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Design and Fabrication Project for Four Wheeler Head Light Doom Turning System

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Abstract: Aim of the study about to examine the Advanced Forward Lighting System is a term used for lights that can automatically adapt to changing driving conditions (road and visibility). Some systems can swivel the main beams left and right up to 15 degrees according to the vehicle's travel path (angle of the curve) and speed. This provides greater lighting to the road ahead. Other systems can automatically switch from high beam to low beam when it detects an approaching vehicle. There are also systems that can shine light 90-degrees in either direction when the vehicle is turning at an intersection. These systems usually use Bi-Xenon or High Intensity Discharge (HID) lights. We can also LED to use as a light source in doom. It is the main use to travel in mountain regions during night times.

INTRODUCTION

Head light doom turning system maximize the effect of light travel path to the wheel direction. In normal condition the light path on the doom travel narrow with some wide path which the car driver can visibly see the road. This shows basic model of a car which the light travels at our modern world we can things modern through this in car it develops up to its end for our safety. Behalf of this light system is one of the most important factors to drive car at night. In normal head light they travels in narrow path and little wide for the road distance. Adaptive Forward Lighting (AFL) is a system intended to help drivers observe objects earlier than they otherwise would when entering a corner in darkness. To prevent night accidents inside a curve or in turning situations. Normally the front lights of a vehicle point directly ahead.

When in a corner, the Dynamic Curve Light function illuminates that part of the road which the vehicle is driving towards by swiveling the light cones to the inside of the curve. This provides a better view into the corner, allowing earlier identification of possible dangers ahead. The Static Curve Light is an additional cornering light which is illuminated to support the driver in tight curves such as turning maneuvers in the city. This additional illumination helps the driver avoid a collision with objects or other road users. Most turning scenarios are at low speeds, and the system is most effective at avoiding accidents with pedestrians and bicyclists. Adaptive forward light system that move as a curve follows the road which to doom rotates to the path of the road. In normal head lights to covers only 15˚ on each side.Night time driving has been shown to be extremely dangerous, especially for very young and very old drivers. A recent study concluded that driving at night for teenage drivers is a bigger contributor to accidents than driving without seatbelts or even under the influence of alcohol. Also, around 50% of fatal accidents happen in night driving situations, even though traffic is much lighter during night time. Innovative features in the new Opel are designed to increase safety and comfort as well as enhance driving excitement. The Insignia offers leading technology in driver assistance systems. Moreover, the latest generation of lighting provides nine different light beam settings to help drivers adapt to diverse driving conditions.
Adaptive head lights that turn and illuminate bends.
Adaptive head lights that lower the beam as to not glare oncoming traffic.
Adaptive head lights that sense and illuminate pedestrians in front of the vehicle.
Brake lights that illuminate when the gas pedal is released rapidly.

LITERATURE REVIEW:

The present invention relates to a vehicle front lamp light distribution control system and more particularly to a vehicle front lamp light distribution control system capable of raising visibility at the time of cornering by controlling light distribution means of the front lamp.192674Laxmi et al. Design & Fabrication of steering controlled headlights in automobile states, A vehicle head lamp including a fog lamp is provided with a movable reflector and by turning the movable reflector in the steering direction by an amount corresponding to a steering angle of the steering wheel, the light distribution pattern of the front lamp is changed in the direction of vehicle's turn so as to raise visibility at the time of cornering However, according to the aforementioned earlier art, the light distribution pattern of the front lamp is changed in the steering direction of the steering wheel by an amount corresponding to the steering angle when the vehicle turns on an intersection or the like, cornering destination cannot be beamed brightly enough before operating the steering wheel.
Czech Tetra and 1920s Ca dills was early implementer of such a technique, producing in the 1930s a vehicle with a central directional headlamp. The American 1948 Tucker Sera was likewise equipped with a third central headlamp connected mechanically to the steering system. The 1967 French Citroën DS and 1970 Citroën SM were equipped with an elaborate dynamic headlamp positioning system that adjusted positioning in response inputs from vehicle steering and suspension systems, though US regulations required this system to be deleted from those models when sold in the USA. Presently, studied changes are unfolding in automotive lighting technology. Automobile manufacturers -together with suppliers and representatives -currently aspire to develop the headlights of morrow. Freeform headlamp is one of the popular design which offers great flexibility and compactness. They 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. 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. The automatic optical axis adjusting device for automatically adjusting direction of optical axis of from lights headlight control apparatus and method controls an irradiation direction of a headlight. This apparatus uses an aviation based swivel angle calculated based upon the shape of a road in navigation based control period and a steering based swivel angle calculated based upon a steering angle in a steering based control period The optical design, fabrication and the measurement of the freeform reflector head lamps are investigated by Shined.

PROBLEM DEFINATION:

3.1 PROBLEM DEFINATION:

- A four wheeler usually find difficulty to drive especially at sharp turn .The model helps them to change the focus of headlight as the steering move on either direction. Adaptive headlights react to the steering system of the car and automatically adjust to illuminate the road wheel.
- Turn the car left, the headlights angles to the left. Instead of moving the headlights, reflectors are fitted on the inside on either side of the headlamp casing. These reflectors are moved to direct a beam in the same direction as the movement of the vehicle .The power required to move the reflectors is transmitted using hydraulic linkages.

3.2 Objectives:
The main aim to move the head light on sharp turning as possible as the vehicle should get illumination front view that could help to driver taking turn on hill areas, And also to make the nation with an accident freeIII.

