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Anti Roll System

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ABSTRACT

In the hill station, the most common problem to the drivers is to park their cars in the slope and to start up the car. While waiting in the traffic, the cars must move on step by step very slowly, this situation is a difficult one for the drivers to make their car not to roll back in the slope. So, the mechanism has to be developed to stop the vehicle from rolling back and it should not stop the vehicle in accelerating forwards. This function can be achieved by using the ratchet and pawl mechanism. We also used a pneumatic cylinder which is useful when we wanted to drive in reverse direction. The present invention provides a wheel braking torque sensor disposed within a wheel brake so that when the vehicle is accelerated and effects corresponding wheel braking torque changes within the brake, the change in torque is sensed and provides an input to either a solenoid connected with the mechanical brake control device or to the control circuit connected to the braking assistance servo-motor in order to effect operatively a release of the brakes from the applied position to a released position and permit movement of the vehicle.

Keywords : Ratchet, Pawl, Anti-Roll, Brake

I. INTRODUCTION

It's a situation that every driver is familiar with. You're driving your car up a hill and at the top of the incline is an intersection with a traffic light. The light is red and there are already two or three cars stopped in front of you. You ease down on the brake pedal and come to a stop behind them. Soon, another car pulls up just a few feet behind you. As the light turns green, you release the brake. If you're driving a manual transmission, you step on the clutch with your left foot and move your right foot to the accelerator pedal. At this point there's nothing stopping your car from rolling backward except the braking force of the engine, and if you're using a clutch even that force is gone. Gravity starts pulling you back down the hill, straight toward the bumper of the car behind you. What do you do? Do you panic and hit the brake? Do you let your car drift into the next car in line? Well, probably not. If you've been driving for any length of time, your reflexes take over. You simply step on the accelerator and gradually bring the engine up to speed. If you're driving a manual transmission,you press the accelerator as you simultaneously let up on the clutch. The car moves forward. Disaster averted.

system to improve the efficiency of the vehicle. The suspension system used for the regeneration of vibration energy is called regenerative suspension system. One of the important losses is the energy dissipation from the vibration of suspension system.

II. LITERATURE REVIEW

2.1 WORK DISCUSSION

In this paper the work for the system is described, in this paper the mechanism has been developed to stop the vehicle from rolling backwards when the vehicle is moving in the hill roads. Ratchet and Pawl mechanism has been identified to arrest the motion to the front axle. Anti-Roll Back mechanism has been fabricated and tested on the front axle assembly. The mechanism works well.

In this work, Ratchet and Pawl mechanism is identified to arrest the backward motion to the car. The ratchet is placed in the front drive shaft and the Pawl is fitted with the frame. When the vehicle is moved in the hill road, the lever has to make the pawl to touch the ratchet. If the vehicle tends to move backward direction, the pawl would stop the ratchet to move Counter Clock-wise direction with respect to front wheel.

As the vehicle is in neutral position, the pawl engaged the ratchet and the vehicle did not move in backward direction. So, the hand brakes need not to be applied. When the vehicle is in moving condition, the engagement between the ratchet and pawl is detached.

2.2.HISTORY OF HILL HOLDER-

Hill-Holder is a name for the mechanism invented by Wagner Electric and manufactured by Bendix Brake Company in South Bend, Indiana. Studebaker and many other carmakers offered the device as either optional or standard equipment for many years. It is a device that holds the brake until the clutch is at the friction point, making it easier to start up hills from a stop in manual transmission automobiles. It was first introduced in 1936 as an option for the Studebaker President. By 1937 the device, called "Noro" by Bendix, was available on Hudson, Nash, and many other cars. Another name for the mechanism is a hill hold control (HHC).

In layman's terms, the modern hill-holder function works by using two sensors, in concert with the brake system on the vehicle. The first sensor measures the forward-facing incline (nose higher than tail) of the vehicle, while the second is a disengaging mechanism. The 1930s-1950s Noro used a ball bearing as a check valve in the hydraulic brake line; when the car was on an uphill incline, the ball rolled back and blocked the brake line - when the car was level or facing downhill, the ball rolled away, leaving the line free. The clutch linkage slightly dislodged the ball when the clutch was released, enabling the car to move away from a stop.

III. CONSTRUCTION AND WORKING OF ANTI ROLL SYSTEM

In this work, Ratchet and Pawl mechanism is identified to arrest the backward motion to the car. The ratchet is placed in the front drive shaft and the Pawl is fitted with the frame. When the vehicle is moved in the hill road, the lever has to make the pawl to touch the ratchet. If the vehicle tends to move backward direction, the pawl would stop the ratchet to move Counter Clock-wise direction with respect to front wheel.

