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(54) **AUTOMATIC DIRECTIONAL CONTROL SYSTEM FOR VEHICLE HEADLIGHTS**

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(58) **Field of Classification Search**
None
See application file for complete search history.

(56) **References Cited**

To view the complete listing of prior art documents cited during the proceedings for Reexamination Control Numbers 95/001,621 and 90/011,011, please refer to the USPTO's public Patent Application Information Retrieval (PAIR) system under the Display References tab.

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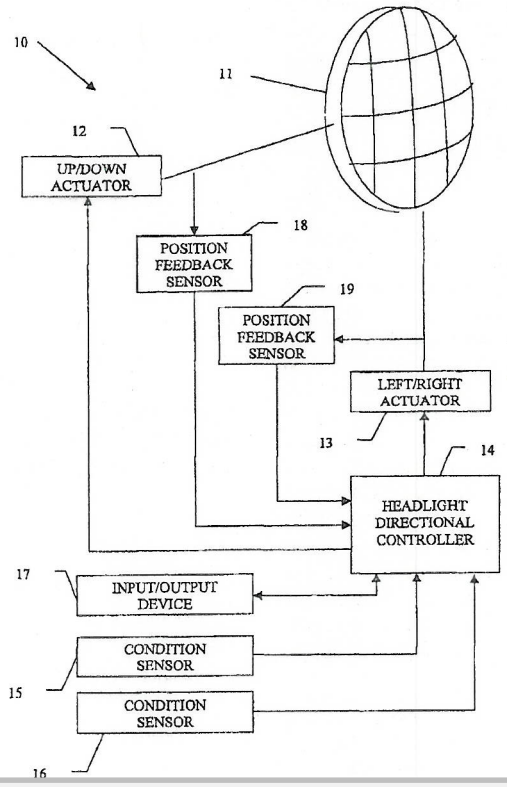
(57) **ABSTRACT**

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.



INTER PARTES REEXAMINATION CERTIFICATE ISSUED UNDER 35 U.S.C. 316

THE PATENT IS HEREBY AMENDED AS INDICATED BELOW.

Matter enclosed in heavy brackets [ ] appeared in the patent, but has been deleted and is no longer a part of the patent; matter printed in italics indicates additions made to the patent.

AS A RESULT OF REEXAMINATION, IT HAS BEEN DETERMINED THAT:

Claims **1-2** are cancelled.

Claims **3-5** are determined to be patentable as amended.

New claims **6-39** are added and determined to be patentable.

3. [The automatic directional control system defined in claim 1] *An automatic directional control system for a vehicle headlight, comprising:*

two or more sensors that are each adapted to generate a signal that is representative of at least one of a plurality of sensed conditions of a vehicle such that two or more sensor signals are generated, said sensed conditions including at least a steering angle and a pitch of the vehicle;

a controller that is responsive to said two or more sensor signals for generating at least one output signal only when at least one of said two or more sensor signals changes by more than a predetermined minimum threshold amount to prevent at least one first one of two or more actuators from being operated continuously or unduly frequently in response to relatively small variations in at least one of the sensed conditions; and

said two or more actuators each being adapted to be connected to the headlight to effect movement thereof in accordance with said at least one output signal;

wherein *at least one of* said [sensor] *two or more sensors* generates [a signal] *at least one of said two or more sensor signals* that is representative of [the] *a rate of change of the* steering angle of the vehicle.

4. The automatic directional control system defined in claim [1] *3*, wherein *at least one of* said [sensor] *two or more sensors* generates a signal that is representative of [the] *a rate of change of the* pitch of the vehicle.

5. The automatic directional control system defined in claim [1] *3*, wherein *at least one of* said [sensor] *two or more sensors* generates a signal that is representative of [the] *a* suspension height of the vehicle.

6. The automatic directional control system defined in claim 3, wherein said two or more sensors include a first sensor and a second sensor.

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

two or more sensors that are each adapted to generate a signal that is representative of at least one of a plurality of sensed conditions of a vehicle such that two or more sensor signals are generated, said sensed conditions including at least a steering angle and a pitch of the vehicle;

a controller that is responsive to said two or more sensor signals for generating at least one output signal only when at least one of said two or more sensor signals changes by more than a predetermined minimum threshold amount to prevent at least one of two or more actuators from being operated continuously or unduly frequently in response to relatively small variations in at least one of the sensed conditions; and

said two or more actuators each being adapted to be connected to the vehicle headlight to effect movement thereof in accordance with said at least one output signal;

wherein said two or more sensors include a first sensor and a second sensor; and

wherein said first sensor is adapted to generate a signal that is representative of a condition including the steering angle of the vehicle and said second sensor is adapted to generate a signal that is representative of a condition including the pitch of the vehicle.

8. The automatic directional control system defined in claim 7, wherein said first sensor is physically separate from said second sensor.

9. The automatic directional control system defined in claim 7, further comprising one or more additional sensors for sensing one or more of a rate of change of road speed of the vehicle, a rate of change of the steering angle of the vehicle, a rate of change of the pitch of the vehicle, a suspension height of the vehicle, or a rate of change of suspension height of the vehicle.

