



Design and Manufacture of Movable Headlight System in Automobile

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ABSTRACT:

This paper presents the hardware of movable Headlight System for motor vehicles. Headlight System is an active safety system, where the head lamp orientation control system rotates the right and left headlights independently and keeps the beam as parallel to the curved road as possible to provide better night time visibility to driver. In this system use rack and pinion arrangement which give drive to the optical axes on which headlight are mounted so when a tie rod arms are moved with steering arm that give predefined motion to the wheel as well as headlights.

Keywords: Automotive light system, steering system, Design

I. INTRODUCTION

Presently, studied changes are unfolding in automotive lighting technology. Automobile manufacturers - together with suppliers and representatives - currently aspire to develop the headlights of tomorrow. Freeform headlamp is one of the popular design which offers great flexibility and compactness. The optical design, fabrication and the measurement of the freeform reflector headlamps are investigated by Jiang et al [1].

Kobayashi [2] proposed by the new standard for cornering light system allows not only the conventionally approved ON/OFF control mode interlocked with the operation of the turn signal switch but also an automatic ON-OFF control according to the steering wheel angle. The active cornering light system (ACL system) on the new DELICA D: 5 have a dedicated ECU to control the operation of the lamps. Chi on-dong lin [3] investigated by car light piloting system objective of the present invention is to provide a steering wheel controlled car light pointing system which automatically turns the lights of the motor car to coincide the projection of the lights with the steering direction of the motor car. Ken chi Nishimura [4] suggested that the apparatus for automatically adjusting a direction of a light axis of a vehicle headlight includes a steering angle sensor detecting a steering angle of a steering wheel of a vehicle and a swivel control unit performing swivel control by which the direction of the light axis of the vehicle headlight is adjusted to the target direction in accordance with the steering angle detected by the steering angle sensor. Hiroaki okuchi [5] proposed automatic optical-axis adjusting device for automatically adjusting direction of optical axes of front lights with respect to steering angle of steering wheel An electronic control for automobile headlight utilizing a spherical sensor comprised of a metal ball surrounding by a fluid encapsulated in a spherical sensor which is connected to the spherical sensor system. Masanori kondo [6], suggested the automatic optical axis adjusting device for automatically adjusting direction of optical axis of front lights headlight control apparatus and method controls an irradiation direction of a headlight. This apparatus uses a navigation based swivel angle calculated based upon the shape of a road in a navigation based control period and a steering based swivel angle calculated based upon a steering angle in a steering based control period.

A. Objective of the present work

The main objective of this system is to apply automotive vehicle.

- To move the headlight along with steering on sharp turning.
- To keep the headlight beam parallel to road turning as possible as can.
- To change the place of area illuminated by headlight and direct illumination area of headlight in useful direction.
- To improve the visibility area of driver at night so that driver can judge road turning well.
- To prevent road accidents on sharp turning at night specially in hilly areas.
- To increase safety at night.

II. STEERING MECHANISM SYSTEM

Steering system is to achieve angular motion of the front wheels to negotiate a turn. This is done through linkage and steering gear which convert the rotary motion of the steering wheel into angular motion of the front road wheels. The parts of steering system are consisting of Steering linkage and Steering gear. Steering Linkage-it depend upon the type of vehicle, wither it is a car which has independent front suspension.

Steering linkage for vehicle is defining two types like as Steering Linkage for Vehicle with Rigid Axle Front Suspension and Steering Linkage for Vehicle with Independent Front System.

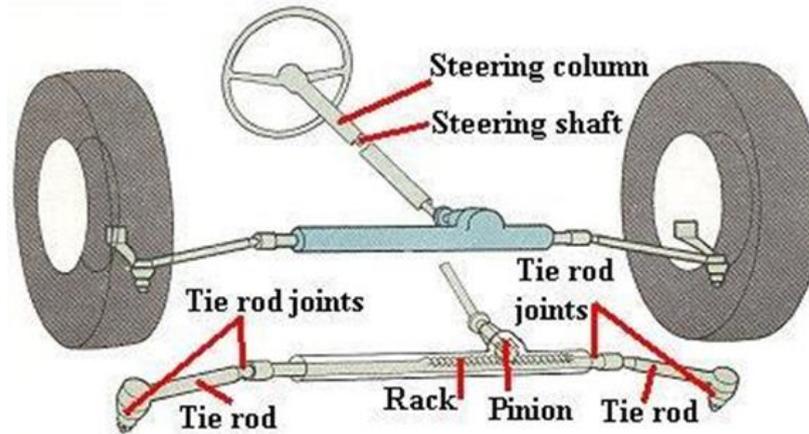


Figure 1. Steering System [7]

Steering Gear- The steering gear convert the turning motion of the steering wheel into the to and fro motion of the link rod of the steering linkage. The working of the other types of steering gear.[9,10]

1. Worm & Wheel Steering Gear: The movement of the steering wheel turns the worm, which is turn drives the worm wheel. Attached to the wheel spindle rigidly is drop arm, so that a rotation of the steering wheel corresponds to a linear motion of the drop arm end, which is connected to the link rod.

