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BRAKE FAILURE INDICATOR AND ENGINE OVER HEATING ALARAM

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Abstract-The aim is to design and develop a control system based an electronically controlled automatic brake failure indicator and engine over heating alarm by using heat sensor is called **"BRAKE FAILURE INDICATOR AND ENGINE OVER HEATING ALARM".** Automatic brake failure indicator and engine over heating alarm is consists of Arduino Uno circuit, Heat sensor, Control Unit and frame. The sensor is used to detect the Heat of the Engine. There is any disconnection of the brake wire or cutting of any few turns of brake wire, the control signal to the alarm unit. Similarly the heat sensor is fixed to the engine and this heat is measured and giving the alarm signal when the engine heat exceeds the setted temperature limit.

Keywords: Braking system, Sensors, Microcontroller, Stepdown Transformer, Bridge Rectifier

1. INTRODUCTION

Car safety is the avoidance of automobile accidents or the minimization of harmful effects of accidents, in particular as pertaining to human life and health. Special safety features have been built into car's occupants only, and some for the safety of others. We have pleasure in introducing our new project "automatic head light dim/bright controller and engine over heat alarm" which is fully equipped by sensors circuit, dim/bright light and engine over heat alarm circuit. It is genuine project which is fully equipped and designed for automobile vehicles. This forms an integral part of best quality. This product underwent test in our automobile vehicles and it is good. The major components of the project are follows In this Project we are using control unit to check the Brake condition and Engine heat. Here we are sending the signal voltage through the Brake Wire from one end to other end. At the other end in the wheel the signal conditioning unit checks that whether the signal voltage in the Brake wire is available or not. The braking system of a vehicle is undoubtedly one of its more important feature. The aim of this work is to create a better braking system with indicator. Brake failure occurs only because of worn out of brake shoe and cut in liner. It consists of two sensors. One sensor is connected with the brake shoe. The other sensor is the brake liner. The signal from the two sensors is given to a microcontroller. When the brake shoe is worn out, the sensor senses signal to the microcontroller. Also if the brake liner is cut, the sensor sends signal to the microcontroller.

1.1 HISTORY OF BRAKING SYSTEM

A brake is amechanical device that inhibits motion by absorbing energy from a moving system. It is used for slowing or stopping a moving vehicle, wheel, axle, or to prevent its motion, most often accomplished by means of friction. Most brakes commonly use friction between two surfaces pressed together to convert the kinetic energy of the moving object into heat, though other methods of energy conversion may be employed. For example,regenerative braking converts much of the energy to electrical energy, which may be stored for later use. Other methods convert kinetic energy into potential energy in such stored forms as pressurized airor pressurized oil.Eddy current brakes use magnetic fields to convert kinetic energy into electric current in the brake disc, fin, or rail, which is converted into heat. Still other braking methods even transform kinetic energy into different forms, for example by transferring the energy to a rotating flywheel. Brakes are generally applied to rotating axles or wheels, but may also take other forms such as the surface of a moving fluid (flaps deployed into water or air). Some vehicles use a combination of braking mechanisms, such as drag racing cars with both wheel brakes and a parachute, or airplanes with both wheel brakes and drag flaps raised into the air during landing. Since kinetic energy increases quadratically with velocity($K=MV^2/2$), an object moving at 10 m/s has 100 times as much energy as one of the same mass moving at 1 m/s, and consequently the theoretical braking distance, when braking at the traction limit, is up to 100 times as long. In practice, fast vehicles usually have significant air drag, and energy lost to air drag rises quickly with speed. Friction brakes on automobiles store braking heat in the drum brake or disc brake while braking then conduct it to the air gradually. When traveling downhill some vehicles canuse their engines to brake. When the brake pedal of a modern vehicle with hydraulic brakesis pushed against themaster cylinder, ultimately a piston pushes the brake pad against the brake disc which slows the wheel down. On the brake drumit is similar as the cylinder pushes the brake shoes against the drum which also slows the wheel down. Motorcycle braking systems have varied throughout time, as motorcycles evolved from bicycles with an engine attached, to the 220 mph (350 km/h) prototype motorcycles seen racing in MotoGP. Most systems work by converting kinetic energy into thermal energy (heat) by friction. When the brake pedal of a modern vehicle with hydraulic brakesis pushed against themaster cylinder, ultimately a piston pushes thebrake pad against the brake disc which slows the wheel down. On the brake drum it is similar as the cylinder pushes thebrake shoes against the drum which also slows the wheel down. Motorcycle braking systems have varied throughout time, as motorcycles evolved from bicycles with an engine attached, to the 220 mph (350 km/h) prototype motorcycles seen racing in Moto GP. Most systems work by converting kinetic energy into thermal energy (heat) by friction. On motorcycles, approximately 70% of the braking effort is performed by the front brake. This however can vary for individual motorcycles; longer-wheelbase types having more weight biased rearward, such as cruisers and tourers, can have a greater effort applied by the rear brake. In contrast, sports bikes with a shorter wheelbase and more vertical fork geometry can tolerate higher front braking loads. For these reasons, motorcycles tend to have a vastly more powerful front brake compared to the rear. Early motorcycles which were essentially a bicycle with a motor attached and did not have any braking system beyond slowing the motorcycle down and putting a foot out. One of the first motorcycles to have any sort of braking mechanism was made by Steffey Motorcycles of Philadelphia in 1902. This used a spoon brake operating on the front wheel only. Around 1909band brakeswere introduced, these used a band contracting round the outside of a drum. Douglas motorcycles were available with Research Association disc brakes front and rear on their 1923 RA model, sometimes called TT model, with Freddie Dixon's 1923sidecar TT-winning machineof that type also having a passenger-operated disc brake for the sidecar wheel. In 1989 BMW released the first motorcycle to be equipped with anti-lock brakes (ABS). The system fitted to the BMW K100 LT weighed significantly more than the light weight systems fitted to modern motorcycles. The front suspension on theYamaha GTS1000released in 1993 was a single sided swingarm that among other characteristics aimed to reduce diving under braking. The design only allowed for a single front disc brake so a comparatively large 330 mm disc was mated to a sixpiston calliper, a world first on a production bike.

