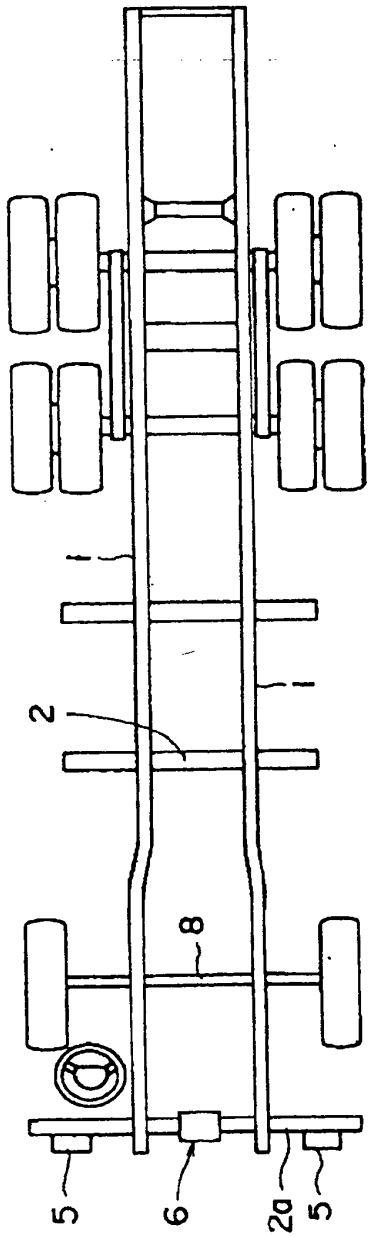


Fig. 3

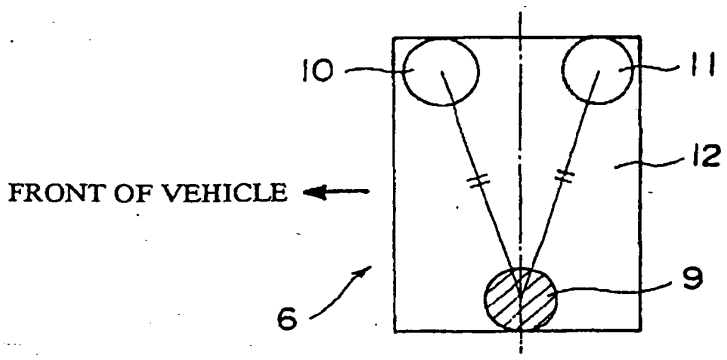
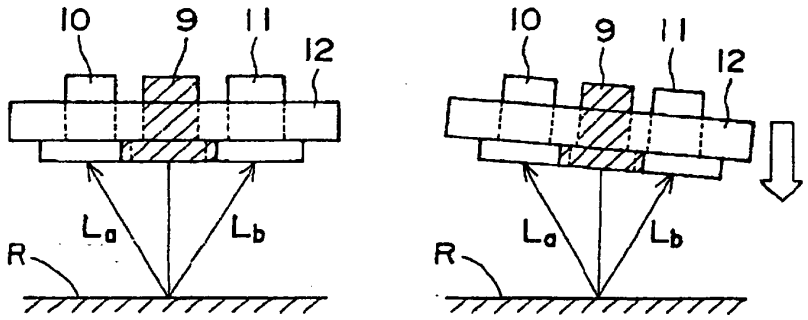


Fig. 4

(a)



(b)

