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Auxiliary Regenerative Braking System

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Abstract— *In today's technologically developed world, power efficiency is considered as one among the most important parameters. World's automotive market is increasing in a exponential rate with induction of new and better technology. This project focuses on the energy that is being lost while braking in conventional system. Although there have been many efforts towards regenerative braking system but the cost involved is very high and also the system is limited to hybrid electric vehicles. This project uses a much simpler system using dynamo's which can be used in any conventional vehicle irrespective of its size. Here in this system part of brake is applied due to contact made by dynamo wheels and the vehicle is brought to a complete stop by use of regular friction brakes. This helps in generating power lost due to friction and also protects the brakes. This simple braking system is comparatively more cost effective and flexible to almost all kind of vehicle with slight modification.*

Keywords— *Dynamo, Conventional braking system, Auxiliary braking system***.**

I. INTRODUCTION

As the basic law of Physics says 'energy can neither be created nor be destroyed it can only be converted from one form to another'. During braking huge amount of energy is lost to atmosphere as heat. It will be good if we could store this energy somehow which is otherwise getting wasted out and reuse it next time we started to accelerate. Brakes are employed to stop or retard the motion of any moving body. Thus, in automobiles the brakes are having the most important function to perform.

In conventional braking system the motion is retarded or stopped by absorbing kinetic energy by friction, by making the contact of the moving body with frictional rubber pad (called brake liner) which causes the absorption of kinetic energy, and this is wasted in form of heat in surroundings. Each time we brake, the momentum of vehicle is absorbed that it has gained by it and to re-accelerate the vehicle we have to start from the scratch to re-develop that momentum by using the more power from an engine .Thus, it will ultimately result in huge waste of energy. It will be good if we could store this energy somehow which is otherwise getting wasted out and reuse it next time we started to accelerate.

The basic concept of regenerative brakes, which provide braking for the system when needed by converting the available energy to some usable form. These are widely used in electric trains and the latest electric cars. Regenerative brake is an energy recovery mechanism which slows a vehicle by converting its kinetic energy into another form, which can be either used immediately or stored until needed. Thus, the generated electricity during the braking is fed back into the supply system (in case of electric trains), whereas in battery electric and hybrid electric vehicles, the energy is stored in a battery or bank of capacitors for later use. Energy may also be stored by compressing air or in a rotating flywheel.

II. NECESSITY

As we all know that survival today without a transport system is impossible. All transport system use a conventional braking system which uses a friction brake to absorb the kinetic energy which is merely a waste. This kinetic energy can be converted and used back as we all the importance of the power today, it is usually said that powered said that power generated is equivalent to power saved. We can formulate that the main problem is that heat energy is lost and the regenerative braking systems that have been developed till date have proved to be very effective but are very costly and not flexible for all kind of vehicles.

This is where our project comes in picture. The auxiliary regenerative braking system is a solution to almost all of it. The design of this system is very simple and yet cost and performance effective. This braking system can be employed almost to all vehicles where help of a brake drum is taken in order to brake. This is a simple concept where a dynamo is used to generate back the lost power. The auxiliary regenerative system not only is cost effective but is flexible in design. It has almost many advantages like it can help to brake effectively and yet protect the brakes from sudden wear and tear thereby improving its life and performance as there is not always direct contact as the vehicle will be first slowed down by the dynamos.

III. FABRICATION PROCESS

The fabrication of ARBS involves operations like drilling, cutting, welding, fitting, mounting, soldering, bending, painting. Initially it starts with the construction of the base which uses aluminium as a material. At one side of the frame brake pedal is fixed with a spring to facilitate controlled braking. This vertical structure is then supported with another strip so as to hold the load. Right at the next end another vertical structure is welded to the frame which contains the pulley along with the steel wire that will be used for braking.

The square frame is divided in 4 quadrants with welding of strips, at one of the quadrant a 220V motor is placed which is in turn connected to the wheel shaft with chain and sprocket mechanism. The main wheel is placed at the center of the square frame in order to ensure proper weight distribution. Three vertical supports are welded in such a way so as to hold the weight of the arrangement. Between two supports the main wheel shaft is layed supported at either end with the two vertical supports along with the brake drum and dynamo

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arrangement. The third support is used to affix the dynamo's which will also move and is backed by a small welded portion.

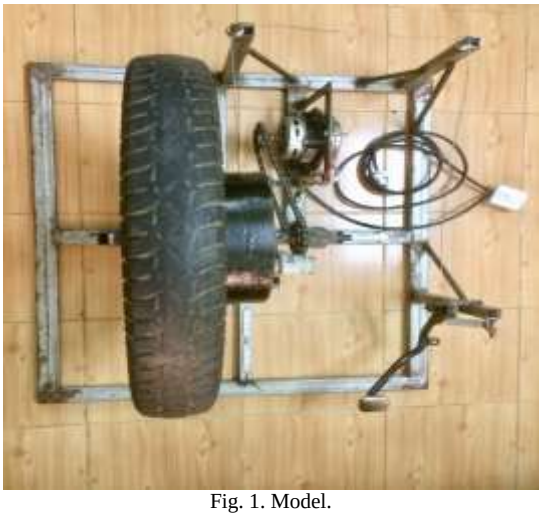

Fig. 1. Model.