3.3 SYNTHESIS OF MECHANISM:
1. Steering System
2. The manual steering system incorporates:
3. Steering wheel and column,
4. manual gearbox and pitman arm or a rack and pinion assembly
5. Linkages; steering knuckles and ball joints
6. The wheel spindle assemblies.
7. Rack And Pinion Steering

Rack And pinion steering is quickly becoming the most common type of steering on cars, small trucks and SUVs. It is actually a pretty simple mechanism. A rack and pinion gear set is enclosed in a metal tube, with each end of the rack protruding from the tube. A rod, called a tie rod, connects to each end of the rack. The pinion gear is attached to the steering shaft. When you turn the steering Wheel, the gear spins, moving the rack. The tie rod at each end of the rack connects to the steering arm on the spindle.
The rack and - pinion gear set does two things:
1. It converts the rotational motion of the steering wheel into the linear motion needed to turn the wheels.
2. It provides a gear reduction, making it easier to turn the wheels.
On most cars, it takes three to four complete revolutions of the steering wheel to make the wheels turn from lock to lock (from far left to far right).

METHODOLOGY:
The paper here is all about Front wheel steering system with moveable headlights with latest technology. The most conventional steering arrangement is to turn the front wheels using a hand –operated steering wheel which is positioned in front of the driver, via the steering column, which may contain universal joints to allow it to deviate somewhat from a straight line. Rack and pinion steering gear mechanism where the steering wheel turns the pinion. The pinion moves the rack, which is a linear gear that meshes with the pinion, converting circular motion into linear motion along the transverse axis of the car (side to side motion) given to the limit switch. There are two Limit switches are used in this project. These switch outputs are connected to the steering D.C motor in Forward and reverse rotation of operation. The rack and pinion arrangement is used to turn the wheel in left and right direction. The Rack is connected to the wheel with the help of liver mechanism and the pinion is coupled to the permanent magnet D.C motor shaft. The Motor is drawn supply from the battery through limit switch arrangement. When the steering is turn in the left direction, it pushes the left side limit switches, so that the D.C motor rotate in forward direction to move the wheel in left side. Similarly When the steering is turn in the right direction, it pushes the right side limit switches, so that the D.C motor rotate in reverse direction to move the wheel in right side.

4.1 MECHANICAL DESIGN:
Mechanical design phase is very important from the view of designer as whole success of the project depends on the correct design analysis of the problem. Designer should estimate these forces very accurately by using design equations. If he does not have sufficient information to estimate them he should make certain practical assumptions based on similar conditions. This will almost satisfy the functional needs. Assumptions must always be on the safer side. Design of Steering Gear Mechanism In order to make the design of our rack-pinion for the steering box, we base our work on the choice of the rack and the pinion which will produce a greater lateral Displacement of the wheels with the same turn of the steering wheel. The other start point is that the rack and the pinion must be the same modulus and the same material. A suitable material for these elements is the project here is all about Front wheel steering system with moveable headlights with latest electronics technology. The most conventional steering arrangement is to turn the front wheels using a hand–operated steering wheel which is positioned in front of the driver, via the steering column, which may contain universal joints to allow it to deviate somewhat from a straight line. Other arrangements are sometimes found on different types of vehicles, for example, a tiller or rear–wheel steering. Tracked vehicles such as tanks usually employ differential steering that is, the tracks are made to move at different speeds or even in opposite directions to bring about a change of course.
Car safety is the avoidance of automobile accidents or the minimization of harmful effects of accidents, in particular as pertaining to human life and health.Special safety features have been built into cars for years, some for the safety of car's occupants only, and some of the safety of others. One of the choices available is Design and fabrication of steering controlled head light system. This device relates to a headlight arrangement for vehicles, and, more operable to maintain headlight members and front wheels pointed in the same direction at all times.

PRINCIPLE OF OPERATION:

Adaptive forward lighting system is most advance lighting system that is more convenient to drivers to drive. It is operated by the connection of steering moment. Each side of doom are connected with u clamp which are molded with body. U clamp are connected with the steering wheel. Most systems require the driver to turn the light switch to the automatic setting. On this we are using LED as a light source. The high tech light source doubles light output thus improving the visibility in comparison to traditional headlamps, making nighttime and inclement weather driving easier and safer. On the other, it decreases the energy consumption by 33% in comparison to traditional halogen headlamp bulb. The system assists the driver by giving him a better view of the road ahead, thus reducing the possibility to hit animals, humans etc. on the road side, particularly in the nighttime driving.

The AFS (Adaptive Front-lightning System) can provide better vision for drivers depending on the different road conditions and curves. The AFS is a method of adapting the front lighting beam direction in order to provide better visual of the road ahead so the driver's eyes cover more visual space over the road which gives him more response time to accommodate with any sudden object or vehicle coming obstructing his way as well as alert him of changing road conditions. Processing this data is rather simple when it comes to sensor input since instantaneous adjustment in front lighting direction is required. The input is a measurement of the current situation so the adjustment should be as quick as possible. However the AFS does not only control the direction of the lighting, but it might also control the light density. So while the car goes through a curve or initiates going up a ramp, the lighting strength can also be increased.

5.2 WORKING PRINCIPLE:

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, withered 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.

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 shows the schematic and actual modal of steering gear mechanism.

5.3 Ackermann Steering Principle:

To achieve true rolling for a four wheeled vehicle moving on a curved track, the lines drawn through each of the four wheel axes must intersect at the instantaneous centre. The actual position the instantaneous centre constantly changes due to the alternation of the front wheel angular positions to correct the steered vehicle's path. Since both rear wheels are fixed on the same axis but the front wheel axles are independent of each other, the instantaneous centers lies somewhere along an imaginary extended. The Ackermann principle is based on the two front steered wheels being pivoted at the ends of an axle -beam. The original Ackermann linkage has parallel set track rod arms, so that both steered wheels swivel at equal angles. Consequently, the intersecting projection lines do not meet at one point. If both front wheels are free to follow their own natural paths, they would converge and eventually cross each other.