1.2 TYPES OF BRAKING SYSTEMS:

1. Foot brake and Handbrake Braking system
2. Internal Expanding Braking system
3. External Contracting Braking system
4. Mechanical Braking system
5. Power Braking system
6. Vacuum Braking system
7. Air Braking System
8. Hydraulic Braking System
9. Electric Braking System
10. Anti-lock Braking System

1.2.1 FOOT AND HAND BRAKING SYSTEM

Foot brake and hand brake is also known as parking and emergency brake. In most passenger cars, the mechanical brake is operating by hand or foot is used for parking and emergency brakes. These brakes either act on the rear wheels or are attached to the transmissionor on the propeller shaft. The brake lever is mounting under the instrument panel to the left of the driver. When the brake is applied, the lever is locked in place by a ratchet. For releasing the brakes, different methods are used. Some hand brakes are released by squeezing the level and control finger together, others are released by turning the lever and pushing it down. The foot pedal is released by special release levers. In rear-wheel-type parking brakes, a cable or pull rod connects the parking or emergency lever to an idol lever that is mounting on the cross member of the frame. The idler lever pulls forward against the action of the pullback spring. Two cables that engage the rear wheel brake are also pulled when applying the brakes. Transmission or propeller shaft parking brakes are of three types,

- External containing type
- Internal containing type
- Disc type

All these types of brakes operate to lock the transmission main shaft or the propeller shaft when the mechanical brake is applied. As the rear wheels are connected to the propeller shaft through theaxle shaft,differential, anduniversal joint,the rear wheel is prevented from turning when the propeller shaft is locked.

Figure 1.Hand Braking System

1.2.2. INTERNAL EXPANDIND BRAKING SYSTEM:

This type of brake consists of two shoes that are S1 and S2. The outer surface of the shoes is lined with some frictional material. Each shoe is pivoted about a fixed fulcrum O1 at one end and at the other end they are made to contact a cam.The shoes are held in a closed position with aspring. The drum contains the entire mechanism to keep out dust and moisture. When the cam rotates, S1 and S2 shoes are pushed outward against the rim of the drum. Friction between the shoe and the drum produces braking torque and therefore reduces drum speed. Such brakes are generally used in motor cars and light trucks.

Figure 1.1Internal Expanding Brake

1.2.3. EXTERNAL CONTACTING BRAKING SYSTEM:

External contract brakes are sometimes used on motor vehicles for parking brakes, and cranes, and to control the speed of the auxiliary drive shaft. In working, the brake band (or shoes) of the external lever is tightened around the drum being rotated by moving the brake lever.The brake band is made of comparatively thin, flexible steel, shaped to fit the drum, with an abrasive line to the inner surface. This flexible band cannot withstand the high pressure required to produce the friction required to stop a vehicle with a high load or speed, but it works well as a parking brake or holds the brake.

