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Prevention from Road Accidents by Eddy Current Controlled Brakes and Computerization of Traffic Poles

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***Abstract*—The term accident itself says that something which is not pre-planned. This paper describes about the usage of eddy currents to develop a protection shield to help trespasser or road-crossers with some safety assurance. The entire set up basically revolves around the fact that eddy currents can have a better impact in controlling the brake of any vehicle, if used. Normal brakes are working under the concept of friction where tyres can easily wear-out, but eddy currents don't harm the tyres like the friction brakes. The aim is to target a smooth flow of vehicles under the traffic controlled zone, so that rash –driving and any instances of accidents can be prevented to a large extent. Special provisions for emergency vehicles can also be considered. A safety carrier is also used to carry road-crossers to sit safely and move from one end of the road to another. This will be a real help for those people who find it difficult to cross the roads, especially to the senior citizens and the younger ones. A software needs to be used to calculate the number of vehicles to be allowed from one pole to the other and also to calculate the duration for which the carriers needs to stop the vehicles to carry the pedestrians from one end to other.**

***Keywords*—Eddy current, electromagnetism, eddy poles, human carrier, pedestrians, emergency vehicles.**

I. INTRODUCTION

One of the drawbacks of going anywhere fast is that you always have to stop sooner or later. In an emergency, when you have to brake quickly, the only thing that comes between safe stopping and disaster is the simple science of friction: you slow to a halt when two surfaces rub together. Now friction brakes have more than proved their worth: you'll find them in every car, bicycle, airplane, and most factory machines. But they have a big drawback too: every time you use them, they wear out a little bit, and that means they're relatively expensive. Moving things have kinetic energy and, if you want to stop them, you have to get rid of that energy somehow. If you're on a bicycle going fairly slowly, you can simply put your feet down so they drag on the ground. The soles of your feet act as brakes. Friction (rubbing) between the rough ground and the grip on your soles slows you down; converting your kinetic energy into heat energy (do it long enough and your shoes will get hot). Brakes on vehicles work pretty much the same way, with "shoes" that press rubber pads (brake blocks) against discs mounted to the wheels.

Even if you make brakes from super-strong, hard-wearing materials, they're still going to wear out sooner or later. But there are other problems with friction brakes. The faster you go, the harder they have to work to get rid of your kinetic energy, and the quicker they'll wear out. Use your brakes too often and you may suffer a problem called brake fade, where heat builds up too much in the brakes or the hydraulic system that operates them and the brakes can no longer work as effectively. What if your brakes can't stop you in time?

What's the alternative? One option is to slow things down with the force of electromagnetism instead of friction.

II. FACTS ABOUT ROAD ACCIDENTS

Road accidents in India kill more than 2 lakhs people: WHO Some 1.25 million people die each year globally as a result of road traffic crashes, according to the WHO's report, despite improvements in road safety.

Chennai: India accounts for more than 200,000 deaths because of road accidents, according to the Global Road Safety Report, 2015 released on Monday by the World Health Organization (WHO). This is 46% more than the national statistics released by the National Crime Records Bureau (NCRB) in July. While the total deaths estimated by WHO for 2014 are 207,551, the deaths reported under Accidental Deaths and Suicides in India (ADSI) by National Crime Records Bureau of India (NCRB) for the year 2014 are 141,526. In India, there has been a continuous increase

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in road crash deaths since 2007, with a brief annual reduction in 2012.16 deaths every hour: Indian roads claim the maximum number of lives in 2014. Over 1.41 lakhs people died in crashes, 3% more than the number of fatalities in 2013. (TNN report dated July 19, 2015)

What are eddy currents?

They're part of the science of electromagnetism: electricity and magnetism aren't two separate things but two sides of the same "coin"—two different aspects of the same underlying phenomenon.

Eddy currents, like all electric currents, generate heat as well as electromagnetic forces. The heat can be harnessed for induction heating. The electromagnetic forces can be used for levitation, creating movement, or to give a strong braking effect. Eddy currents can often be minimized with thin plates, by lamination of conductors or other details of conductor shape.

1. Electricity and magnetism go hand in hand

2. How eddy currents are made

What if the conductor you're moving through the magnetic field isn't a wire that allows the electricity to flow neatly away? You still get electric currents, but instead of flowing off somewhere, they swirl about inside the material. These are what we call eddy currents. They're electric currents generated inside a conductor by a magnetic field that can't flow away so they swirl around instead, dissipating their energy as heat.

One of the interesting things about eddy currents is that they're not completely random: they flow in a particular way to try to stop whatever it is that causes them. This is an example of another bit of electromagnetism called Lenz's law (it follows on from another law called the conservation of energy, and it's built into the four equations summarizing electromagnetism that were set out by James Clerk Maxwell).