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Since the vehicle moves along a single mean path, both wheel tracks conflict continuously with each other causing tier slip and tread scrub. Subsequent modified linkage uses inclined track rod arms so that the inner wheel swivels about its king-pin slightly more than the outer wheel. Hence the lines drawn through the stub-axles converge at a single point somewhere along the rear axle projection.

Ackermann Steering Principle:

5.4 CALCULATIONS:

DESIGN OF FRAME:

Let,

Rs = Radius of steering wheel,

Rp = Radius of pinion pitch circle,

T = No. of teeth on pinion,

P = Circular pitch of the pinion for one revolution of the steering wheel, the input movement at the steering wheel, and the output movement at the rack,

Xi = 2×π× Rp

= T×P

Movement ratio = MR = Xi/Xo

= (2×π ×Rp) / (2×π×Rs)

= Rs/Rp

Also, MR= 2×π× Rs / T× P

If there is no friction in the gears,

MR = output load at the rack / input effort at the steering wheel

= W/E

DETERMINATION OF PITCH CIRCLE DIAMETER OF THE PINION:

Let,

Radius of pinion pitch circle = Rp

Rs = Radius of the steering wheel = 150 mm

Movement ratio = MR = Rs / Rp

= 150 / Rp

Also,

Output Resistance of the rack, W = 1000 N

And Input Effort of steering wheel, E= 50N

Therefore, MR = 150 / Rp = 1000 / 50

Hence, Rp = 7.5 mm

i.e. Pitch circle diameter of pinion = Rp = 15 mm

As induced stress is less than allowable stress the design of hollow cylinder is safe.

SUMMARY:

6.1 STEERING GEOMENTRY:

We observed that when the steering wheel is rotated through a certain angle towards right side of the driver, the head lights are tilted through certain angle between 0-20 degrees to the right with the help of different linkages arranged with respect to the steering wheel which were discussed earlier. The same features are observed when the steering wheel is turned to the left side. The results that we have achieve with mechanically actuated steering controlled head lights is pictorially represented as shown in figures. The representation f the mechanism when installed in a vehicle can be observed in motion as follows: Representation of a Vehicle in Motion with Mechanism Installed In the view of forgoing disadvantages inherent in the known types of road tracking headlamps now present in the prior art, the present invention provides a new movable vehicle head light construction wherein the same can be utilized for automatically aiming the head lamps in the same direction of the travel regardless of the terrain of the road. The further object of the system is, this is susceptible of a low cost of manufacturing with regard to both cost and labor and which accordingly is then susceptible of low prices of sale to the public.

6.2 Construction and Working of various parts:

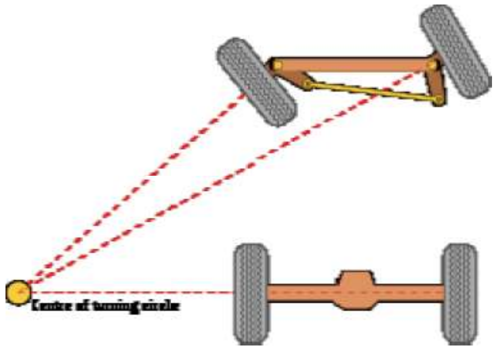
A simple approximation to perfect Ackermann steering geometry may be generated by moving the steering pivot points inward so as to lie on a line drawn between the steering kingpins and the centre of the rear axle. The steering pivot points are joined by a rigid bar called the tie rod which can also be part of the steering mechanism, in the form of a rack and pinion for instance. With perfect Ackermann, at any angle of steering, the centre point of all of the circles traced by all wheels will lie at a common point. Note that this may be difficult to arrange in practice with simple linkages, and designers are advised to draw or analyze their steering systems over the full range of steering angles.

Modern cars do not use *pure* Ackermann steering, partly because it ignores important dynamic and compliant effects, but the principle is sound for low-speed maneuvers. Some race cars use *reverse* Ackermann geometry to compensate for the large difference in slip angle between the inner and outer front tires while cornering at high speed. The use of such geometry helps reduce tire temperatures during high-speed cornering but compromises performance in low-speed maneuvers. A rack and pinion is a type of linear actuator that comprises a pair of gears which convert rotational motion into linear motion. A circular gear called "the pinion" engages teeth on a linear "gear" bar called "the rack"; rotational motion applied to the pinion causes the rack to move, thereby translating the rotational motion of the pinion into the linear motion of the rack.

For example, in a rack railway, the rotation of a pinion mounted on a locomotive or a railcar engages a rack between the rails and forces a train up a steep slope. For every pair of conjugate involute profile, there is a basic rack. This basic rack is the profile of the conjugate gear of infinite pitch radius (I.e. a toothed straight edge.) A generating rack is a rack outline used to indicate tooth details and dimensions for the design of a generating tool, such as a hob or a gear shaper cutter.[1]

The most conventional steering arrangement is to turn the front wheels using a hand–operated steering wheel which is positioned in front of the driver, via the steering column, which may contain universal joints (which may also be part of the collapsible steering column design), to allow it to deviate somewhat from a straight line. Other arrangements are sometimes found on different types of vehicles, for example, a tiller or rear–wheel steering. Tracked vehicles such as bulldozers and tanks usually employ differential steering — that is, the tracks are made to move at different speeds or even in opposite directions, using clutches and brakes, to bring about a change of course or direction.

