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Design and Fabrication of Regenerative Braking System

Prof. Praful Randive[1], Akshay Bondre[2], Mayur Pardhi[3], Vaibhav Rotake[4], Chetan Belkhede[5] , Pavan Wanare[6]

1Professor, Department of Mechanical Engineering, Abha Gaikwad patil college of engineering, Nagpur
2-6 Student, Department of Mechanical Engineering, Abha Gaikwad patil college of engineering, Nagpur.

ABSTRACT
In today's world, there is an energy crisis and the natural resources are exhausting at higher rate, there is a requirement of such a technology that helps to recover the energy, that is usually wasted. so, here comes the technology called regenerative braking system .the regenerative braking system is energy recovery mechanism that helps automobiles or objects to recover its kinetic energy by the automobiles The energy that is recovered from an object can be used immediately or can be converted into a specific energy form for future use. Storing into a battery or capacitors .energy can also store in the rotating flywheel which is the cost efficient and effective method of storing energy . The electric vehicle employed the motor as a generator when braking with regenerative braking, allowing the output to both recharge the vehicle and improve its efficiency.
Keywords*: Generator, Regenerative braking, Flywheel Brake pad, Energy recovery*

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I. Introduction

The demand of reliable alternative energy resources is increase in recent years .todays automotive industry is doing a research on getting higher efficiency and reduce exhaust gas emission .the commercial vehicles that are mostly used as refuse trucks and delivery vehicles lose lot of kinetic energy due to frequent braking , leads to emission of higher greenhouse gases and consumption of fuel .the Diesel particular filter (DPF) and Exhaust gas emission are installed in most modern vehicles are effective ways to reduce the emission but not GHG gases.

Regenerative stopping mechanism is the best component of electric autos. The energy recovery system aids electric vehicles in lowering their energy use. There are two types of regenerative braking systems used in commercial vehicles. the regenerative braking system and boost recuperation system According to current braking, commercial trucks lose 50 to 80 percent of their braking energy.

II. LITERATURE SURVEY

[1]. Sayed Nashit, Sufiyan Adhikari, Shaikh Farhan, Srivastava Avinash and Amruta G

- The task ('Design, Fabrication and Testing of Regenerative Braking Test Rig for BLDC Motor) makes attention to engineers towards energy proficiency and energy preservation. The regenerative braking cannot used as primary braking system, it works more efficient at higher speed. The project describes us about the bright and green future of efficient energy due to automobiles as they help to regain the waste part by regenerative braking system

[2]. Tushar L. Patil, Rohit S. Yadav, Abhishek D. r, Mahesh Saggam, Ankul Pratap

- The project (Performance improvement of Regenerative braking system) the techniques to increase the efficiency of the regenerative braking system is mentioned. Because of the utilization of light weight car parts increment the general presentation, in regenerative slowing mechanism super capacitors can further develop the transformation rate.

[3]. C. Jagadeesh Vikram, D. Mohan Kumar, Dr. P. Naveen Chandra

-The project Fabrication should done according to the given measures in automotive transportation to get maximum performance in braking.in regenerative braking system the execution is important.

[4]**.** Ketan Warake, Dr. S. R. Bhahulikar, Dr. N. V. Satpute

- The mechanical energy of the generator is converted into the useful charge of the battery. As the regenerative braking system cannot bring vehicle to rest that's why it cannot be used as primary braking system. The Project shows 11% of battery charge can be recovered by this system which is either waste in heat due to friction brakes.

III. Working Principle

The regenerative braking is a braking system /mechanism that helps the vehicle to increase its efficiency by using mechanical energy of motor to transform kinetic energy into electrical energy fed back to the battery source. Evidently, good part of kinetic energy transforms by regenerative braking system to power the battery, using the same idea as alternator.

In regenerative braking mode, the car slows down by using the motor when the driver applies force to the brake pedal, causing the electric motor to work in the opposite direction, slowing the car down. The motor acts as a generator when working in the other direction, charging the batteries as shown in fig (1)

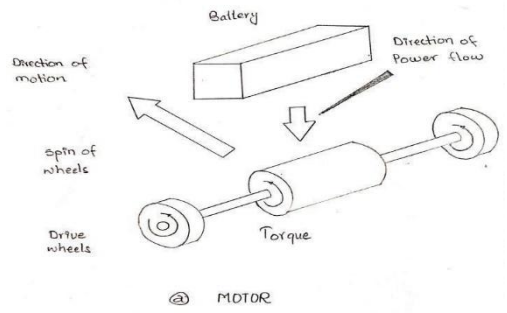

Fig.1.forward driving condition

in normal condition for moving car in forward direction it takes power from battery. By the use of regenerative braking, it increases the fuel Efficiency, lowering emissions and reduce the dependence on fuel. Such braking system works efficiently in the urban cities where frequent braking is done.as given in fig (2).

