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RESTORE OF BRAKING SYSTEM

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Abstract - *In today's world, where there are energy crises and thus the resources are depleting at a far better rate, there is a requirement of specific technology that recovers the energy, which gets usually wasted. So, in case of automobiles one of these useful technologies is that regenerative braking system. It's an energy recovery mechanism that slows a vehicle by converting its K.E. into a form which can be either used immediately or stored until needed. Using this system in automobiles enables us to recover the K.E of the vehicle that lost during the braking process. The converted K.E. is stored for future use or fed back to power system of the vehicle. This energy is usually stored in battery for later use. Energy can also be stored with the help of a rotating flywheel which is inexpensive and effective method of storing and regenerating power. This invention provides energy storing regenerative braking system by transmitting the flywheel force as a torque tending to resist the forward rotation of a wheel on applying the brakes. A brake-paddle assembly, mount concentrically with the hub of a ground-engaging wheel, has actuated on braking to provide frictional engagement in the middle hub and clutch mechanism, while applying a decelerating torque to the wheel. Vehicles driven by electric motors using the motor as a generator when using regenerative braking and its output is supplied through the electrical load. The transfer of energy to the load provides the braking effect and regenerates power.*

Key Words: *Regenerative Braking system, Conventional Braking System, Electromagnetic, Flywheel, Battery, Creo Software.*

1. INTRODUCTION

Regenerative Braking System is that the way of slowing vehicle by using the motors as brakes. Instead of surplus energy of the vehicle which are being wasted as undesired heat, the motors act as generators and return variety of the overhead wires in the form of electricity. The vehicle is primarily powered from the electricity generated from the generator, which burns gasoline. This energy is stored during an outsized battery, and employed by an electrical motor that provides drive to the wheels. The regenerative braking happening on the vehicle could also be a because of obtain more efficiency, instead of converting K.E. to thermal energy through frictional braking, the vehicle can convert an honest fraction of its K.E. back to charge within the battery, using the same principle as an alternator. So, if you are driving long distance without applying braking, you will be powering the vehicle completely from gasoline. Regenerative Braking System comes into its own when you're driving within the town, and spending an honest deal of a while braking. you'll still use more fuel within the town for each mile you drive than on the highway, though. Thermodynamics tells us that everyone inefficiency comes from heat generation. as an example, once you brake, the brake pedals heat up and a quantity of heat, or energy, is lost to the surface world. Friction within the engine produces heat within an equivalent way.

In most electric and hybrid electric vehicles on the road today, this is often accomplished by operating the traction motor as a generator, providing braking torque to the wheels and recharging the traction batteries. The energy which are being provided through the regenerative braking that can be used for propulsion to power vehicle accessories.

1.1 Conventional Braking Systems in Automobiles

In conventional braking, brakes are applied employing a pedal which when pressed transfers the hydraulic pressure from hydraulic brake cylinder to restraint with help of fluid lines, restraint successively presses against the brake disc to stop the vehicle. during this way the K.E. change of auto is completely lost within the type of warmth between restraint and disc also as some amount between tyre and road. This heat isn't recovered and is lost to atmosphere.so today there's need of more efficient braking system.

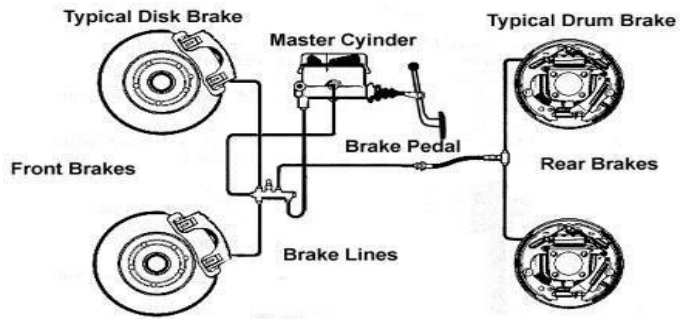

Fig -1: Conventional Braking System

1.2 Regenerative Braking Systems in Automobiles

In Regenerative braking system rather than wasting the K.E. of auto within the sort of heat it's converted into electricity to be stored in batteries and capacitors or as mechanical energy through which flywheel having a very large moment of inertia. In this way an outsized proportion of energy of vehicle is saved only to be used later for either accelerating the vehicle or for various electrical purpose.

- ✓ Motor Based Regenerative Braking
- ✓ Flywheel Based Regenerative Braking

1.3 PROBLEM STATEMENT

At this century, automotive industry has posted an excellent challenge so as to scale back the vehicle fuel consumption and emission, these is thanks to the shortage of fuel resources and worsen air pollution problem. consistent with figures released by the US Environmental Protection Agency (EPA), conventional ICE vehicles currently contribute 40-50% of ozone, 80-90% of carbon monoxide, and 50-60% of air toxins found in urban areas.

