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REGENERATIVE BRAKING SYSTEM

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Abstract - *Regenerating brake is used to stop/slowing of the vehicle and the surplus amount of the kinetic energy is not wasted as the heat as happens in the conventional ,in the conventional braking a considerable amount of surplus energy is being stored in the battery for further use such as at the time when vehicle is accelerating .Regenerative braking is used to enhance or increase the fuel efficiency of the engine by a considerable amount in regenerative braking surplus kinetic is not wasted as thermal energy we obtain a good fraction of this surplus energy by using the motor in reverse direction and it work as an alternator. In electric vehicle vehicles which are primarily powered by the electrical energy and this electrical energy is stored in the battery, by the regenerating braking, we can charge the battery by a considerable amount at the time of braking and due to this the efficiency of vehicle can be increased.*

Key Words: **Regenerative braking system, Conventional braking system, Fuel efficiency, Efficiency of the vehicle, Electrical energy.**

1. INTRODUCTION

Regenerative brake has the same function as the conventional brake. Function is to stop the vehicle partially/fully. But in the convention braking all the surplus kinetic energy is wasted but in the regenerative braking a considerable part of that surplus kinetic energy is being stored in the battery which can used at the when the vehicle is again accelerating and by the virtue of this mechanism the fuel efficiency of the vehicle can be increased further up to 33 %of the initial efficiency. Regenerative brake is not much useful when you are driving long distance without braking like on the highway ,but if you moving in the city then you have to apply the brake very frequently and in this regenerative braking is very useful and by using the regenerative brake the fuel efficiency of the vehicle will increased by the considerable amount. By using regenerating braking, we are minimizing the fuel consumption and we are also minimizing the pollution in our habitat.

2. LITERATURE REVIEW

Y. Luo, D. Huang and X. Gao's "Research on energy recovery for electric vehicle based on motor-generator integration system,"[1] took electric vehicle as research object and concentrated on its energy recovery system. In this experimental project, the idea of motor-generator integration was proposed. Theory and method to accomplish the integration was also presented in detail. Additionally, an intelligent gearbox was assembled into our vehicle model, which is a relatively new attempt to the research of electric vehicle. Zhang Guirong, in "Research of the regenerative braking and energy recovery system for electric vehicle"[2] described that when driving in braking the inertia of the vehicle wheels through the transmission of energy to pass through to the motor, to control electrical engineering with the generating electricity a way work refreshes for power battery and achieve the regeneration of braking energy. Meanwhile, the power produced during the motor braking torque can be exerted through the transmission of the during wheel brake, resulting in braking force.

3. CONVENTIONAL BRAKING SYSTEM

Conventional brakes use friction pads to stop the wheel. Conventional braking system actuates the brakes with the help of mechanical or fluid linkages. In modern vehicles mostly hydraulic braking system or pneumatic braking system are used. Let us discuss these two briefly to get an idea about why there is a need of improvement.

3.1 HYDRAULIC BRAKING SYSTEM

Hydraulic braking system in contrast to its name generally does not use water but uses oil as a fluid linkage. Main parts of hydraulic braking system are- Master cylinder, Primary and secondary piston, Fluid pipes, Wheel cylinder, Caliper.

Hydraulic braking system amplifies the force applied by the driver on the brake pedals. How this happens – Answer lies in the pascal law. As the pascal law suggests that pressure is transmitted uniformly at all point in the fluid. Pressure is force per unit area. Hence same pressure can generate a larger force it acts on a small cross-sectional area. This way we can amplify the force applied on brake pedals. Master cylinder has two reservoirs of oil, named as primary and secondary cylinder. Secondary cylinder carries extra oil to counter losses from leakages. Below there is a cylinder which has two pistons, primary and secondary piston. Secondary piston is connected to primary piston which is connected to brake pedal with the help of return spring. Force applied by driver passes on the brake pedal amplifies due to low cross-sectional area of fluid pipes. This pressurized fluid reaches caliper of front wheels and wheel cylinder of rear wheels and imparts force to friction pads which comes in contact with the wheel and eventually stops it.