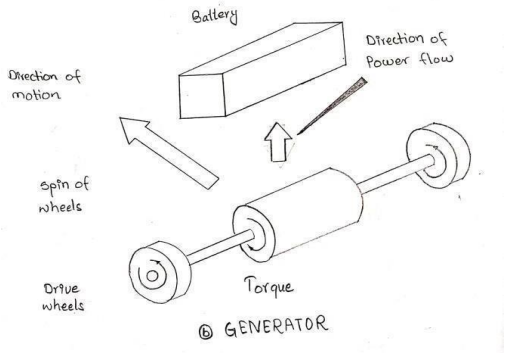

Fig. Regenerative action during braking

IV. Types of Regenerative Braking System

In regenerative braking system there are multiple ways of energy transformation along with flywheel, spring, electromagnetic and hydraulic. Electromagnetic -flywheel system is one of hybrid regenerative braking system. Every type of regenerative braking system uses a different energy transformation or storage system, giving different efficiency and application for each type. As follows-

a) Electromagnetic

In electromagnetic system, the electric generator is attached to the drivetrain in automobiles, slowing the automobile and generation of electricity takes place. In gasoline powered the energy is utilize to power electronics of vehicle or stored to the battery for the future purpose.

b) Flywheel

In flywheel type regenerative slowing mechanism, the dynamic energy of the auto is utilized to turn flywheel join to the driveshaft box transmission. The rotating flywheel gives the torque to the drivetrain, which gives the automobile power uplift.

V. Fabrication

List of materials used in fabrication.

- Square bar
- Journal Bearing
- Brake Wheel
- Solid Shaft
- Bicycle Wheel
- Brake Spindle
- Sewing Machine Motor
- Pulley
- Pulley Rope
- LEDs
- Electric Wires
- D.C. Motor

VI. Equipment

Equipment used in fabrication.

- Drilling Machine
- Metal Cutting
- Hacksaw
- Angle Clip from square bar
- Arc Welding
- Basic Welding Circuit

VII. Procedure

- To begin with, the gentle steel square bar is cut at a point of 45 degrees and consolidated the bar welded to shape an edge.
- To frame a table-like construction the square bar is welded at the two finishes.
- The Plummer block is welded on the square edge gave on the highest point of level plate
- Bike wheel, brake haggle are organized and fitted to strong in the middle between Plummer block.
- The engine is welded, for working the casing
- The force of the engine is given to the bike wheel by interfacing pulley and engine with a belt.
- The equipped DC engine set at the brake wheel which is set upon the brake paddle.

VIII. Design and Calculation

- Motor used = 1 Hp(960rpm)

Motor speed is simply measurement of the revolution per minute, while vibration frequency is expressed in hertz.

Therefore,

Vibration frequency (F) =960/60 =16hz

- Alternator = 20v
- Shaft outer diameter =25mm
- Plummer block bearing =25mm
- Driven pulley size =8inch
- Drive pulley size =4inch
- Gear ratio =4/8 =1:2
- Frame size =35*16
- Wheel size =13inch

IX. Precautions Taken while fabrication

- The Apron is must during each course of Fabrication.
- During welding process face safeguards and welding
- During the Drilling system appropriate coolant ought to give
- During grinding process, the gloves are utilized for security insurance
- In the creation cycle materials were dealt with cautiously.

A. Design

Creo software used to design this model

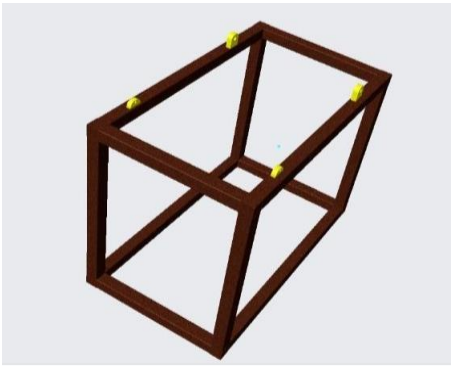

Fig.3. Design of Frame

Fig 4. Design of pulley

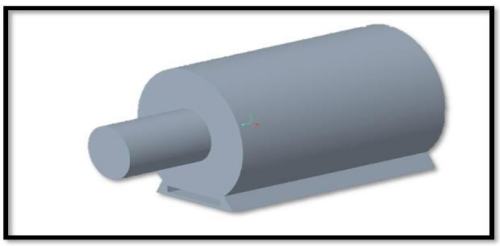

Fig.6.design of motor

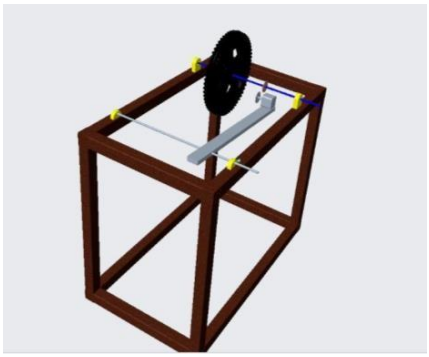

Fig.7.Final assembly with belt drive mechanism

X. Result

The model is tested and operated successfully and the results obtained in various loading condition are as follows

S. No.	Rpm before brake	Rpm after brake	Voltageoutput
1	500	480	9.34
2	900	870	10.88
3	1300	1260	11.81
4	1700	1650	12.91
5	2100	2040	13.49
6	2300	2270	13.89
7	2500	2460	14.49

Results obtained in various loading condition

As displayed in above tables that the proficiency of the regenerative slowing mechanisms utilizing D.C Motors increments as the rakish speed of the engine increments and subsequently the regenerative slowing down systems are moreproductive as higher angular velocities and as the motor speed increases the recoverable energy also increases.

XI. Conclusion

Analytically it is found that the voltage generation is increase while increase in the speed (RPM)of the wheel. During the examination the researcher utilize servo engine as regenerative engine it is supplanted with DC engine in this venture and engine with gear. Voltage made by the DC motor is higher than that of two motors. Voltage created by the DC engine is higher than that of two engines.

Thus, 11% of battery power can be recovered if it is placed in actual vehicle using the regenerative braking system which is as always wastedto heat in friction brakes.

Final Fabrication

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