A study shows that, one third (20 to 25%) energy is consumed during brake. The invention of Regenerative Braking System is viewed as an answer to those 4 problems, because it recovered wasted energy and restored to a different sort of useful energy. Although the precious and positive effect brought by Regenerative Braking System which is realized, it is still has its issue or problem which is to be solved; one of the main problems is observed because the suitable battery to be utilized in this sort of automobiles.

1.4 ADVANTAGE, DISADVANTAGE & APPLICATION

a) Applications

1. For recovering K.E. of auto lost during braking process.
2. One theoretical application of regenerative braking would be during a factory that moves material from one workstation to a different on a conveyer system that stops at each point.
3. Regenerative braking is employed in some elevator and crane hoist motors.

b) Advantages

1. Improved Performance.
2. Improved Fuel Economy.
3. Reduction in Engine wears.
4. Reduction in Brake Wear, reducing cost of replacement brake lining, cost of labor to install them, and vehicle down time.
5. Engine emissions which are being reduced by engine decoupling, reducing the total engine revolutions and total time of engine operation.
6. Operating range is comparable conventional vehicles a drag not yet overcome by electric vehicles.

c) Disadvantages

1. Added weight extra component can increase weight.
2. Friction brakes are still necessary.
3. Safety primary concern with any of the energy storage unit of high energy density.

1.5 FUTURE SCOPE

Future developments, however, like ultra-capacitors, flywheels and hydraulic systems could have much higher power capacities, which could open up the likelihood to rely more heavily on the regenerative braking system, even for top speed, high stops and therefore the opportunity to downsize or maybe eliminate the friction-braking system.

2. MOTIVATION

Hybrids and every one electric vehicles create their own power for battery recharging through a process known as regenerative braking. We have to explained regenerative braking working and the process works generally terms, but many people have an interest within the deeper nuts and bolts of electricity generation. They understand that during a hybrid or all electric vehicle the word "regenerative" in terms of regenerative braking, means that it holds the vehicle's momentum (kinetic energy) and turning it into electricity that recharges (regenerates) on board battery because the vehicle is slowing down and or stopping. It is this charged battery that successively powers the vehicle's electric traction motor. In an all-electric vehicle, this motor is that the sole source of locomotion.

2.1 Objective

To restore energy from braking system by charging a battery then reuse that energy in

i) Other parts of vehicle like charging point, for the head lights.
ii) Use that charge battery for lamp in camping.
iii) For inverter (convert DC into AC)
iv) Enhancing the efficiency etc.

3. METHODOLOGY

3.1 Design consideration

Regenerative braking system might not suffice the essential requirement of braking system alone. This is because of limitation of energy dissipation at very high power so it is very relabel. The storage and generation systems may not be capable to operate at those levels due to design limitations. Due to critical level of safety involved the system, reliability becomes debatable and it necessitates a frictional electrical regenerative with braking system braking system to co-exist. This forms a hybrid braking system, which means:

i. Just like hybrid propulsion systems, there can be many design configurations and control strategies.
ii. Design and control of system should be such that they ensure vehicle's desired braking performance while at the same time capturing as much energy as possible.

It is a careful consideration of braking behavior and its characteristics, during developing strategies with respect to speed, braking power, deceleration rate etc. must be made.

3.2 Design procedure

✓ The design is done by using Creo software.

1) Open the Creo software version 6.0.
2) Go to the file select new, click on part-design, remove using default templates, then click ok.

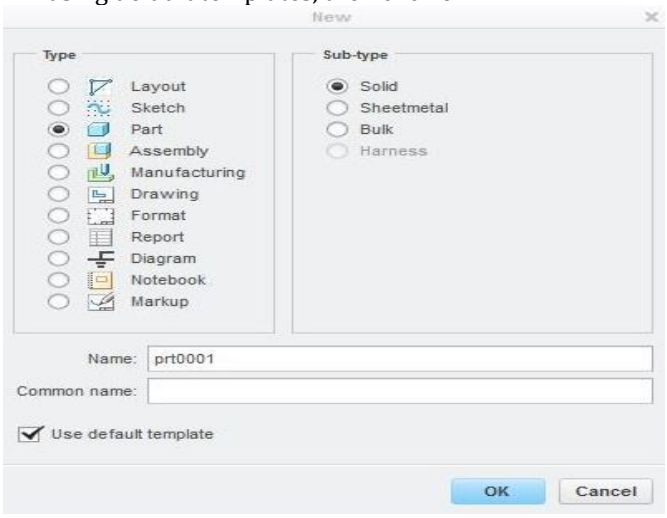

Fig -4: Initialization of project.

