DESIGN AND FABRICATION OF THEFT PROOF VEHICLE USING BRAKE SYSTEM

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Abstract

The rate of car robbery are being increased rapidly now a days and to avoid car theft a model is fabricated in car with the use of car braking system. When the owner from the vehicle locks the car the brakes are also locked by using additional key by which the brakes are applied on all 4 wheels and the movement of the car is fully arrested. When anyone car tries to break into car, the car does not move as its motion is fully locked and it cannot be tow also.In regular car braking system, there will be a tandem cylinder from which brake oil is applied in all four wheels through brake lines. In theft proofing braking system, T-joint is introduced on all four brake lines and by passed the brake oil to another tandem cylinder. So from that brake can be operated. The piston of another cylinder is pushed by using rack and pinion mechanism which is operated by electronic circuit.

Keywords- Brake oil, car theft, tandem cylinder, rack and pinion

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1. Introduction

Car theft is one of the strangest events of one's life. Thus, theft proofing your car is as important as purchasing one. The additional vehicular security systems to be perfectly installed are very important. When the car is parked and locked by the owner it should be in rest in all condition till the owner unlocks it. The brake is applied in all four wheels by using additional tandem cylinder. Normally the vehicle has tandem cylinder which is filled with brake oil is connected to all four wheels by using brake lines.

The secondary tandem cylinder is used in four wheel drive which is connected to the primary tandem cylinder by using T-joint and brake lines are bypassed to wheel of the vehicle. When the car is locked the brakes are also locked along with it, the piston of secondary cylinder pushes the oil which is applied in all four wheels when the vehicle is stationary. This is done by using rack and pinion mechanism which is connected with a motor. the electronic circuit is connected with the motor which rotates by using battery of the car it rotates pinion by the rack. The electronic device consists of two limit switches a DPDT switch and two key switches The unlocking is done by using key switch or remote controller.

2. Literature Review

From the journal published by Omkar Vaishampayan, Akshay ,Savio Pereira [1] had given brief explanation about the speed reduction in vehicle and it also give detail about braking system is to attain a reduction in speed of a vehicle to facilitate speed control and manuverability keeping in mind various constraints like cost, stopping distance, etc. Hence accurate calculation of braking force becomes a crucial design concern.

From the journal published by Praveen J. Reddaiah, Dr. G. Harinath Gowd, S. Praveen Kumar, V. Vishnuvardhan [2] on the topic of Design & Analysis of Master Cylinder of Hydraulic Braking System and it is published on June 2013, which explains about Master cylinder is a component of hydraulic braking system and it is just a simple piston inside a cylinder. Master cylinder is the key element of braking system which initiates and controls the braking action. A reservoir is attached to the master cylinder to store brake fluid.

From the journal on Research On New Automobile Power Hydraulic Braking System By Vibratory Energy [3] by explains concept of automobile power hydraulic braking system by vibratory energy is introduced which includes four vibration dampers, four energy accumulators, hydraulic booster, one storage

tank, four wheel cylinders, four electromagnetic one-way valves, brake master cylinder, vacuum booster, brake pedal and loading sensing pressure proportioning valve(LSPV). Vibration damper is composed of nitrogen cavity, piston, piston rod, shell, rebound valve, compression valve, inlet tube, outlet tube and so on. Energy accumulator contains relief valve and oil return tube. The electromagnetic one-way valves are controlled by brake pedal.

3. Design of braking system
3.1 Frame

A vehicle frame, also known as its chassis, is the main supporting structure of a motor vehicle to which all other components are attached, comparable to the skeleton of an organism. While appearing at first glance as a simple hunk of metal, frames encounter great amounts of stress and are built accordingly. The first issue addressed is beam height, or the height of the vertical side of a frame.
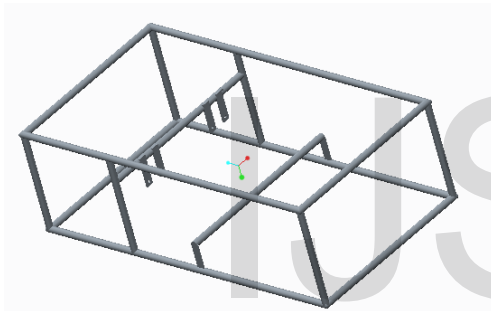

3.2 Tandem cylinder

The tandem cylinder is the start of the brake hydraulic system. It actually is a cylindrical pump. The cylinder is sealed at one end, and the movable pushrod extends from the other end . The pushrod moves a pair of in-line pistons that produce the pumping action. When the brake pedal lever moves the pushrod, it moves the pistons to draw fluid from a reservoir on top of the master cylinder. Piston action then forces the fluid under pressure through outlet ports to the brake lines. Motor vehicle safety standards require this dual-brake system to provide hydraulic system operation in case one hose, line, or wheel brake assembly loses fluid.

A - CAP
B - RESERVOIR
C - INLET VALVE
D - CYLINDER
E - OUTLET VALVE
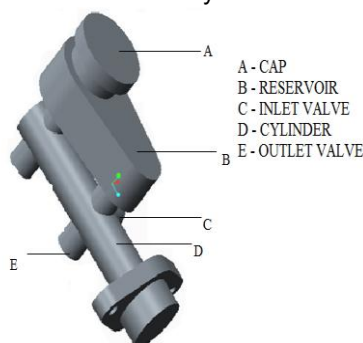
3.3 Disc and hub assembly