As the vehicle is in neutral position, the pawl engaged the ratchet and the vehicle did not move in backward direction. So, the hand brakes need not to be applied. When the vehicle is in moving condition, the engagement between the ratchet and pawl is detached. We also introducing the Push button operated Single acting cylinder. The single acting cylinder is useful when a driver wants to drive vehicle in the reverse direction. The pneumatic cylinder will move in forward direction and the linkages will move for predetermined direction. This will provide to ride in reverse direction too.

IV. DESIGN

4.1.1 DESIGN OF FRAME:

Material used –mild steel, square pipe

Area=1.5*1.5inch=38.1*.8.1=1451.61 mm2

Length of link=20 inch=508 mm

Weight of project=15 kg= 15*9.81 =147.15 N

1. Effective length

Effective length, when both end fixed,

$Le=\frac{L}{2}=\frac{508}{2}=254$ mm

2. Internal Area

Internal width and depth, which have 3 mm thickness,

d=b=38.1-2*3 =32.1 mm

3.Moment of inertia

I=$\frac{BD^3-bd^3}{12}$=$\frac{38.1*38.1^3-32.1*32.1^3}{12}$=**87118.902 mm4**

4. Crippling load by Euler's formula

Pc=$\frac{\pi^2 EI}{Le^2}$=$\frac{\pi^2*210*10^3*87.118*10\text{^}3}{254^2}$=

=2798.46 KN

4.1.1.2 FRAME DESIGN

Material used –mild steel, square pipe

Area=1.5*1.5inch=38.1*.8.1=1451.61 mm2

Length of link=30 inch=762mm

Weight of project=15 kg= 15*9.81 =147.15 N

Solution

1. Effective length

Effective length, when both end fixed,

Le=$\frac{L}{2}$=$\frac{762}{2}$=381 mm

2. Internal Area

Internal width and depth, which have 3 mm thickness,

d=b=38.1-2*3 =32.1 mm

3.Moment of inertia

I=$\frac{BD^3-bd^3}{12}$=$\frac{38.1*38.1^3-32.1*32.1^3}{12}$=**87118.902 mm4**

4. Crippling load by Euler's formula

Pc=$\frac{\pi^2 EI}{Le^2}$=$\frac{\pi^2*210*10^3*87.118*10\text{^}3}{381^2}$=

=**1243.875 KN**

Specifications of Double acting cylinder used -

Cylinder Bore: 25 mm

Stroke: 25 mm

Volume of air exhaust from piston and cylinder = Stroke × Area of Piston.

= 100 x (π/4 × D2)

= 12271.84 mm 3

Outward force of cylinder=pressure *area

=0.4*π/4*D2

=0.4*π/4*252

=196.34 N

Inward force of cylinder= pressure *area(effective)

=0.4*π/4*(D2-d2)

=0.4*π/4*(252-72)

=180N

4.1.2 DESIGN OF RATCHET AND PAWL

4.1.2.1 DESIGN OF RATCHET:

Max. torque transmitted M_t =20 kg-cm= 1.962

No of teeth Z=10

Ψ=b/m =2 (assume)

Max. Tensile strength=S_t=250 N/mm^2

Bending stress σ_b= S_t/2 =250/2 =125 N/mm^2

Solution

M= $\sqrt[3]{\frac{1.962}{z\psi\sigma b}}$

= $\sqrt[3]{\frac{20000}{10*2*125}}$

m=0.09224mm

but minimum value of module is 6 so that m=6 mm

a=m=6

h=0.75 m=0.75*6=4.5

b=ψm=2*6=12

D=Zm=10*6=60

P=$\frac{2Mt}{Zm}$=$\frac{2*1.962}{10*6}$

=0.0654

M_b=Ph=0.0654*4.5

=0.2943

4.1.2.2 DESIGN OF PAWL:

Mb1=Pe1

σ= $\frac{6Mb1}{bx*x}$+$\frac{P}{xb}$

=2.98*10^-3<56.25

Hence our design is safe

4.1.3 DESIGN OF SHAFT:

Data:

Shaft length=28"

M.S. Material used

Material properties,

Syt=460 N/mm^2

Sut=700 N/mm^2

Permissible shear stress,

0.3*syt=0.3*400=138 N/mm^2

0.18*Sut =0.18*700 =126 N/mm^2

τ =0.75*126=94.5 N/mm^2

chain velocity=v=(ZPN)/ (60*10^3)

= (18*9.525*100)/ (60*10^3)

= 0.2857 m/s

P_A= (1000*kW)/v

kW=(2πNT)/60*1000

= (2π*100*1.962)/60*1000

= 0.02054

P_A= (1000*0.02054)/0.2857

=71.89 N

Force on ratchet P=0.0654

Bending force on shaft,

Mb= P_A*12” +P*24”

=71.89*12*25.4+0.0654*24*25.4

=21951.93 N-mm

Mt= (60*10^6*kW)/(2πN)

= (60*10^6*0.02054)/(2π100)

=1961.42 N-mm

τ=16/ (πd^3)$\sqrt[3]{(Mt^2 + Mb^2)}$

=16/(πd^3)$\sqrt[3]{(1961.42^2 + 21951.93^2)}$

D=10.59 mm

Next standard value of shaft diameter is 12 mm.