Here's an example. Suppose you drop a coin-shaped magnet down the inside of a plastic pipe. It might take a half second to get to the bottom. Now repeat the same experiment with a copper pipe and you'll find your magnet takes much longer (maybe three or four seconds) to make exactly the same journey. Eddy currents are the reason. When the magnet falls through the pipe, you have a magnetic field moving through a stationary conductor (which is exactly the same as a conductor moving through a stationary magnetic field). That creates electric currents in the conductor—eddy currents, in fact. Now we know from the laws of electromagnetism that when a current flows in a conductor, it produces a magnetic field. So the eddy currents generate their own magnetic field. Lenz's law tells us that this magnetic field will try to oppose its cause, which is the falling magnet. So the eddy currents and the second magnetic field produce an upward force on the magnet that tries to stop it from falling. That's why it falls more slowly. In other words, the eddy currents produce a braking effect on the falling magnet. It's because eddy currents always oppose whatever causes them that we can use them as brakes in vehicles, engines, and other machines.

How does an eddy current brake stop something moving?

Suppose we have a railroad train that's actually a huge solid block of copper mounted on wheels. Let's say it's hurtling along at high speed and we want to stop it. We could apply friction brakes to the wheels—or we could stop it with eddy currents. How? What if we put a giant magnet next to the track so the train had to pass nearby? As the copper approached the magnet, eddy currents would be generated (or "induced") inside the copper, which would produce their own magnetic field. Eddy currents in different parts of the copper would try to work in different ways. As the front part of the train approached the magnet, eddy currents in that bit of the copper would try to generate a repulsive magnetic field (to slow down the copper's approach to the magnet). As the front part passed by, slowing down, the currents would start generating an attractive magnetic field that tried to pull the train back again (again, slowing it down). The copper would heat up as the eddy currents swirled inside it, gaining the kinetic energy lost by the train as it slowed down. It might sound like a strange way to stop a train, but it really does work.

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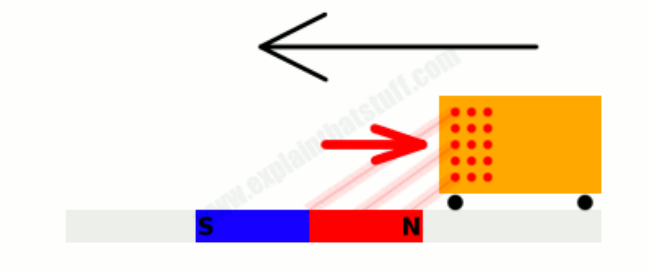

Artwork: Here's our simple copper block train moving from right to left, and I've embedded a giant bar magnet in the track to stop it. As the train approaches, eddy currents are induced in the front of it that produce a repulsive magnetic field, which slows the train down. If the train is moving really fast, this magnet might not stop it completely, so it'll keep moving beyond the magnet. As it moves past the other end of the magnet, the induced eddy currents will work to produce an attractive magnetic field that tries to pull the train backward, but still tries to slow it down. The basic point is simple: the eddy currents are always trying to oppose whatever causes them.

III. EDDY CURRENT CONTROLLED TRAFFIC ZONE: THE ROAD-CROSSING AID

Accidents are quite frequent, and we can't intend to live things as unpredictable. When things can be controlled at least to a minor extent, we can make a start by now. I intend to suggest the idea of an eddy current controlled traffic region or traffic den. The region of traffic signal should have eddy currents that will automatically control the brake of the vehicle and bring them up to a prescribed speed, so that hitting or collisions of vehicles standing on the traffic queue can be avoided. When the signal goes for the passers to walk-by, an automatic rail track should come up from the road that will have a human safety carrier that will carry the pedestrians to the other side of the road. This carrier should be made of such a material that any vehicle trying to beat the eddy currents generated much before the traffic line, could not reach this vehicle. It needs to be covered by a magnetic field that will push the vehicles away from it. The amount of eddy current can be increased from lower to highest as the vehicle moves closer and closer to the traffic signal. So the vehicle does not get any jerks, or sudden pressure because of any sudden brakes. These needs to be done because most of the time, sudden jerks felt by the vehicles are responsible for hitting the near-by vehicles and thus creating a colliding fall or dashing of the followed vehicles. So when the vehicles which are heading towards the traffic signal, they are automatically under the speed control and under any condition they can't cross the signal until they are supposed to, because of the rail track carrying the pedestrians to their destination. There needs to be 2 carriers (for each road, so 8 carriers for a 4 cross road junction) to carry the pedestrians to the to and fro as needed. Since the centre or the major area near the traffic signal is under high percentage of eddy current, the carrier also will be under control and will not collide or will not create any harm incase the brakes needs to be applied.