2. Rack And Pinion Steering Gear: The rotary motion of the steering wheel is transmitted to the pinion of the steering gear through universal joints. The pinion is in mesh with a rack. The circular motion of the pinion is transferred into the linear rack movement which is further relayed through the ball joints and tie rods to the stub axles for the wheel to be steered. In the figure 2 shows the schematic and actual modal of steering gear mechanism.[11]

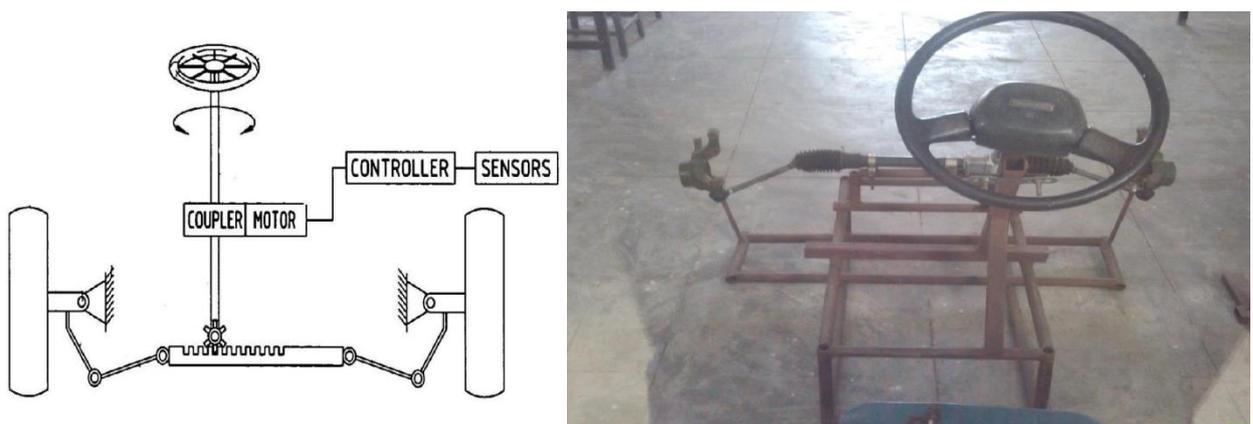


Figure 2. Rack and pinion steering gear

III. PROBLEM DESCRIPTION

Approximately one third of all traffic accidents happen at night, even though there is less traffic at night than during the day. The vehicle moves on a circular path when driver turn the steering wheel. The circular path is defined by the movement of the wheel and angle position of the front wheel. when driver steer the wheel could not able to the turn headlight in the direction of the road turn, so driver will not judge the proper turn of the road which causes accident

in sharp turning. The lights of a motor car are commonly fixed in position. as shown in fig.3, the projection of light d of the light l of the motor car m is the constantly maintained in line with the motor car m. when steering wheel the motor car m is turned in the either direction, the body of the motor car m is not synchronously turned in the same direction, i.e. the body of the motor car m moved to follow the steering direction at the time delay. Because the driver wheel directs the eye towards their desired direction before the motor car M is turned to coincide, a blind angle G exists out of the projection of the light of the lights L of the motor car M within the drivers view angle.

Now, When driver steer the wheel could not able to the turn headlight in the direction of the road turn, so driver will not judge the proper turn of the road which causes accident in sharp turning. At night time, driving a vehicle in hilly areas can be quite challenging. No illumination on turns due to fixed headlamps makes it difficult to accommodate for sharp turns. Lack of visibility at turns in narrow roads can prove to be fatal.[8]

Therefore, a traffic accident may happen while one is changing the steering direction of the motor car.