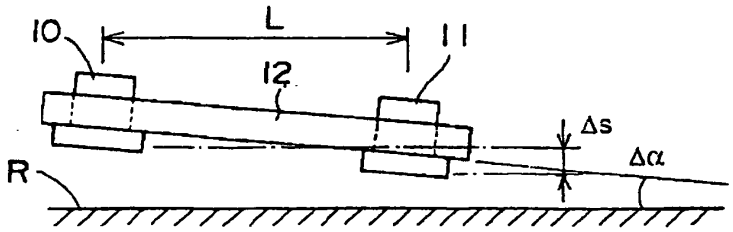


Fig. 5

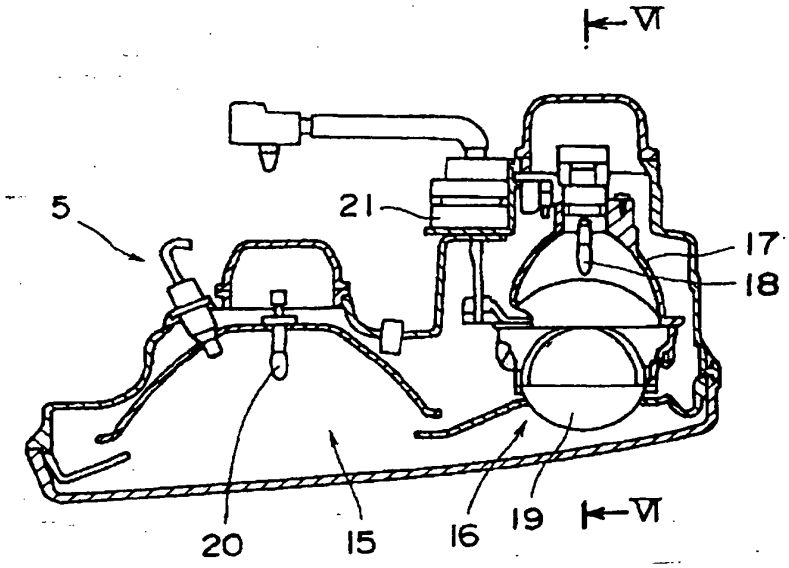


Fig. 6

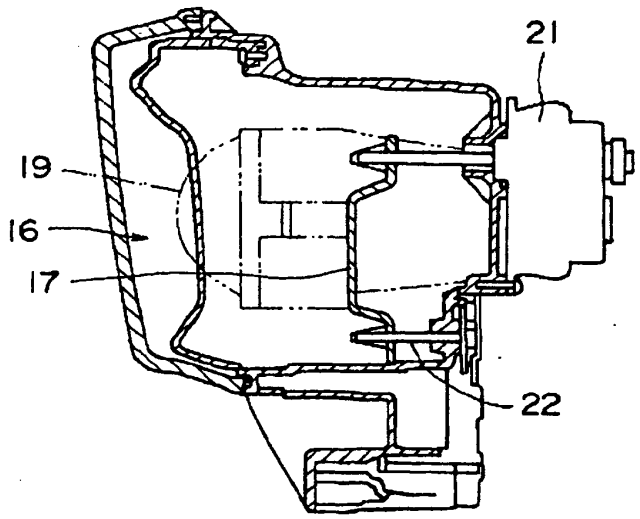