6.3 Basic geometry:

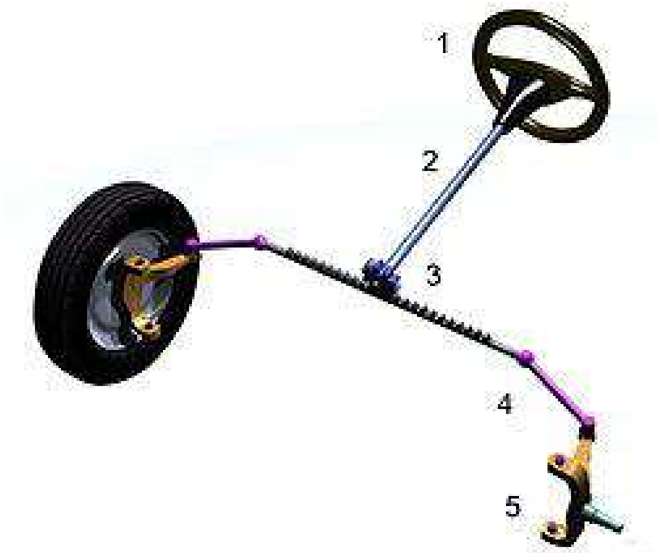


Caster angle θ indicates kingpin pivot line and gray area indicates vehicle's tire with the wheel moving from right to left. A positive caster angle aids in directional stability, as the wheel tends to trail, but a large angle makes steering more difficult.

Curves described by the rear wheels of a conventional automobile. While the vehicle moves with a constant speed its inner and outer rear wheels do not. The basic aim of steering is to ensure that the wheels are pointing in the desired directions. This is typically achieved by a series of linkages, rods, pivots and gears. One of the fundamental concepts is that of *caster angle* – each wheel is steered with a pivot point ahead of the wheel; this makes the steering tend to be self-centering towards the direction of travel. The steering linkages connecting the steering box and the wheels usually conforms to a variation of Ackermann steering geometry, to account for the fact that in a turn, the inner wheel is actually travelling a path of smaller radius than the outer wheel, so that the degree of toe suitable for driving in a straight path is not suitable for turns. The angle the wheels make with the vertical plane also influences steering dynamics (see *camber angle*) as do the tires. Rack and pinion unit mounted in the cockpit of an Ariel Atom sports car chassis. For most high volume production, this is usually mounted on the other side of this panel Steering box of a motor vehicle, the traditional (non-assisted), you may notice that the system allows you to adjust the braking and steering systems; you can also see the attachment system to the frame. Many modern cars use rack and pinion steering mechanisms, where the steering wheel turns the pinion gear; the pinion moves the rack, which is a linear gear that meshes with the pinion, converting circular motion into linear motion along the transverse axis of the car (side to side motion). This motion applies steering torque to the swivel pin ball joints that replaced previously used kingpins of the stub axle of the steered wheels via tie rods and a short lever arm called the steering arm. The rack and pinion design has the advantages of a large degree of feedback and direct steering "feel". A disadvantage is that it is not adjustable, so that when it does wear and develop lash, the only cure is replacement. Older designs often use the recirculating ball mechanism, which is still found on trucks and utility vehicles. This is a variation on the older worm and sector design; the steering column turns a large screw (the "worm gear") which meshes with a sector of a gear, causing it to rotate about its axis as the worm gear is turned; an arm attached to the axis of the sector moves the Pitman arm, which is connected to the steering linkage and thus steers the wheels.

The recirculation ball version of this apparatus reduces the considerable friction by placing large ball bearings between the teeth of the worm and those of the screw; at either end of the apparatus the balls exit from between the two pieces into a channel internal to the box which connects them with the other end of the apparatus, thus they are "recirculated".

Rack and pinion, recirculation ball, worm and sector:



The recirculating ball mechanism has the advantage of a much greater mechanical advantage, so that it was found on larger, heavier vehicles while the rack and pinion was originally limited to smaller and lighter ones; due to the almost universal adoption of power steering, however, this is no longer an important advantage, leading to the increasing use of rack and pinion on newer cars. The recirculating ball design also has a perceptible lash, or "dead spot" on center, where a minute turn of the steering wheel in either direction does not move the steering apparatus; this is easily adjustable via a screw on the end of the steering box to account for wear, but it cannot be entirely eliminated because it will create excessive internal forces at other positions and the mechanism will wear very rapidly. This design is still in use in trucks and other large vehicles, where rapidity of steering and direct feel are less important than robustness, maintainability, and mechanical advantage. The worm and sector was an older design, used for example in Willys and Chrysler vehicles, and the Ford Falcon (1960s). Other systems for steering exist, but are uncommon on road vehicles. Children's toys and go-karts often use a very direct linkage in the form of a bellcrank (also commonly known as a Pitman arm) attached directly between the steering column and the steering arms, and the use of cable-operated steering linkages (e.g. the Capstan and Bowstring mechanism) is also found on some home-built vehicles such as soapbox cars and recumbent tricycles. **Steering ratio** refers to the ratio between the turn of the steering wheel (in degrees) or handlebars and the turn of the wheels (in degrees). The steering ratio, is the amount of degrees you have to turn the steering wheel, for the wheels to turn an amount of degrees. In motorcycles and bicycles, the steering ratio is always 1:1, because the steering wheel will always follow the wheel. x:y means that you have turn the steering wheel x degree(s), for the wheel(s) to turn y degree(s). In most passenger cars, the ratio is between 12:1 and 20:1. **Example:** If one complete turn of the steering wheel, 360 degrees, causes the wheels to turn 24 degrees, the ratio is then 360:24 = 15:1 (360/24=15). A higher steering ratio means that you have to turn the steering wheel more, to get the wheels turning, but it will be easier to turn the steering wheel. A lower steering ratio means that you have to turn the steering wheel less, to get the wheels turning, but it will be harder to turn the steering wheel. Larger and heavier vehicles will often have a higher steering ratio, which will make the steering wheel easier to turn. If a truck had a low steering ratio, it would be very hard to turn the steering wheel. In normal and lighter cars, the wheels become easier to turn, so the steering ratio doesn't have to be as high. In race cars the ratio becomes extremely low, because you want the vehicle to respond a lot quicker than in normal cars. The steering wheel will also become a lot harder to turn.