3) Go to the sketch, select the plane and click on the sketch view. Select the required
4) Use the extrude command, select the object, give the required thickness, then click ok.

4. COMPONENT LIST

Table -1: Component List

Sr. No.	Name of Parts Used	Description
i.	Square bar	40*40 Hollow Bar (M.S)
ii.	Journal Bearing	Internal Dia.12mm
iii.	Brake Wheel	Outer Dia.8cm
iv.	Solid Shaft	Outer Dia.12mm
v.	Wheel	Inner Dia. 12 mm
vi.	Brake Spindle	40*40 Hollow Bar (M.S)
vii.	Sewing Machine Motor	9500 rpm
viii.	Pulley & Pulley Rope	Internal Dia.12mm & V-belt
ix.	Battery	5 watt
x.	LEDs	7v
xi.	Electric Wires	Copper wire
xii.	D.C Motor	Brushed D.C 12v

5. CALCULATION

5.1 Calculation for pulley

For power given select small pulley diameter (d) from V-Belt then using the speed -

- ✓ Calculate the larger pulley diameter(D),
- ✓ Speed ratio= D/d = N1/N2
- ✓ Large pulley diameter, D = Speed of ratio x d

For the Power of 100 Kw the small pulley diameter d = 355 mm

For power given select the small pulley diameter (d) from V-Belt Table.

- ✓ Speed ratio = 4.235
- ✓ Larger pulley diameter, D = Speed ratio x dD = 4.235 x 355
- ✓ Motors = 9500 rpm

5.2 Calculation for shaft

Maximum shear stress developed during a shaft subjected to torque is given by,

$$\tau = \frac{T\,r}{J} \leq [\tau]$$

Where, T = Twisting moment (or torque) which is acting upon the shaft,

J = Polar moment of inertia of shaft about the axis of its rotation

= $\frac{\pi d^4}{32}$ for solid shafts with diameter d

= $\frac{\pi(d_o^4 - d_i^4)}{32}$ for hollow shafts (do) and (di) as outer and inner diameter.

r = Distance from neutral axis to outer most fibre = d/2 (or do/2)

5.3 Calculation procedure for bearing

1. Temperature rise ΔTas is assumed.
2. Effective temperature Teff = Ten + 0.5ΔTas
3. Oil viscosity η at the temperature Teff which is decided by (viscosity-temperature chart).
4. Relative bearing of the clearance is calculated by Ψ = (D-Dj)/D
5. Somerfield number which is calculated gives the value So = F Ψ^2/(DBωη)
6. Values of the Somerfield number and the geometry parameter B/D determine the bearing eccentricity ε, which is obtained by the eccentricity chart ε (So, B/D).
7. Minimum oil film of the thickness h min = 0.5DΨ (1 – ε)
8. Eccentricity of the value and therefore the geometry ratio B/D are used for the determination and the specific coefficient of friction f' (ε, B/D), position for the minimum oil film thickness φ (ε, B/D) and oil flow parameter Q' (ε, B/D).
9. Coefficient of friction f = f'Ψ
10. Oil flow Q = D3ωΨQ'
11. Power loss thanks to friction P = fFωD/2
12. Calculated oil temperature rise ΔTca = P/(cQ) where c is restricted heat capacity of oil
13. Calculated oil temperature rise ΔTca is compared to the assumed value ΔTas and if there's a significant difference between them a replacement assumption of the temperature rise is formed.

✓ The above procedure is calculated for several time until the calculated and assumed values of the temperature rise become equal.

6. CONCLUSION

The regenerative braking system which are being used in the vehicles satisfies the purpose of saving a part of the energy lost during braking. The regenerative braking system is designed for the partially recover the battery charge are being wasted in braking of the vehicle. The energy is converted into heat by friction brakes which are dissipated to the environment. This Energy is being utilized to rotate the rotor of generator which are converting the mechanical energy of wheels into the useful charge of battery. The regenerative braking system couldn't be used as the main braking system of vehicle as it cannot bring the vehicle to the rest.

Experimentally it is found that, on increasing the speed of the wheel (rpm) the voltage generated will also be increasing and vice-versa. As others researchers who had used the stepper or servo motors as regenerative motor, so in this project, it is replaced with D.C motor. motor with gear. It has been found that the voltage generated by the D.C motor with gear is higher than that of voltage produced by those two motors.

Hence, if this system is installed in the actual vehicles minimum 11% battery energy can be recovered by using the regenerative braking system which would otherwise be wasted due to heat in friction brakes. So the distance travelled between the two successive charging requirements can be increase upto 10 to 15 % using this regenerative braking system.

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