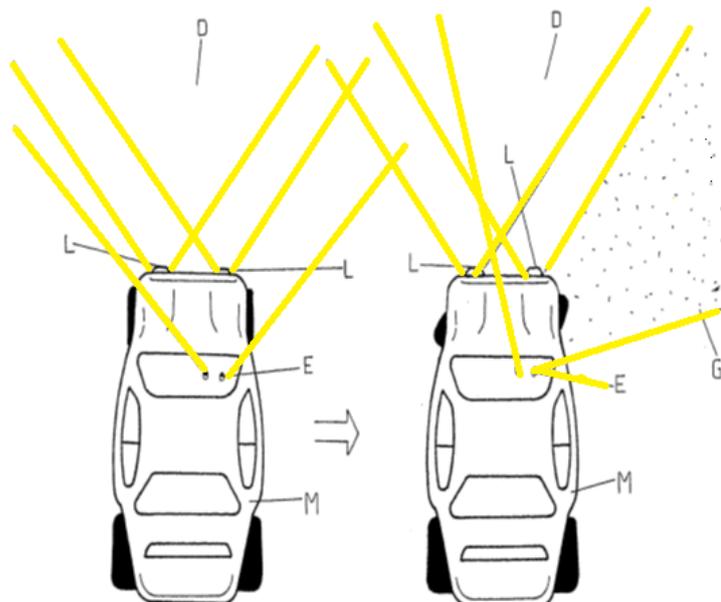


Figure 3 Projection of headlight automotive vehicle[7]

IV. CONSTRUCTION AND WORKING OF AUTOMOTIVE HEADLIGHT

Construction: In this system we have mounted two clamps C1 and C2 on rack as shown in figure. Two connecting rods are mounted between each headlight and each clamp. Connecting rods are pivoted at clamp end and are simply supported in the slots of headlight back plate. Here in each back plate of headlight one slot is provided for desired movement of headlight. Headlight back plates are pivoted on two vertical rods to have an angular movement.



Figure 4. Movable headlights with Steering System

Working: When driver rotates steering left or right this motion is transmitted to pinion through steering shaft and universal joint. Rotary motion of pinion is converted into liner motion of rack. It causes clamps to move linearly with

rack. Connecting rods are having rotary motion at pivoted end and having sliding motion in slots at other end. Back plates of headlight have rotary motion on pivoted rods. So, when we move steering left the connecting rod the left side pulls the left back plate and causes the headlight to turn left on pivoted rod. The connecting rod the right side pushes the right back plate and causes the headlight to turn left on pivoted rod. In the same way, when we move steering right the connecting rod the right side pulls back the left back plate and causes the headlight to turn right on pivoted rod. The connecting rod the left side pushes forward the right back plate and causes the headlight to turn right on pivoted rod. Slots are provided to select the variable change in angle of headlight orientation. Slots are to give some allowance to headlight. So till steering does not move from center position through some particular angle headlights' orientation does not change. Figure 5 explaining area with and without modification view of angle in the car.

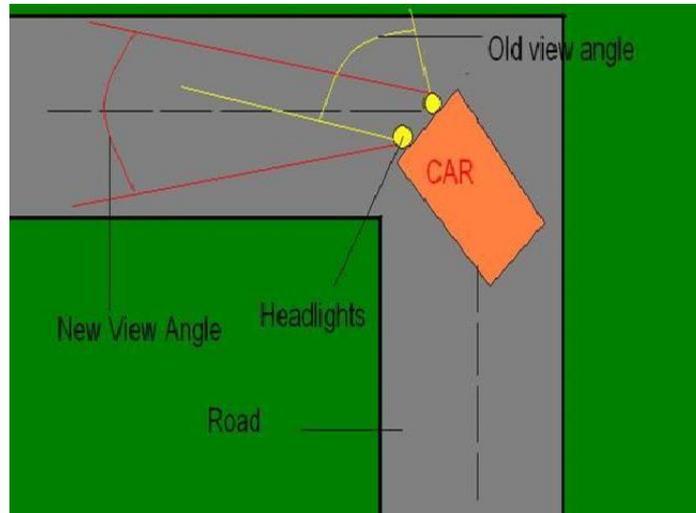


Figure 5. Explaining areas with and without modification view of angle in the car

Angle of turning of Steering wheel X(degrees) -ve (left) +ve (right)	Angle of turning of Steering wheel Y(degrees) -ve (left) +ve (right)	Steering Ratio (X/Y)	Angle of turning of headlight on left side(degrees) -ve (left) +ve (right)	Angle of turning of headlight on right side(degrees) -ve (left) +ve (right)
-200	-11	18.18	-8	-5
-400	-22	18.18	-16	-10
-600	-33	18.18	-25	-15
0	0		0	0
200	11	18.18	5	8
400	22	18.18	10	16
600	33	18.18	15	25

Table 1. Automotive system data for left and right side turn

V. RESULTS AND CONCLUSION

For the purpose of results used a rack and pinion arrangement which give drive to the optical axes on which headlight are mounted so when a tie rod arms are moved with steering arm that give predefined motion to the wheel as well as headlights. In this system can be used for swivelling headlight according with steering movement such as methods like optical sensor, light piloting system. This system helps to move headlights left or right as per requirement along with the turn and can help to reduce accidents at night on sharp turning and hilly areas.

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