A well advanced computer system needs to be available at each point of the signal post. The work of this computer is to scan all the humans waiting to cross the road and accordingly decide the time needed to carry the people from one end to the other. This can be done on the basis of the seats provided in the carrier, the number of humans waiting, the distance between the 2 roads or the width of the roads, whichever applicable.

IV. EDDY CURRENT ON ROADS TO CONTROL VEHICLE BRAKES

Eddy pole is a collection of computer under network, with cameras with very high clarity, etc. There needs to be a computerized network, which will be available at equal distance of eddy poles. When a vehicle arrives at any pole, it will be scanned and every vehicle will be captured along with its vehicle registration number. These vehicles will be counted, and as per the width of the road, the message from the next pole and any unavoidable scenario between the 2 poles, a definite number of allowed vehicles between the two poles will be decided. The moment the decided limit is about to be reached, the eddy current needs to be discharged slowly so that the vehicles automatically catch up brake state and no vehicle over the decided limit will be allowed to cross the first pole till the second pole indicates a 'traffic clear' message. The basic idea is no overloading of vehicles between any 2 neighboring poles should be entertained.

V. EMERGENCY VEHICLES

Special provision needs to be made for emergency vehicles. This could be done by the human being assigned for each pole. An emergency message can be passed to the next pole about the sudden arrival of the emergency vehicle, so that all the vehicles before it can be cleared immediately and the allowed limit for next chain of vehicles between those 2 poles can be set to zero or a minimum value. Thus every pole will clear out the vehicles so that the emergency vehicle reaches its destination as soon as possible.

Advantages:

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The humans crossing are safe to a very large extent. They need not cross roads under nervousness. The pressure of crossing roads at signal for old people and kids won't be a trouble any longer. The rail tracks risen from the floor (road) will surely prevent people from breaking the traffic signal. If they intend to break the signal, then they will end up exercising a sudden brake because of eddy currents high percentage or they might even be stopped by the safety carrier's rail tracks.

At each pole, the amount of allowed vehicles is not random but quick and as per the current scenario of traffic between the 2 poles.

Every vehicle is tracked and scanned, thus enforcing safety and security too. Eddy current is cheaper as it won't wear out the tires of vehicles easily. The vehicle brakes are controlled mostly by eddy current as a result speed of the vehicle can be well controlled.

The driver need not worry or take pains to maintain a speed at different points; he will be indirectly guided for the same. Unlike friction based brakes, eddy current based brakes don't release toxic chemicals.

Disadvantages of eddy current brakes

The drawbacks of eddy current brakes are more to do with how little experience we have of using them in real-world settings. They generate heat too. Another important question is whether eddy-current brakes will ever become widespread, given the growing interest in regenerative brakes that capture and store the energy of moving vehicles for reuse (a much more energy-efficient approach than turning energy into useless heat with eddy currents).

VI. NEEDS (HARDWARE OR SOFTWARE REQUIREMENTS)

- A well advanced computer system with high storage to store the image captured of all the vehicles with time and date.
- A well advanced and reliable network connection to get up to date information from each pole.
- A continuous power supply.
- A human at every pole, if needed, etc
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VII. THE ENTIRE PROCESS FLOW

The eddy pole calculates the allowed number of vehicle between the 2 poles. The systems scans the vehicles and counts them and allows only the current limit of vehicles. As it reaches near the signal post, vehicle speed is automatically controlled. The vehicle stops. The system here calculates the time duration for which the percentage of eddy current should be lowered, this needs to be more than or equal to the actual time taken for the carrier to go from one end to other. It will be more if needs to take more than one rounds, if the number of pedestrians is more.

VIII. THE WORKING OF THE SOFTWARE

Calculate the distance between 2 poles. Follow FCSFS or priority scheduling as and how needed. If the distance between 2 vehicles is less than 10 m then the poles should slow down the count of vehicles crossing them. This means that the wait time for vehicles at the traffic signal should be increased. The count of rounds for the human carriers should not be more than 2. And the duration of the time needed for the carrier to move from one point to the other is decided by the distance between the 2 points. The vehicles neither the carriers should be made to wait indefinitely. This depends on many external factors like state of the road, width of the road, count of the pedestrians waiting, climatic conditions (rains), etc. The software can be edited as per the restrictions, example school area, hospitals etc.

CONCLUSSION

Life is precious. It is not worth to lose it by any accidental deaths. Instead of waiting till we become the victim, I just wish to make an attempt to think on a direction which is not so developed but can work wonders if taken in the proper spirit and attitude. Though this approach may require huge investment of time, effort and money it will surely be an aid for reducing the number of accidental deaths in India or globally. It indirectly aims in carrying every human safely. It means that every person walking on road need not fear about any unknown uncontrolled vehicle coming and dashing him down. He can work with a bit more hopes of safety on roads.

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