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Reverse Braking System In Automobiles

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ABSTRACT

The project consists of braking system that constraint the reverse motion of a vehicle. The ratchet is keyed over the rotating shaft. A push button provided in drivers operating range which controls the pawl's to and fro motion which is mounted over the ratchet through the actuator which ultimately stop the reverse motion of vehicle by engaging and disengaging the pawl.

***Keywords* : Rotating Ratchet, Pawl, Live axle.**

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I. INTRODUCTION

A vehicle while on an upward slope, experiences a gravitational force towards the reverse side. While the vehicle is stationary and when not subject to an active break mechanism or forward acceleration, it experiences an almost instant pull in the reverse direction and may undergo a downward fall by releasing potential energy.This is a common problem faced by all vehicle users and causes considerable inconvenience to them while ensuring the safe mobility of the vehicles. On certain occasions the undesirable reverse movement may even cause accidents and damage to life or property. To overcome this problem, certain anti-reverse mechanisms have been introduced and implemented in vehicle, more particularly in light motor vehicles. However, the electronic mechanisms are expensive, involve excessive number of components and are dependent on electronic devices and sensors.The present invention in its various embodiments, aims to address the above drawbacks and requirements, and provide effective systems and methods to prevent a vehicle from reverse movement in a slope.

II. BACKGROUND OF THE INVENTION

Brake is the indispensable part of automobile vehicle without which the automobile vehicle is incomplete. It also acts as safety device to the vehicle to control its unwanted motion.But when the brakes are apply all the wheels of the vehicle gets locked the vehicle will not be able to move in forward as well as in the reverse direction. This is considerable only when our intention is to stop the vehicle but when moving on gradient roads such as Ghatsthat time the reverse motion is to constraint to provide safe ride to driver as well as to other vehicles on the roads.So to overcome the problem associated with the brake. It locks all the four wheels of the vehicle, we have design such a concept that it will allow the motion in forward direction only thereby constraining the reverse motion of the vehicle. The concept consists of Ratchet and Pawl mechanism. This mechanism will be mounted on rear side of the vehicle such that the ratchet will have the drive with the rear wheels of the vehicle.

III.COMPONENTS

Ratchet and Pawl

A ratchet consists of a round gear or linear rack with teeth, and a pivoting, spring loaded finger called a ***pawl*** that engages the teeth. The teeth are uniform but asymmetrical with each tooth having a moderate slope on one edge and a much steeper slope on the other edge.When the teeth are moving in the unrestricted (i.e., forward) direction the pawl easily slides up and over the gently sloped edges of the teeth, with a spring forcing it (often with an audible 'click') into the depression between the teeth as it passes the tip of each tooth. When the teeth move in the opposite (backward) direction, however, the pawl will catch against the steeply sloped edge of the first tooth it encounters, thereby locking it against the tooth and preventing any further motion in that direction.

Actuators

A linear actuator is an actuator that creates motion in a straight line, in contrast to the circular motion of a conventional electric motor. Linear actuators are used in machine tools and industrial machinery, in computer peripherals such as disk drives and printers, in valves and dampers, and in many other places where linear motion is required. Hydraulic or pneumatic cylinders inherently produce linear motion. Many other mechanisms are used to generate linear motion from a rotating motor.

Electro Mechanical Actuator

Electro-mechanical actuators are similar to mechanical actuators except that the control knob or handle is replaced with an electric motor. Rotary motion of the motor is converted to linear displacement. There are many designs of modern linear actuators and every company that manufactures them tends to have a proprietary method. The following is a generalized description of a very simple electro-mechanical linear actuator.

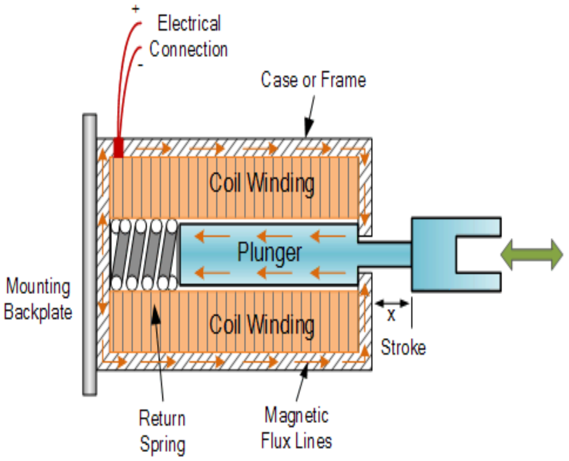

Fig.1. Electro Mechanical Actuator

IV. WORKING

Mechanism consists of **Ratchet and Pawl** arrangement which will be mounted on the rear axle of the vehicles or any other location which will have the drive along with the motion of the wheel. One push button will be mounted on steering wheel or dashboard which will be operated by the driver on choice. On pushing the button the pawl will came in engage position with the ratchet and will constraint the reverse motion of the vehicle.