6.4 Variable-ratio steering:

Variable-ratio steering is a system that uses different ratios on the ball, in a rack and pinion steering system. At the center of the rack, the space between the teeth is smaller and the space becomes larger as the pinion moves down the rack. In the middle of the rack you'll have a higher ratio and the ratio becomes lower as you turn the steering wheel towards lock.

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This makes the steering less sensitive when the steering wheel is close to its center position, but makes it harder for the driver to over steer at high speeds. As you turn the steering wheel towards lock, the wheels begin to react more to your steering input.

6.5 Steering Quickened:

A steering quickened is used to modify the steering ratio of factory installed steering system, which in turn modifies the response time and overall handling of vehicle. When a steering quickened is employed in an automobile, the driver of the automobile can turn the steering wheel a smaller degree when compared to a factory-installed steering system without a steering quickened, to turn the vehicle through same distance.

Alternate definition:

Another use of the term **steering ratio** is for the ratio between the theoretical turning radius based on ideal tire behavior and the actual turning radius based on real tire behavior.] Values less than one, where the front wheel side slip is greater than the rear wheel side slip, are described as under-steering; equal to one as neutral steering; and greater than one as over-steering. Values less than zero, in which the front wheel must be turned opposite the direction of the curve due to much greater rear wheel side slip than front wheel, have been described as counter-steering. Originally, with the 'turntable' steering of horse-drawn wagons, this was a single pin on which the moveable axle was pivoted beneath the wagon's frame. This located the axle from side to side, but the weight of the wagon was carried on a circular wooden ring turntable surrounding this. Similar centre pivot steering was used by steam traction engines, the kingpin being mounted on the 'perch bracket' beneath the boiler. Some early cars also used centre pivot steering, although it became apparent that it was unsuitable for their increasing speeds.

Ackermann steering separates the steering movement into two pivots, one near the hub of each front wheel. The beam axle between them remains fixed relative to the chassis, linked by the suspension. Ackermann steering has the two advantages that it reduces tyre scrub, the need to drag tyres sideways across their tread when turning the steering, and also it reduced bump steer, suspension and road bumps tending to upset the steering direction. The kingpins were now fixed to the axle ends and the hub carriers pivoted upon them. Most commonly the centre of the kingpin was fixed in the axle and the hub carrier was forked to fit over this, but some vehicles, including the Ford Model T illustrated, used a forked axle and a kingpin fixed into a single piece carrier. Kingpins were always clamped in the centre and the swivel bearings at the ends, to increase the lever arm and so reduce the bearing load. Independent front suspension developed through the 1930s, for high-performance cars at least, often using double wishbone suspension. This performance also encouraged the reduction of unsprung weight. Rather than using separate pivots for both the up-and-down motion of the suspension and the steering swivel, the use of a spherical ball joint that could move in two degrees of freedom allowed the same joint to carry out both functions. The hub carrier extended vertically to span the ends of both wishbones, with a ball joint at each end. In the 1950s and 1960s, such independent suspension became commonplace through light cars in all price ranges. Although the kingpin was no longer an identifiable physical component, suspension geometry was still designed in terms of a virtual kingpin along a line between the ball joint centers. Although they are largely obsolete, kingpin suspensions have the advantage of being able to carry much heavier weights, which is why they are still featured on some heavy trucks. Dana produced the king pin version of the D60 axle until 1991. (The functionally analogous, similar looking and very robust joint between the chassis and boom on a backhoe is however referred to as a king post. The nipple at the front of a semi-trailer to connect to a fifth wheel coupling on a tractor unit is also known as a kingpin, which usage is analogous to the original horse-drawn wagon and traction engine steering use.

6.6 Kingpin inclination:

On most modern designs, the kingpin is set at an angle relative to the true vertical line, as viewed from the front or back of the vehicle. This is the kingpin inclination or KPI (also called steering axis inclination, or SAI).SAI is non-adjustable, since it would change only if the wheel spindle or steering knuckles are bent. This has an important effect on the steering, making it tend to return to the straight ahead or centre position. This is because the straight ahead position is where the wheel is at its highest point relative to the suspended body of the vehicle - the weight of the vehicle tends to return the kingpin to this position. A second effect of the kingpin inclination is to set the scrub radius of the steered wheel. This is the offset between the tyre's contact point with the road surface and the projected axis of the steering down through the kingpin. If these points coincide, the scrub radius is zero. Zero scrub radius is possible without an inclined kingpin, but requires a deeply dished wheel so that the kingpin is at the centerline of the wheel. It is much more practical to incline the kingpin and use a less dished wheel, which also gives the self-centering effect. Zero scrub radius is not necessarily desirable - larger scrub radii lead to less steering effort (especially on vehicles without power steering), but more force applied to the steering components by road surface imperfections, braking, etc. Zero scrub radius isolates the steering from these effects but can lead to a "dead" feel for the driver which is undesirable, especially on performance vehicles. In automotive engineering, toe, also known as tracking, is the symmetric angle that each wheel makes with the longitudinal axis of the vehicle, as a function of static geometry, and kinematic and compliant effects.