Wheel hub assembly also referred to as hub assembly, wheel hub unit, wheel hub bearing, etc., is an automotive part used in most cars, passenger vehicles and light and heavy trucks.It is located between the brake drums or discs and the drive axle. On the axle side, it is mounted to the holding bracket from the chassis; on the disc side, the wheel is mounted to the bolts of the wheel and hub. When replacing, a wheel hub assembly should be torque to the vehicle's specifications to prevent failure.
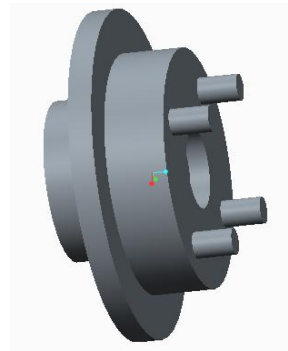
4. Calculation

Power, P = 180w

Speed of pinion, N = 70 rpm

No. of teeth in pinion, Z1 = 24

No. of teeth in rack,Z2 = 54

Diameter of pinion,d = 32 mm

Material = Mild steel

1. Calculation of tangential load (Ft)

$$Ft = \frac{P}{v} \times K0$$

$$V = \frac{\pi dNm}{60 \times 1000}$$
   = 0.117m m/s

Ko = steady shock = 1.2 (From PSG design data book)

Ft = 1843.003 / m

2. Calculation of initial dynamic load (Fd)

Fd = Ft / Cv

$Cv = 6 / (6+v)$ where v=12 m/s from PSG design data book

$= 0.33$

$Fd = 5584.85 / mss$

3. Calculation of beam strength (Fs)

$Fs = \pi mb\sigma by$

where σb = allowable static stress = 180 N/ mm2

b = face width = 10 mm

$y = 0.154 - 0.912/ Z1$ (From PSG design data book)

$Fs = 825.610 \ m2$

4. Calculation of module

$Fs \geq Fd$

$825.610 m2 \geq 5584.85 / m$

$m = 2$

5. Calculation of accurate dynamic load

$Fd = Ft + \frac{21v(bc+Ft)}{21v+\sqrt{(bc+Ft)}}$

$C = 11860e$

$e = 0.05$

$Ft = P/ v$

1.53

$Fd = 17206.36 \ N$

5. Methodology

5.1 Hydraulic brake

In a hydraulic brake system, when the brake pedal is pressed, a pushrod exerts force on the piston(s) in the master cylinder, causing fluid from the brake fluid reservoir to flow into a pressure chamber through a compensating port. This results in an increase in the pressure of the entire hydraulic system, forcing fluid through the hydraulic lines toward one or more calipers where it acts upon one or two caliper pistons sealed by one or more seated O-rings (which prevent leakage of the fluid).The brake caliper pistons then apply force to the brake pads, pushing them against the spinning rotor, and the friction between the pads and the rotor causes a braking torque to be generated, slowing the vehicle. Subsequent release of the brake pedal/lever allows the spring(s) in the master cylinder assembly to return the master piston(s) back into position

5.2 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. 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.
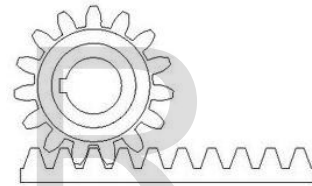

5.3 Dc motor

A DC motor is a electrical machines that converts direct current electrical power into mechanical power. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic to periodically change the direction of current flow in part of the motor. Most types produce rotary motion; a linear motor directly produces force and motion in a straight line. Different number of stator and armature fields as well as how they are connected provide different inherent speed/torque regulation characteristics. The speed of a DC motor can be controlled by changing the voltage applied to the armature.

5.4 **Limit switch**

Limit switch is a switch operated by the motion of a machine part or presence of an object. They are used for controlling machinery as part of a control system, as a safety interlocks, or to count objects passing a point. A limit switch is an electromechanical device that consists of an actuator mechanically linked to a set of contacts. When an object comes into contact with the actuator, the device operates the contacts to make or break an electrical connection .
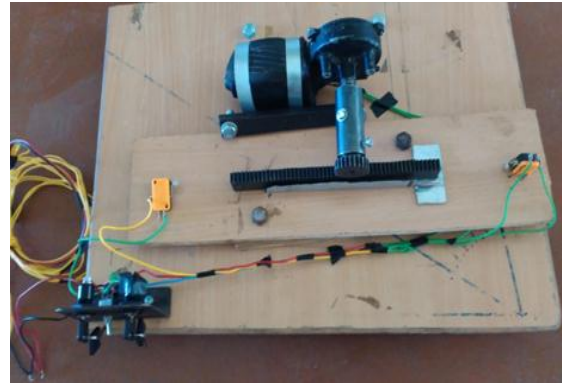
6. Conclusion

The braking system used in theft proof vehicle makes the car to safe in any condition when it is unlocked. The cars are robbed often and it makes discomfort to the car user to park in public places. It gives security to the car without any human work. This system provides user friendly and adds more safety from theft. The car cannot be towed without the knowledge of user.

> ➢ With the limits of our study, we have designed and fabricated the theft proof braking system with low cost.
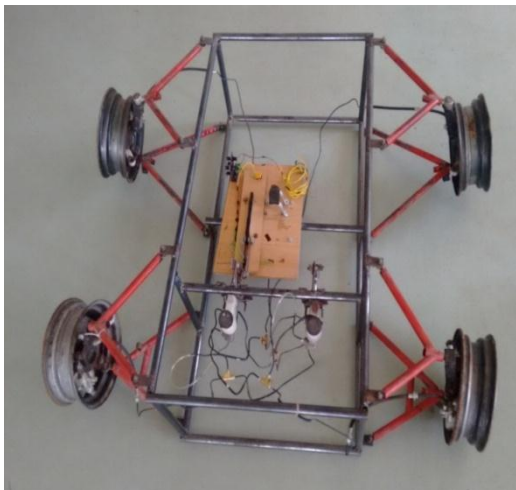
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