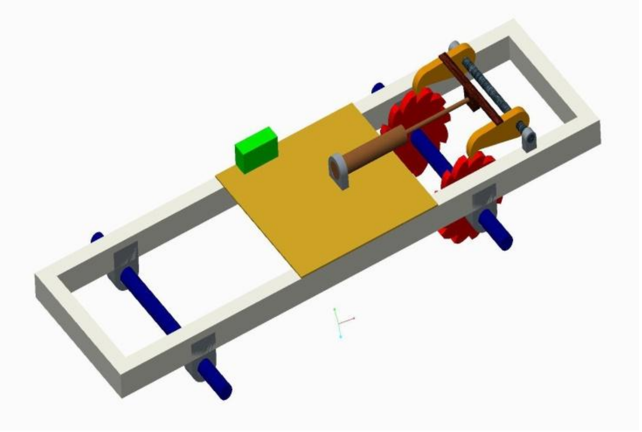
Fig.2. CAD diagram of actual working

The above shown is the CAD diagram of the mechanism. The working of the mechanism can be clearly understood from the diagram. The Ratchet (shown in red colour) is mounted on rear axle of the vehicle. The Pawl (shown in orange colour) is just above the Ratchet will be engaged and disengaged with the Ratchet with the help of linear actuator as shown in the figure. The electric supply to the actuators will be given with the help of 12V DC battery, due to this the actuator will be reciprocated in and out. The output of the actuators is connected to the common link from the two Pawls.

When outlet shaft of the actuator say moves inward, the pawl will rise ie disengagement will take place and the vehicle will be able to move in both the directions viz forward and reverse direction. Now exactly opposite to this when outlet of the actuators will move outward and the pawl will fall and engagement will take place. Now the reverse motion of the vehicle will be constraint ie now the vehicle will not move in the reverse direction it will only move in forward direction. N this way engagement and disengagement of Ratchet and Pawl will take place with the help of push button provided on the steering wheel of the vehicle.

V. DESIGN CALCULATIONS

$P=W\times9.81\times\cos45$
$=30{,}000\times9.81\times\cos45$
$=208.1015\times10^3$ N
Considering 4 Ratchet and 4 Pawl

$P=208.1015\times10^3/(4\times4)$
$P= 13.0063\times10^3$

Transmitting Torque

$T= P\times C.G$
$= 13.0063\times10^3\times1000$
$T= 13.0063\times10^6$ N-mm
Now, Assuming

No of teeth (z)= 22
$\Psi(b/m)$ = 05
Material, C45 = 600 N/mm2

Design Bending Stress

$\sigma b = Sut/3$
$= 600/3$
$= 200\ N/mm2$

Now, Calculate Module

$m = 2\times\sqrt{(t)/(z\times\psi\times\sigma b)}$

$= 2\times\sqrt{(13.0063\times10^6)/(22\times5\times200)}$

$= 16.78 = 17$

$D = m \times z$
$= 17 \times 22$
$= 374\ mm$

For Ratchet Wheel

Thickness (t) = 37.70mm
Height (h =19mm
Nose Radius (r) = 1.5mm
Side Thrust (a) = 12mm
Face Width (b) (ψ×m) = 60mmm

[From Design Data Book – Page No. 7.85]

For Pawl = 12mm
Height (h1) = 24mm
Thickness (a1) = 50mm
Diameter of Pin (d) = 50mm

[From Design Data Book for Module 12, Pg No. 7.86]

Checking,

$Mb1 = Pe1$
$e1 = 19mm$

P= Peripheral Force
$= 2\times Mt/Zm$
$= 72{,}250\ N$

$Mb1 = 650.25\times10^3\ N\text{-}mm$

$\sigma = \sigma.Mb1/bx2 + P/xb \leq [\ \sigma\ ]$

$\sigma = (6\times650.25\times10^3)/(60\times30^2) + 72250 / 30\times60$

$= 72.25+40.1388$

$= 112.388 < 200$

Hence, The design is Safe.

Diameter of the Pawl Pin

$d = 2.71\times\sqrt{(P/2.\sigma b)}\times((b/2)+a)$

$= 2.71\times\sqrt{(72.250/2\times200)}((60/2)+6)$

$d = 50.58mm$

VI.EXPECTED OUTCOME

The major consideration while doing this project is safety of human and nothing is important in front of human life. This mechanism is user-friendly. And in our market survey we came to know that no any industry is manufacturing such mechanism for low budget vehicles which is very shocking. On one hand Government in giving more emphasis on vehicle safety measures but till most of them are neglecting the safety measures.

Also the engagement-disengagement can be done by providing the sensors to the actuators which will sense the gradient roads and speed of the vehicles and accordingly engagement will take place.

VII. CONCLUSION

It is our privilege to express deep gratitude to everyone who has rendered valuable help in presenting this project work. We have conclude that our design of mechanism is safe under the different loading conditions and ensures the full safety and comfort to the driver.

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