This can be contrasted with steer, which is the ant symmetric angle, i.e. both wheels point to the left or right, in parallel (roughly). Positive toe, or toe in, is the front of the wheel pointing in towards the centerline of the vehicle. Negative toe, or toe out, is the front of the wheel pointing away from the centerline of the vehicle Toe can be measured in linear units, at the front of the tire, or as an angular deflection. In a rear wheel drive car, increased front toe in provides greater straight-line stability at the cost of some sluggishness of turning response. The wear on the tires is marginally increased as the tires are under slight side slip conditions. On front wheel drive cars, the situation is more complex. Toe is always adjustable in production automobiles, even though caster angle and camber angle are often not adjustable. Maintenance of front end alignment, which used to involve all three adjustments, currently involves only setting the toe; in most cases, even for a car in which caster or camber are adjustable, only the toe will need adjustment. One related concept is that the proper toe for straight line travel of a vehicle will not be correct while turning, since the inside wheel must travel around a smaller radius than the outside wheel; to compensate for this, the steering linkage typically conforms more or less to Ackermann steering geometry, modified to suit the characteristics of the individual vehicle.

DESCRIPTION OF VARIOUS PARTS:

- RACK AND PINION
- WHEEL AND AXLE
- STEERING WHELL
- JOINT AND LINKAGES

7.2 RACK AND PINION:

A **rack and pinion** is a type of linear actuator that comprises a pair of gears which convert rotational motion into linear motion. A circular gear called "the pinion" engages teeth on a linear "gear" bar called "the rack"; rotational motion applied to the pinion causes the rack to move, thereby translating the rotational motion of the pinion into the linear motion of the rack. For example, in a rack railway, the rotation of a pinion mounted on a locomotive or a railcar engages a rack between the rails and forces a train up a steep slope. For every pair of conjugate involute profile, there is a basic rack. This basic rack is the profile of the conjugate gear of infinite pitch radius I.e. a toothed straight edge. A generating rack is a rack outline used to indicate tooth details and dimensions for the design of a generating tool, such as a hob or a gear shaper cutter.

Applications:

Rack and pinion combinations are often used as part of a simple linear actuator, where the rotation of a shaft powered by hand or by a motor is converted to linear motion. The rack carries the full load of the actuator directly and so the driving pinion is usually small, so that the gear ratio reduces the torque required. This force, thus torque, may still be substantial and so it is common for there to be a reduction gear immediately before this by either a gear or worm gear reduction.

Steering:

A rack and pinion is commonly found in the steering mechanism of cars or other wheeled, steered vehicles. Rack and pinion provides a less efficient mechanical advantage than other mechanisms such as recirculating ball, but less backlash and greater feedback, or steering "feel". The mechanism may be power-assisted, usually by hydraulic or electrical means. The use of a variable rack (still using a normal pinion) was invented by Arthur Ernest Bishop, in the 1970s, so as to improve vehicle response and steering "feel," especially at high speeds. He also created a low cost press forging process to manufacture the racks, eliminating the need to machine the gear teeth.

Rack railways:

Rack railways are mountain railways that use a rack built into the centre of the track and a pinion on their locomotives. This allows them to work on steep gradients, up to 1 in 2 (50%), far in excess of those a conventional railway relying on friction can achieve. Although the extra grip of the rack system is obviously important for climbing, it has perhaps a more important use in also allowing controlled braking on these steep lines and for being much less affected by snow or ice on the rails.

Actuators:

A rack and pinion with two racks and one pinion is used in actuators. An example is pneumatic rack and pinion actuators that can be used to control valves in pipeline transport. The actuators in the picture on the right are used to control the valves of large water pipeline. In the top actuator, a gray control signal line can be seen connecting to a solenoid valve (the small black box attached to the back of the top actuator), which is used as the pilot for the actuator. The solenoid valve controls the air pressure coming from the input air line (the small green tube). The output air from the solenoid valve is fed to the chamber in the middle of the actuator, increasing the pressure. The pressure in the actuator's chamber pushes the pistons away.

While the pistons are moving apart from each other, the attached racks are also moved along the pistons in the opposite directions of the two racks. The two racks are meshed to a pinion at the direct opposite teeth of the pinion. When the two racks move, the pinion is turned, causing the attached main valve of the water pipe to turn.

7.3 STEERING WHEEL:

A **steering wheel** (also called a **driving wheel** or a **hand wheel**) is a type of steering control in vehicles and vessels (ships and boats). Steering wheels are used in most modern land vehicles, including all mass-production automobiles, as well as busses, light and heavy trucks, and tractors. The steering wheel is the part of the steering system that is manipulated by the driver; the rest of the steering system responds to such driver inputs. This can be through direct mechanical contact as in recirculating ball or rack and pinion steering gears, without or with the assistance of hydraulic power steering, HPS, or as in some modern production cars with the assistance of computer controlled motors, known as Electric Power Steering.

Steering wheels for passenger automobiles are generally circular, and are mounted to the steering column by a hub connected to the outer ring of the steering wheel by one or more spokes (single spoke wheels being a rather rare exception). Other types of vehicles may use the circular design, a butterfly shape, or some other shape. In countries where cars must drive on the left side of the road, the steering wheel is typically on the right side of the car (right-hand drive or RHD); the converse applies in countries where cars drive on the right side of the road (left-hand drive or LHD).

Adjustable steering wheels:

The original Tilt Wheel was developed by Edward James Lobdell in the early 1900s. The seven positions Tilt Wheel was made available in several General Motors products in 1963. Originally a luxury option on cars, the **tilt** function helps to adjust the steering wheel by moving the wheel through an arc in an up and down motion. Tilt Steering Wheels rely upon a ratchet joint located in the steering column just below the steering wheel. By disengaging the ratchet lock, the wheel can be adjusted upward or downward while the steering column remains stationary below the joint. Some designs place the pivot slightly forward along the column, allowing for a fair amount of vertical movement of the steering wheel with little actual tilt, while other designs place the pivot almost inside the steering wheel, allowing adjustment of the angle of the steering wheel with almost no change it its height. The "tilt wheels" were supplied to the other automakers (except to Ford) by GM's Saginaw Division. Developed by General Motors Saginaw Steering Gear Division (now Nexteer Automotive), the telescoping wheel can be adjusted to an infinite number of positions in a 3-inch range. The 1955-1957 Ford Thunderbird had a telescoping steering wheel. The Tilt *and* Telescope steering wheel was introduced as an exclusive option on Cadillac automobiles in 1965.