Fig. 7

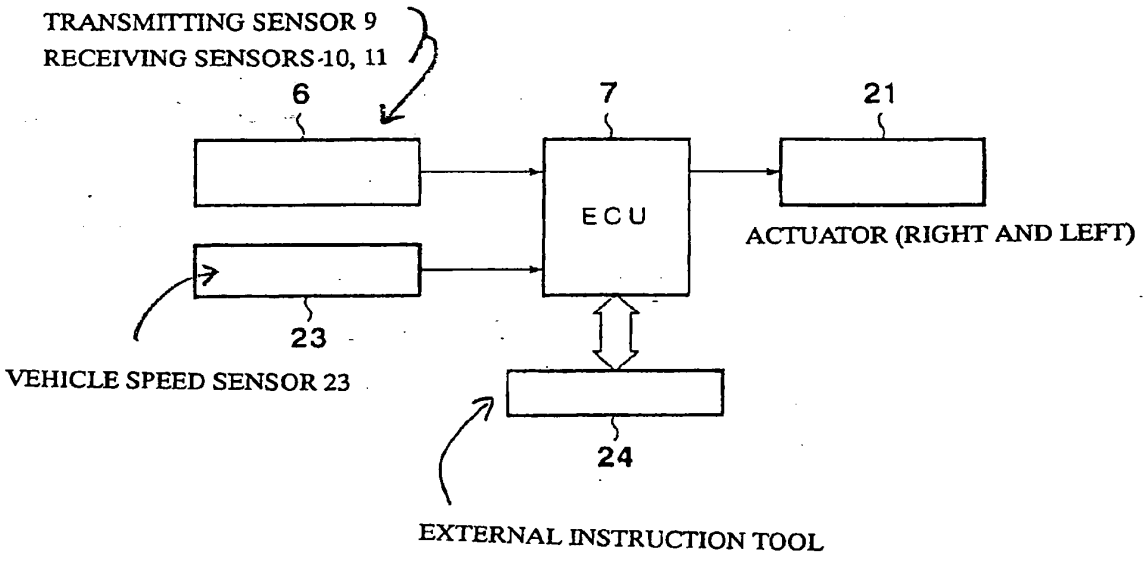


Fig. 8

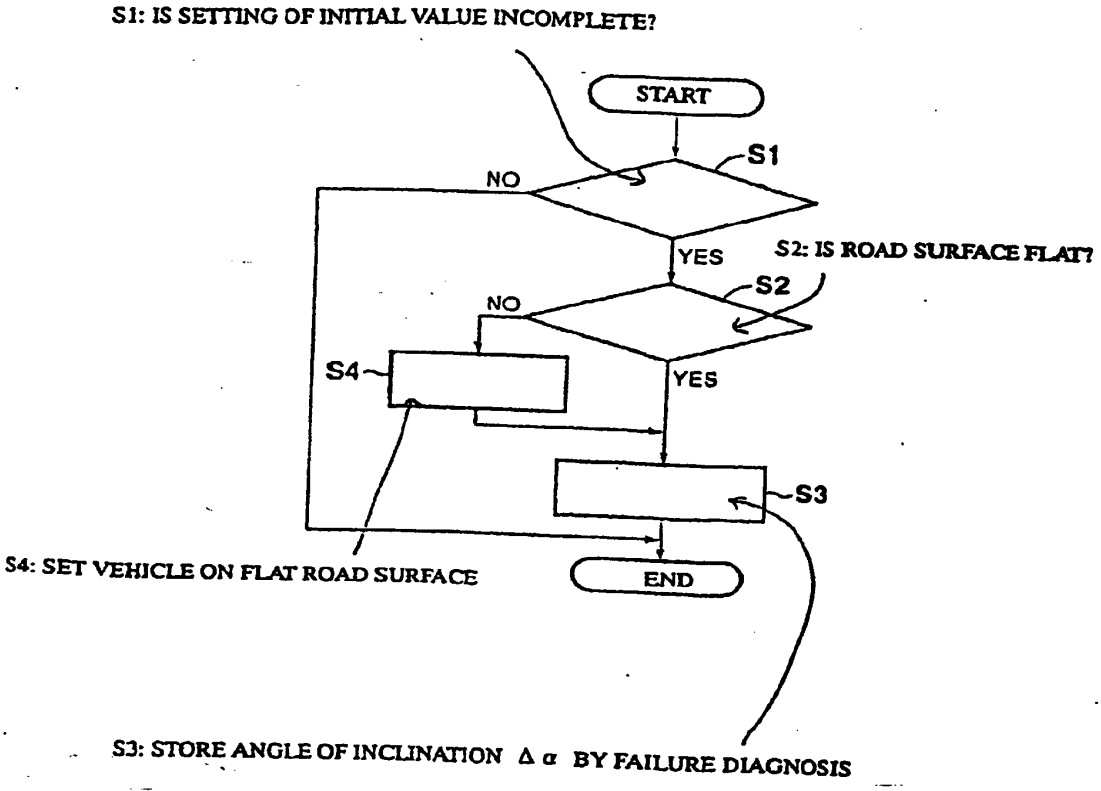


Fig. 9

