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(54) Title of Invention **VEHCILE HEADLIGHT CONTROL DEVICE**

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SPECIFICATION

1. Title of Invention

VEHICLE HEADLIGHT CONTROL DEVICE

2. Scope of Patent Claims

A vehicle headlight control device with a headlight that changes an irradiation direction in conjunction with a steering operation, comprising: driving means that changes an irradiation direction of the headlight; means for detecting a steering angle; calculation means that calculates an amount of change in the steering angle speed; and driving control means that drives the driving means when the amount of change of the speed is greater than a predetermined value.

3. Brief Description of the Invention

[Industrial Field of Application]

The present invention relates to a vehicle headlight control device that can change an irradiation direction in conjunction with a steering operation of a steering wheel.

[Conventional Art]

There have been a variety of ideas to change the irradiation direction of a headlight in conjunction with a steering operation at the time of cornering of a vehicle. For example, a mechanical cornering lamp system configured to move a headlight via a link from a steering rod, or an electric cornering lamp system configured to detect a rotating angle of a headlight through a rotary encoder and control through a servomotor, and according to JPS62-77249A, there have been suggestions to gradually change the irradiation direction with the object to simplify the complex configuration that is a weakness of the latter electric cornering lamp system.

[Problem to be Solved by the Invention]

Despite this, among the conventional cornering lamp systems, the mechanical cornering light system is transmitted as a driving force wherein a steering force directly changes the irradiation direction by a headlight, thus creating a system with excellent responsiveness to an amount of change in a steering angle, but a dedicated design is necessary for each type of vehicle so that it lacks versatility, and for example, there is a problem in that the system cannot be provided as optional equipment.

Meanwhile, among electric cornering lamp systems that are regarded as easy to provide versatility, the electric cornering lamp system disclosed in JPS62-77249A is configured such that an amount of change in a steering angle of a steering operation is transmitted to a driving means that changes an irradiation direction of a headlight via detection means that detects the steering angle in a stepwise manner and a driving circuit that executes a predetermined action based on a signal from the detection means, and therefore there has been a problem in that a considerable time delay (time lag) is caused until the driving means is activated to change the irradiation direction of the headlight, which may cause a feeling of discomfort depending on a vehicle speed.

An objective of the present invention is to provide, in an electric cornering lamp system, that is, a vehicle headlight control device, a vehicle headlight control device having versatility and reduced time delay (time lag).

[Means to Solve the Problem]

The present invention is made in view of such problems, and to resolve the above problems and achieve the above object, the following configuration is provided, that is,, with a headlight that

changes an irradiation direction of the headlight, means for detecting a steering angle, calculation means that calculates an amount of change in the steering angle speed, and driving control means that drives the driving means when the change of amount of the speed is greater than a predetermined value.

[Operation]

In the vehicle headlight control device configured as described above, an amount of change in speed of the turning of the steering wheel is calculated by the calculation means and the like in a process where a steering wheel is turned until the steering wheel reaches a predetermined steering angle, and when this speed change amount is greater than a predetermined value, the driving means is operated to change the irradiation direction of the headlight

[Example]

One example of the present invention is described below with reference to the drawings, and FIG. 1 is an outside view illustrating when fog lamps configuring one example of the vehicle headlight control device of the present invention are installed. In FIG. 1, a bumper 3 is attached to the front bottom part of a vehicle and, as optional equipment, fog lamps 1R, 1L hang via a stay from the bottom portion of the bumper 3 below the headlights 2R, 2L.

Protective covers 4 that can open and close are attached to the respective fog lamps 1R, 1L, and when not in use, they are in the position illustrated so as to protect lenses that are not illustrated.

FIG. 2 is a perspective view illustrating a structure of the fog lamps 1R, 1L that are attached as is shown, and for the sake of explanation, the protective cover 4, the opening and closing device for the protective cover 4, and the lens have been omitted. In FIG. 2, in the approximate center portion of the main body 30, a lamp is supported by a freely exchangeable lamp holder not illustrated, and on the back portion of the lamp 5, a reflector 8 is arranged towards the main body 30, so as to change a light distribution of the lamp 5 to an optical path that faces forward. A sub-reflector 6 is placed between the lamp 5 and the reflector 8, but rotating fulcrums 6A, 6B are rotating centers and are free to rotate.

Meanwhile, a motor 10 is set in the left back corner of the main body 30, and a motor link 11 is fixed to the rotary output shaft of motor 10. A link 12 is connected to one end of the motor link 11. Also, a reflector link 13 is fixed to the rotating fulcrum 6B of the sub-reflector 6 and connected to a link 12.

Accordingly, the rotating force of the motor 10 is transferred so as to rotate the sub-reflector 6.

FIG. 3(a), (b) illustrate a cross-sectional view of main parts of the fog lamps 1R, 1L configured in this manner. FIG. 3(a) illustrates a state wherein the sub-reflector 6 is placed in a neutral position and the lamp 5 is turned on, so that all of the optical pathways illustrated by arrows U reflect forward as is illustrated.

Next, FIG. 3(b) illustrates a state wherein the sub-reflector 6 is placed in a rotated position and the lamp 5 is turned on, and in this position, the optical pathways U reflected from the sub-reflector 6 irradiates a direction θ degrees from the optical pathways facing the front direction reflected by the reflector 8.

FIG. 4 (a), (b), (c) are action explanation views showing the relationship between a steering angle of a steering wheel 14 and the positions of irradiation for the fog lights 1R, 1L. In FIG. 4, a steering angle detection device not illustrated is set up inside the steering wheel 14 and if the steering wheel is turned to the left, a negative (-) steering angle detection signal will be displayed, and if the steering

wheel is turned to the right, a positive (+) steering angle detection will be displayed, and in FIG. 4(a) at the neutral position in the illustration, the steering angle detection signal will not be displayed. Accordingly, with the fog lamps 1R, 1L configured to change irradiation direction based on these steering angle detection signals, when the steering wheel 14 is in a neutral position, the fog lamps 1R, 1L will both irradiate in the front direction as is illustrated.