4.1.4 DESIGN OF BEARING:

Shaft diameter=12 mm

Fr=71.95 N

L10h=20000

Bearing life in million revolutions,

L10= (60*n*l10h)/10^6

= (60*100*20000)/10^6

= 120 N

Load, P

P=(xFr+yFa) S

=(1*71.95+0)1.1

=79.15N

C=P$(L10)^{1/b}$

=79.15$(120)^{1/3}$

=390.40 N

We select bearing no.6201 for diameter 12 mm.

4.1.5 DESIGN OF CHAIN:

chain -06 B

pitch -9.525 mm

roller diameter, d1=6.35 mm

width, b1=5.72 mm

transverse pitch pt.=10.24 mm

z1=18

z2=18

approximate center distance,

a=40p

=40*9.525

=381 mm

No of links,

Ln=2 $(\frac{a}{p})+\frac{z1+z2}{2} + \left(\frac{z1-z2)}{2\pi}\right) * (\frac{p}{a})$

=2$(\frac{381}{9.525})+\frac{18+18}{2} + 0$

=98

4.1.6 DESIGN OF SPROCKET:

Used chain no.06B

For Z=18

From table no 14.1

Pitch, P=9.525

Width between inner plates, b1=5.72

Roller diameter, d1=6.35

Transverse pitch pt.=10.24

1.pitch circle diameter

D=$\frac{p}{\sin(180/z)}$

=$\frac{9.525}{\sin(180/18)}$

=54.85 mm

Top diameter (Da)

(Da)max=D+1.25p-d1

=54.85+1.25*9.525-6.35

=60.4 mm

Root diameter,

Df=D-2r1

But roller seating radius(r1)

(r1) max=0.505d1+0.069$\sqrt[3]{d1}$

=0.505*6.35+0.069$\sqrt[3]{6.35}$

=3.33 mm

Df=D-2r1

=54.85-2*3.33

=48.19mm

Tooth flank radius(re)max=0.008d1(Z2+180)
=0.008*6.35 (182+180)
=25.6 mm
(re)min=0.12d1(Z+2)
=0.12*6.35 (18+2)
=15.24
Roller seating angle (ά)max=(120-90/Z)
= (120-90/18)
=115
(ά)min=(140-90/Z) =140-90/18
=135
Tooth height above the pitch polygon
(ha)max=0.625 p-0.5d1+0.8p/Z
=0.625*9.525-0.5*6.35+0.8*9.525/18
=3.2 mm
(ha)min=0.5(p-d1)
=0.5(9.525-6.35)
=1.58 mm
Tooth side radius (ax)=p
Tooth width bf1=0.95b1
=0.95*5.72
=5.434 mm
Tooth side relief (ba)=0.1p
=0.1*9.525
=0.9525 mm

V. ADVANTAGES AND DISADVANTAGES

ADVANTAGE:

A. Design of system using Mechanical components.
B. Easy to understand and design.
C. Low cost of System. (Components and manufacturing)
D. Overall low cost as compared to electrical system.
E. It moves in one direction

DISADVANTAGES:

A. The device works in one direction only. It will not restrict the rolling back
B. For driving the vehicle in reverse direction, it requires manual deactivation of the device.
C. To change the direction of motion, every time it requires activation or deactivation of the device manually.

VI. APPLICATIONS AND FUTURE SCOPE APPLICATIONS:

- ✓ It used in modern vehicles.
- ✓ SUV- Mahindra, TATA, Volkswagen.
- ✓ Heavy Vehicles- Eicher, Ashok Leyland, TATA, Volvo.

VII. FUTURE SCOPE

- ✓ Avoiding accidental damages.
- ✓ Avoiding backward motion of vehicle during hill climbing condition.

VIII. CONCLUSION

The project entitled "Anti roll system' aims to provide a proper and efficient technique to reduce accidents. Provides a low cast method for technical and automobile purpose to maintain the vehicles. This project we can deal to oppose the reverse direction of vehicle at hill climbing condition.

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