10. The automatic directional control system defined in claim 9, wherein at least one of said one or more additional sensors generate a signal that is representative of the rate of change of the road speed of the vehicle.

11. The automatic directional control system defined in claim 9, wherein at least one of said one or more additional sensors generate a signal that is representative of the rate of change of the steering angle of the vehicle.

12. The automatic directional control system defined in claim 9, wherein at least one of said one or more additional sensors generate a signal that is representative of the rate of change of the pitch of the vehicle.

13. The automatic directional control system defined in claim 9, wherein at least one of said one or more additional sensors generate a signal that is representative of the suspension height of the vehicle.

14. The automatic directional control system defined in claim 7, wherein the automatic directional control system is configured such that said two or more actuators include a first actuator and a second actuator and wherein the first actuator connected to the headlight to effect movement thereof in a first direction and the second actuator connected to the headlight to effect movement thereof in a second direction different from the first direction.

15. The automatic directional control system defined in claim 7, wherein the two or more actuators include a first actuator that is adapted to be connected to the headlight to effect movement thereof in a vertical direction.

16. The automatic directional control system defined in claim 15, wherein the two or more actuators include a second actuator that is adapted to be connected to the headlight to effect movement thereof in a horizontal direction.

17. The automatic directional control system defined in claim 7, wherein the two or more actuators include an electronically controlled mechanical actuator.

18. The automatic directional control system defined in claim 7, wherein the two or more actuators include a step motor.

19. The automatic directional control system defined in claim 7, wherein the two or more actuators include a servo

20. The automatic directional control system defined in claim 7, wherein the two or more actuators include a microstepping motor capable of being operated in fractional step increments.

21. The automatic directional control system defined in claim 7, wherein the automatic directional control system is configured such that the headlight is adjustably mounted on the vehicle such that a directional orientation at which a beam of light projects therefrom is capable of being adjusted both up and down relative to a horizontal reference position and left and right relative to a vertical reference position.

22. The automatic directional control system defined in claim 7, wherein the automatic directional control system is configured such that, while in a calibration mode, a directional orientation at which a beam of light projects is capable of being adjusted relative to the vehicle by manual operation of the two or more actuators.

23. The automatic directional control system defined in claim 7, wherein the automatic directional control system is configured such that the controller includes a microprocessor.

24. The automatic directional control system defined in claim 7, wherein the automatic directional control system is configured such that the controller includes a programmable electronic controller.

25. The automatic directional control system defined in claim 7, wherein the automatic directional control system further includes at least one position feedback sensor capable of providing a position feedback signal associated with at least one of the two or more actuators.

26. The automatic directional control system defined in claim 25, wherein the at least one position feedback sensor includes a Hall Effect sensor.

27. The automatic directional control system defined in claim 25, wherein the at least one position feedback sensor includes an optical interrupter.

28. The automatic directional control system defined in claim 7, wherein the automatic directional control system further includes memory.

29. The automatic directional control system defined in claim 28, wherein the memory includes non-volatile memory.

30. The automatic directional control system defined in claim 28, wherein the memory is configured to store a predetermined reference position associated with the headlight.

31. The automatic directional control system defined in claim 7, wherein the automatic directional control system is configured such that the pitch of the vehicle is capable of being determined by sensing a front and a rear suspension height of the vehicle.

32. The automatic directional control system defined in claim 7, wherein the automatic directional control system is configured such that the pitch of the vehicle is capable of being determined by a pitch sensor.

33. The automatic directional control system defined in claim 7, wherein the automatic directional control system is configured such that the controller is programmed to be responsive to changes in a suspension height of the vehicle that occur at frequencies lower than a suspension rebound frequency of the vehicle.

34. The automatic directional control system defined in claim 7, wherein the automatic directional control system is configured such that the controller is programmed to be responsive to changes in a suspension height of the vehicle that occur at frequencies lower than a suspension rebound frequency of the vehicle, thereby ignoring frequency changes in the suspension height of the vehicle that are a result of bumps in a road.

35. The automatic directional control system defined in claim 7, wherein the automatic directional control system is configured such that the predetermined minimum threshold amount functions as a filter to minimize undesirable operation of at least one of the two or more actuators.

36. The automatic directional control system defined in claim 7, wherein said controller is further responsive to at least one of said two or more sensor signals to automatically activate one or more vehicle lights that are different than the headlight.

37. The automatic directional control system defined in claim 36, wherein said one or more vehicle lights that are different than the headlight include one or more lights for illuminating a road in front of the vehicle during a turn.

38. The automatic directional control system defined in claim 7, wherein said controller is further responsive to a steering angle in excess of a predetermined magnitude for automatically activating one or more vehicle lights that are different than the headlight.

39. The automatic directional control system defined in claim 7, wherein said controller is further responsive to a steering angle in excess of a predetermined magnitude for automatically activating one or more vehicle lights that are different than the headlight to extend an angular range of a road surface.

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