Also, in FIG. 4 (b), if the steering wheel 14 is turned to the left and the negative (-) steering angle detection signal is displayed, the sub-reflector 6 of the fog lamp 1L moves and irradiates in a left direction at θ degrees. Similarly, in FIG. 4 (c), if the steering wheel 14 is turned to the right and the positive (+) steering angle detection signal is displayed, the sub-reflector 6 of the fog lamp 1R moves and irradiates in a right direction at θ degrees.

FIG. 5 shows a block diagram for performing an operation of FIG. 6.

In this drawing, in a main control part 100, the calculations means, which calculates to convert the steering angle detection signal to an amount of change in speed, and a driving electric circuit are installed, and if the calculated amount of change in speed exceeds a predetermined value, the driving electric circuit is operated to drive the motor 10 stored inside the fog lamps 1R, 1L.

As the detection means for the steering angle, for example, a detection device 20 configured by a variable resistor is set up inside the steering wheel 14 illustrated by a dotted line and outputs a resistance value corresponding to a steering angle of the steering wheel 14. Here, the calculation means becomes unnecessary when the detection device 20 is configured with an acceleration sensor that can detect an amount of change in speed.

An ignition switch 17 works to demand power to the main control part 100 and is connected to one end of a positive electrode P of a battery not illustrated. A fog switch 15 is provided for purpose of allowing the ON/OFF light of the lamp 5 of the fog lamps 1R, 1L and the main control part 100 to start a program to be discussed later, and is connected to one end of a positive electrode P of a battery not illustrated. A symbol G indicates grounding.

FIG. 6 is an operating region graph of the headlight control device configured in this manner, and shows the condition of the operating region indicated by diagonal lines for when an absolute value of the calculated amount of change in speed exceeds a predetermined value V, or, for example, when a vehicle is in a stopped position and the absolute value of a predetermined steering angle exceeds θ1.

FIG. 7 is a flowchart illustrating one example of the flow to be executed in the block diagram of FIG. 5. In FIG. 7, when both the ignition switch 17 and the fog switch 15 are in the ON position, the program starts, and first, on step S1, it determines whether an amount of change in speed is greater than the predetermined value V, and if it determines it to be YES, it proceeds to step S2, and next it determines whether the amount of change in speed is positive or negative, and if it determines it is positive, it proceeds to step S3, and causes the motor 10 stored inside the fog lamp 1R to start driving.

On the other hand, if it determines it to be negative in step S2, it proceeds to step S4 and causes the motor 10 stored inside the fog lamp 1L to start driving. The motor 10 that is started in this manner stops after a predetermined rotation. Also, it proceeds to step S7, and if the steering angle θ becomes zero, which is close to the neutral position of the steering wheel, it proceeds to step S8, and the motor 10 returns to the neutral position, and execution of the program terminates.

Also, on step S1, if it determines that the amount of change in speed is less than the predetermined value V, it proceeds to step S5, and determines whether the steering angle θ is greater than a

predetermined steering angle θ1. At step S5, if it is determined to be YES, it proceeds to step S6, and it determines whether the steering angle θ is positive or negative, and if it determines it to be positive, it proceeds to step S3, and causes the motor 10 stored inside the fog lamp 1R to start driving.

On the other hand, if it determines it to be negative, it proceeds to step S4 and causes the motor 10 stored inside the fog lamp 1L to start driving.

Also, at step S5, a NO determination, or in other words, if it is determined that the steering angle θ is less than the predetermined steering angle θ1, it proceeds to step S7, and if the steering angle θ becomes zero, which is close to the neutral position of the steering wheel, it proceeds to step S8, and the motor 10 returns to the neutral position, and execution of the program terminates.

According to the program explanation above, when both or either of the amount of change in the steering angle speed and the steering angle exceed the predetermined amount that has been preset, the program activates the driving means, and changes the direction of the lamp, namely the headlight, with reduced time delay (time lag) and no discomfort.

Note that this example is only about a fog lamp, but the present invention can obviously be applied to other front lights such as a headlight.

Also, the driving speed of the motor 10 stored inside the fog lamp 1 and the amount of change in the steering angle speed may be linear.

[Effect of the Invention]

As is explained above, according to the vehicle headlight control device of the present invention, it is electronically configured to change the irradiation direction of a headlight in accordance with the amount of change in the steering angle speed by a steering operation, thus it is possible to provide a vehicle headlight control device having versatility, and in which time delay (time lag) is reduced.

4. Brief Description of the Drawings

FIG. 1 is an outside view illustrating when fog lamps of one example of the vehicle headlight control device of the present invention are installed.

FIG. 2 is a perspective view illustrating a structure of the fog lamps of FIG. 1.

FIG. 3(a), (b) are a cross-sectional views of main parts of the fog lamp of FIG. 2.

FIG. 4 (a), (b), (c) are an operation explanatory drawings showing the relationship between a steering angle of a steering wheel and the positions of irradiation for the fog lights.

FIG. 5 is a block diagram for performing an operation of FIG. 6.

FIG. 6 is an operating region graph,

FIG. 7 is a flowchart to be executed in the block diagram of FIG. 5.

In the drawings, 1R, 1L … fog lamps, 2R, 2L … headlights, 5 … lamp, 6 … sub-reflector, 8 … reflector, 10 … motor, 14 … steering wheel, 15 … fog switch, 17 … ignition switch, 20 … detection device, 100 … main control part

$\frac{d\theta}{dt}$ … amount of change in velocity, and θ … steering angle.

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