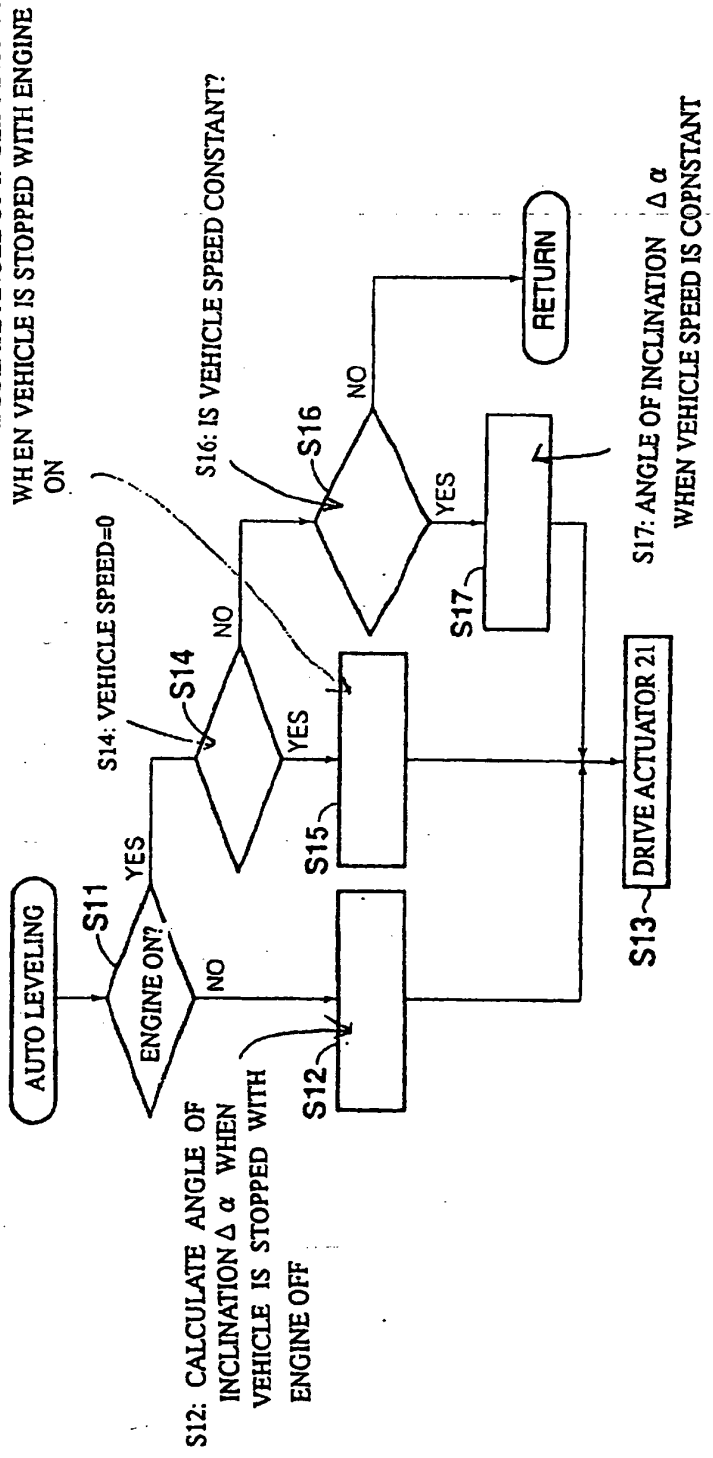


Fig. 10

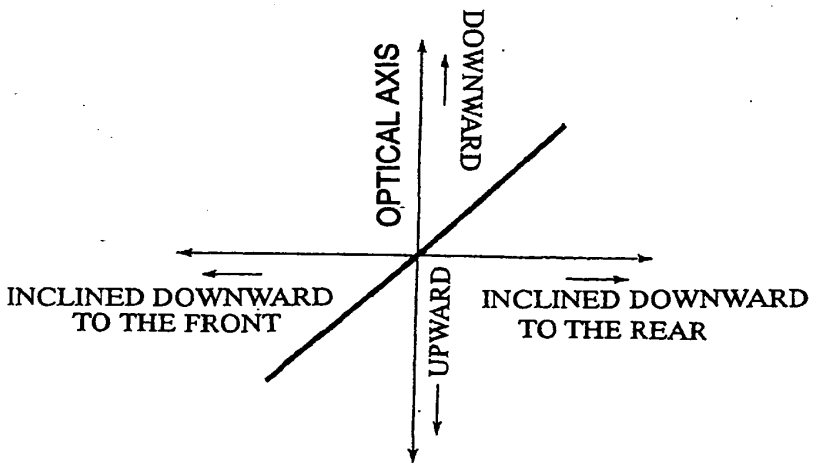


Fig. 11

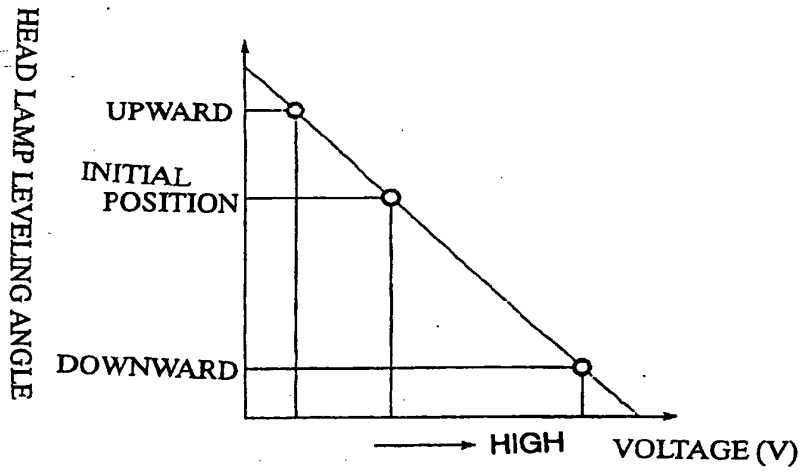


Fig. 12