3.2 PNEUMATIC BRAKING SYSTEM

This braking system differs from the former in the way that force applied by driver on the brake pedal does not amplify and stop the vehicles but acts as regulating force. Main parts of pneumatic braking system are-Air compressor, Belt and pulley drive, Storage tank and pressure regulating valve, Control valve/brake valve, Brake chamber. It consists a air compressor which compresses the atmospheric air which is driven by engine with the help of belt and pulley drive. Compressed air is stored in storage tank with safety valve which releases air into atmosphere if pressure reaches max safety level. This compressed air is regulated by brake valve with the help of brake applied by driver. This compressed air reaches brake chamber, forces the diaphragm which actuates the cam mechanism with the help of push rod connected to it.

4. NEED OF REGENERATIVE BRAKING SYSTEM

World is facing an energy crisis. Hence any new technology that can save energy efficiently becomes the need of time. In the previous braking system, we have seen that frictions pad are used to stop the wheels of a vehicle. Friction pads reduces the kinetic energy of wheels by transforming it into heat energy into atmosphere which we cannot use making it a energy wastage process. Thus any process that can capture that energy and convert into some usable form can be of great help. With this arises the scope for regenerative braking system. Does energy lost during the braking is significant-by this question we mean that does energy lost in braking is worth saving? What percentage of total energy consumption is lost in braking? Answer is yes, the energy lost is significant. EPA FTP75 urban drive cycle speed vs time graph show that the energy lost due to braking in an urban area where continuous braking at low speed is required is nearly 40% of the total energy consumption.

5. WORKING PRINCIPLES

Faraday's first law-When flux linked with the conductor is changes then emf induced in the conductor.

Faraday's second law-_According to faraday's second law emf induced in the conductor due to change in the flux is directly proportional to rate of change of flux with the time.

Lenz's law- According to law, emf induced in the conductor is opposes the change in flux linked with conductor.

6. OUTLINE OF MODEL

In our model, Energy via engine is replaced by a DC motor which drives the wheel with the help of a drive. Wheel is stopped with the help of a brake system which captures its energy and a portion of captured energy is used to move the rotor of the dynamo which transform the energy into electric energy. Output of that we can see via lightening of LED bulbs and charging of a battery. This is our model and example of Regenerative braking system.

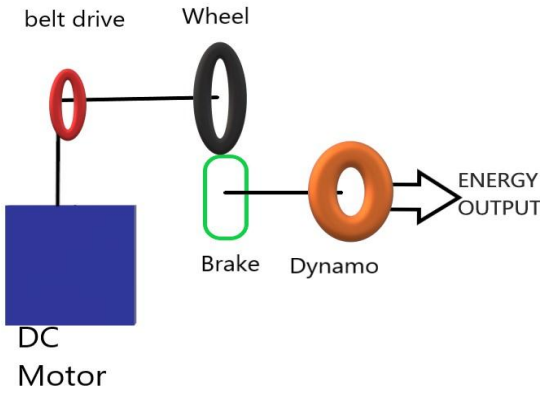

Fig. 1: outline of model

6.1 MATERIAL REQUIRED

1. wheel
2. dynamo (300rpm)
3. L.E.D.
4. brake wire
5. battery 6 volt
6. bearing
7. gear
8. shaft
9. belt
10. pulley
11. D.C. gear motor 80 rpm
12. iron plate
13. flexible wire
14. switch
15. stand
16. nut and bolt
17. spring plywood

7. CONCLUSION

While using regenerative braking system, we still need friction brakes because regenerative braking system cannot stop the vehicle effectively in case of emergency thus there is further scope of new innovations in this field. But the use of present model can also be useful. Study has showed that regenerative braking system can increase the efficiency of engine by reducing the fuel consumption thus improving fuel economy and we are able to capture the energy which was going to waste by the use of our model. So we can say that result of this project is satisfactory.

8. REFERENCES

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