Adjustable steering column:

In contrast, an adjustable steering column allows steering wheel height to be adjusted with only a small, useful change in tilt. Most of these systems work with compression locks or electric motors instead of ratchet mechanisms; the latter may be capable of moving to a memorized position when a given driver uses the car, or of moving up and forward for entry or exit.

7.4 WHEELANDAXLE:

A **wheel** is a circular component that is intended to rotate on an axial bearing. The wheel is one of the main components of the wheel and axle which is one of the six simple machines. Wheels, in conjunction with axles, allow heavy objects to be moved easily facilitating movement or transportation while supporting a load, or performing labor in machines. Wheels are also used for other purposes, such as a ship's wheel, steering wheel, potter's wheel and flywheel.

Common examples are found in transport applications. A wheel greatly reduces friction by facilitating motion by rolling together with the use of axles. In order for wheels to rotate, a moment needs to be applied to the wheel about its axis, either by way of gravity, or by the application of another external force or torque.

Mechanics and function:

The wheel is a device that enables efficient movement of an object across a surface where there is a force pressing the object to the surface. Common examples are a cart pulled by a horse, and the rollers on an aircraft flap mechanism. Wheels are used in conjunction with axles; either the wheel turns on the axle, or the axle turns in the object body. The mechanics are the same in either case.

The low resistance to motion (compared to dragging) is explained as follows (refer to friction):

- The normal force at the sliding interface is the same.
- The sliding distance is reduced for a given distance of travel.
- The coefficient of friction at the interface is usually lower.

CALCULATION:

Example:

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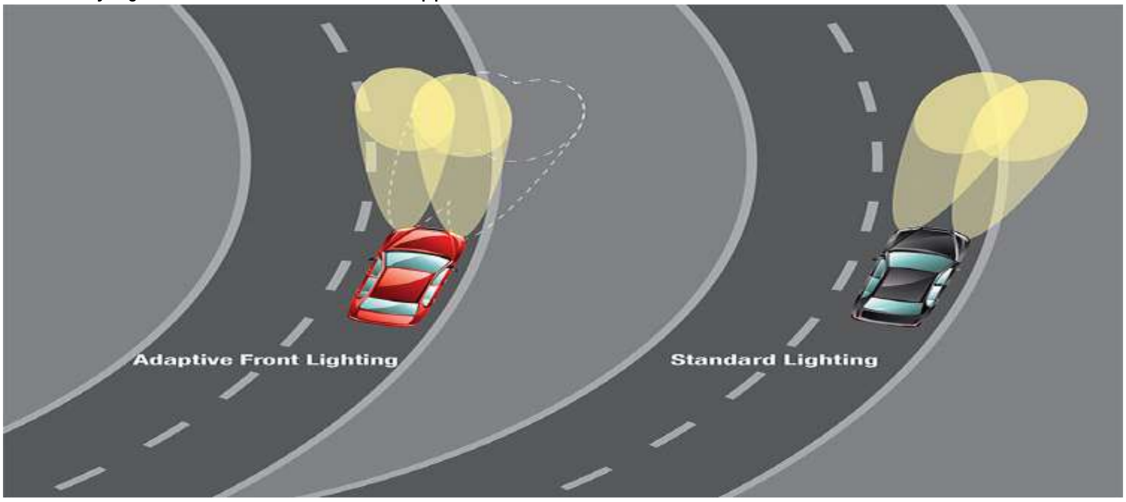
- If a 100 kg object is dragged for 10 m along a surface with the coefficient of friction $\mu = 0.5$, the normal force is 981 N and the work done (required energy) is (work=force x distance) 981 × 0.5 × 10 = 4905 joules.
- Now give the object 4 wheels. The normal force between the 4 wheels and axles is the same (in total) 981 N. Assume, for wood, $\mu = 0.25$, and say the wheel diameter is 1000 mm and axle diameter is 50 mm. So while the object still moves 10 m the sliding frictional surfaces only slide over each other a distance of 0.5 m. The work done is 981 × 0.25 × 0.5 = 123 joules; the work done has reduced to 1/40 of that of dragging.

Additional energy is lost from the wheel-to-road interface. This is termed rolling resistance which is predominantly a deformation loss. This energy is also lowered by the use of a wheel (in comparison to dragging) because the net force on the contact point between the road and the wheel is almost perpendicular to the ground, and hence, generates an almost zero net work. This depends on the nature of the ground, of the material of the wheel, its inflation in the case of a tire, the net torque exerted by the eventual engine, and many other factors. A wheel can also offer advantages in traversing irregular surfaces if the wheel radius is sufficiently large compared to the irregularities. The wheel alone is not a machine, but when attached to an axle in conjunction with bearing, it forms the wheel and axle, one of the simple machines. A driven wheel is an example of a wheel and axle. Note that wheels pre-date driven wheels by about 6000 years, themselves an evolution of using round logs as rollers to move a heavy load—a practice going back in pre-history so far, it has not been

8.1 EXPERIMENTAL PROCEDURES:

Adaptive front-lighting system means a lighting device, providing beams with differing characteristics for automatic adaptation to varying conditions of use of the dipped-beam.