The dynamos are connected to a diamond like structure designed with respect to the braking operation. Couples of nuts and bolts are fixed on this structure so as to form a kind of a link which will help in the expansion of the structure when applied with brakes. Simple plates are used here to form the diamond shaped mechanism and holes according to placements are drilled connecting the two plates to each other. The final erected structure is provided with the same small circular pulley along with the steel wire. A spring is attached below to facilitate the movement of the diamond structure. The opposite quadrant to the brake pedal arrangement consists of a LED illuminator system which is sticked upon to the lower frame using adhesive and its connection is soldered with that to the dynamos. The electric motor is supplied with a switch so as to regulate the speed of the wheel; this switch has a connection to a plug which will provide the necessary power for the apparatus.

IV. WORKING

The Auxiliary regenerative braking system (ARBS) works on the principle that the energy wasted in form of heat due to friction can be used to run the coupled dynamos. When the power is supplied to the 220V motor it starts to rotate at a speed of approximately 1320rpm which is in turn connected to the wheel shaft and the wheel starts to rotates along which the brake drum, as we know the minimum speed required for the dynamo to produce electricity is 300rpm so the attained speed is more than enough.

As soon as the wheel along with the brake drum starts to rotate pressure is applied on the brake pedal that in turn applies pressure on the diamond like mechanism of the dynamo's and it starts to expand and after the brake is pressed half the dynamo's come in contact with the rotating brake drum and start to move in the opposite direction of the brake drum. This contact makes the dynamo to run thereby producing the required power.

The prototype ARBS uses a LED illumination system that works at 12V so that we can confirm that the power generated is 12V. This half brake system facilitates the partial braking of the vehicle and not the full. The full braking is attained when the brake pedal is pressed full thereby stopping the vehicle completely using the conventional friction brake. The major advantage of the ARBS is that there is no first direct contact of the frictional brake and hence is helpful in protecting the brake liners thereby increasing their life.

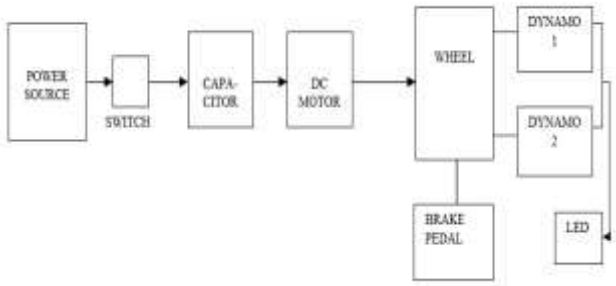

Fig. 2. Block diagram.

V. CALCULATIONS

Consider the wheel is moving with a speed 'N' rpm as the speed varies due to driving conditions the brake force applied differs hence the rotation of the coil in the dynamo varies so that the power output depends on the speed of the wheel and it is given by,

$$P=V*I$$

Where,

P = Power generated in mill watts (mW)
V= Voltage in volts (V)
I = Current in milliamps (mA)

The following trails have been done on the basis of experimental analysis

Trial 1: For N=100rpm
V=11.4 V
I=0.79 mA
P=V*I = 11.4 * 0.79
P= 9.006 mW
Trial 2: For N=150rpm
V=14.1 V
I=0.83 mA
P=V*I = 14.1 * 0.83
P= 11.703 mW

VI. RESULTS

TABLE 1. Experimental readings.

Sl No.	SPEED (N) 'rpm'	VOLTAGE (V) 'volts'	CURRENT (I) 'mA'	POWER (P) 'mW'
1.	100	11.4	0.79	9.006
2.	150	14.1	0.83	11.703
3.	200	18.1	0.88	15.928
4.	250	21.5	0.91	19.565
5.	300	24.6	0.95	23.37

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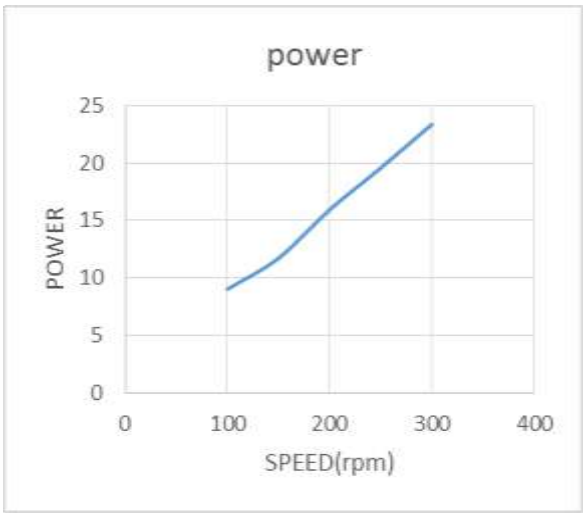

Fig. 3. Power v/s speed.

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