If it applies, the main-beam (driving beam) with a minimum functional content as indicated in paragraph such systems consist of the system control supply and operating device. If any and the installation units of the right and of the left side of the vehicle To achieve a crucial advance for optimal visibility conditions in darkness, a new kind of system is under development. Besides the adaptive front lighting system distributions, the illumination can be adapted to the particular traffic situation and the road topography. The system adjusts the extent of the illumination by raising and lowering the cutoff line, which is the horizontal limitation of the illumination of the road in front of the car It is characterized by a high gradient, meaning that the luminance on the road in the far distance has to be very high, but above the horizon (where the oncoming traffic has a view of the approaching cars), it must be close to zero. This enables a significantly higher reach of illumination than that of the standard low beam. Thus, the driver obtains the optimum field of view in any situation.

8.2 TOOL COMPOSITION:

SQUARE CLAMP:

It is basically u in shape .in this adaptive forward light system u clamps are fixed and the doom are movable to wheels direction. Square clamp are typically made of steel or cast iron, though smaller clamps may be made of pot metal. At the top of the "square clamp" is usually a small flat edge.

At the bottom is a threaded hole through which a large threaded screw protrudes. One end of this screw contains a flat edge of similar size to the one at the top of the frame, and the other end usually a small metal bar, perpendicular to the screw itself, which is used to gain leverage when tightening the clamp.

When the clamp is completely closed, the flat end of the screw is in contact with the flat end on the frame. When the clamp is actually used, it is very rare that this occurs. Generally some other object or objects will be contained between the top and bottom flat edges

BI-XENEON:

It is xenon laser lamp which is controlled to pass over the distance programmed it is mainly used in automobile vehicles

High-intensity discharge lamps (HID) produce light with an electric arc rather than a glowing filament. The high intensity of the arc comes from metallic salts that are vaporized within the arc chamber. These lamps are formally known as *gas-discharge burners* and have a higher efficacy than tungsten lamps. Because of the increased amounts of light available from HID burners relative to halogen bulbs, HID headlamps producing a given beam pattern can be made smaller than halogen headlamps producing a comparable beam pattern. Alternatively, the larger size can be retained, in which case the xenon headlamp can produce a more robust beam pattern Automotive HID may be called "xenon headlamps", though they are actually metal-halide lamps that contain xenon gas. The xenon gas allows the lamps to produce minimally adequate light immediately upon start, and shortens the run-up time. The usage of argon, as is commonly done in street lights and other stationary metal-halide lamp applications, causes lamps to take several minutes to reach their full output. The light from HID headlamps can exhibit a distinct bluish tint when compared with tungsten-filament headlamps, although a range of spectra are available commonly specified as a Colour Temperature.

LED:

LEDs require less than one-third the energy to provide an equivalent level of light compared with incandescent light sources, so the energy savings is evident from the start. Most luxury vehicles today are using LEDs for some of their rear lighting functions, but the steady reduction in the cost of LEDs and the availability of even higher output versions could provide major energy savings for a vehicle if used in all exterior lighting application. It emits the light source in narrow path of wide reach.

The technology involved in this approach is a formidable challenge. Because of the dynamics in the traffic area in front of the vehicle with many light sources to be considered simultaneously, electromechanical and mechanical systems are not suitable for this function. The amount of mechanical movable parts and the requested speed and cycles for movement will not fit in most systems. Because LEDs use no mechanical elements and are small and robust, the current technological approach works well with individual LEDs as well as arrays arranged in a pattern.

FUTURE OF ADAPTIVE SYSTEM:

- Despite the fact that the optical performance of novel headlight systems for motor vehicles has increased impressively in recent years, nighttime driving is still loaded with risks. In Europe, for example, 47 percent of all fatalities happen at night, even thoughonly 25 percent of all driving is done then. For pedestrians, the risk of being killed in an accident at night is even higher. A study conducted at the University of Michigan Transportation Research Institute in 2001 showed that the probability of pedestrian accidents occurring in the dark was a factor of 4.14 higher than it was in daylight.
- The goal is to provide sufficient low-beam lighting while avoiding glare for the oncoming traffic. To increase the safety level, the challenge for designers is to adapt optical parameters and characteristics of headlight systems for various traffic and environmental condition
- Given the rate of accidents at night it is clear that the future of adaptive lights is bright. In the future there will be more integration between the systems onboard the vehicle e.g. adaptive cruise control systems could work with anti glare adaptive headlights to set the distance between two vehicles to provide ample braking distance and minimum glare to the front vehicle.
- But in addition to aforementioned systems some new systems can be seen on the horizon. Systems such as active night vision systems, using near to infrared (NIR) sensors and light sources. Such systems will not only benefit the driver in darkness but also in bad weather. One great benefit for adaptive lights and active safety systems in general would be if standardizing organizations would start to look at, and grade active safety systems with passive safety systems. Since today the only vehicles equipped with these systems are primarily luxury vehicles.

RESULTS AND DISCUSSION:

- It is estimated that AFL can support the driver in avoiding more than 15 percent of serious accidents within a curve occurring at night in Europe.
- The analysis excluded those night-time accidents where alcohol was a contributory factor.
- AFL is intended to provide more time for the driver to react to possible dangers ahead by better lighting.
- When fitted to all cars on the roads it is expected that nearly 1,000 severely injured or fatal accidents could have been prevented.

CONCLUSION:

The gains from adaptive headlights could in theory be considerable seeing that so many crashes happen during night time driving. According to the IIHS some 142.000 crashes or accidents could have been avoided or mitigated with the use of adaptive headlights, furthermore about 2500 fatalities could have been avoided with the system. To evaluate the robustness of the system and control algorithms used in adaptive headlamps several tests have been done. It is shown that the system currently used by OEMs can be considered robust. Also some testing and simulation has been done to improve image sensors and detection algorithm used.

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