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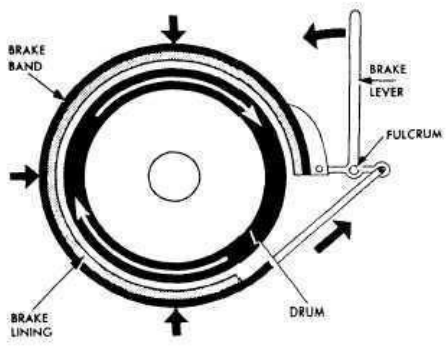

Figure 1.3: External Contracting brake

1.2.4 DISC BRAKE

A disc brake is a type of brakethat uses the caliperst o squeeze pairs of pad sagainst a disc or a "rotor"to create friction.[2]This action slows the rotation of a shaft, such as avehicleaxle, either to reduce its rotational speed or to hold it stationary. The energy of motion is converted into waste heat which must be dispersed.Hydraulically actuated disc brakes are the most commonly used form of brake for motor vehicles, but the principles of a disc brake are applicable to almost any rotating shaft. The components include the disc, master cylinder, caliper (which contains cylinder and two brake pads) on both sides of the disc.

Figure 1.4: Disc Brake

2. METHOD &METHODOLOGY

2.1 Methodology

Today, Machines are widely controlled by automated control system. To meet the need of growing population economic, effective and reliable control of machines as well as their control system is necessary. The main objective of this project is to continuously monitor the braking system at each and every time during the operation of the vehicle. Now a days, accidents are occurring due to lot of reasons, the one of the main reason is brake failure, it caused to due to poor maintenance, improper use and product defect, in order to safe guard the valuable human for accident the accident monitoring of brake is very important issue in automobile.Almost 40% of the accidents occur because of brake failure issue. With early identification of this condition, we can reduce accident rate. The project 'Automobile Brake Failure Indicator' is the solution to this global issue. You might be wondering how this project is responsible to lower accident rate. Well, this indicator circuit keeps an eye on the condition of the brake at regular intervals and provides audio-visual indication of the situation. The project includes two LEDs and a piezo buzzer as indicators. Under normal circumstances when the brake is applied, green LED blinks and piezo buzzer beeps for a second. However, during brake failure, red LED glows and buzzer doesn't beep). The project AutomobileBrake Failure Indicator is limited to those vehicles with negative grounding, else this project..

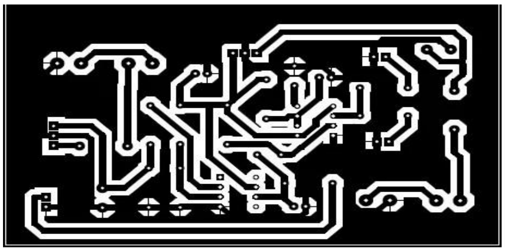

Figure 2.Solder Side Printed Power Supply Board

The drop-in fluid pressure is only noticeable when the fluid leakage is high enough to cause heavy drop in the pressure level of the brake. The project informs every single time the brake is applied.Talking about the circuit elements, it uses an op-amp IC CA3140 (IC2) as voltage comparator and a timer NE555 (IC3) in monostable configuration to sound an alarm. The voltage level across the brake switch is monitored by the IC2 to check pressure level. Half amount of the supply voltage is fed to the pin3 (non-inverting) of IC2 through potential divider resistors R3 and R4, each of 10 kilo-ohms. Similarly, the brake switch is linked to the inverting input pin 2 of IC2 via diode D1, IC 7812 (IC1) and resistor R2. When the brake is applied, pin2 receives high voltage. Initially, the output of IC2 is high and the red LED is on. The output from IC2 activates the IC3 once it is fed as input through coupling capacitor C2 to trigger pin 2. To maintain input stability of IC2, resistor R1 is included. A combined combination of IC1 along with capacitor C1 offer a ripple-free regulated supply to the inverting input of IC2. IC3 provides output pulse of one second and it is wired as such; a monostable. Resistor R7 and capacitor C4 serve as timing elements and they contribute to high output for a second to operate the buzzer and green LED. Initially, the buzzer and green LED are off as the trigger pin of IC3 is high due to resistor R6. Once the brake switch is closed, IC2 receives high voltage via pin2 and the IC output falls low to turn the red LED off. IC3 gets triggered by the low output of IC2 which passes through C2. Finally, the buzzer beeps and green LED turns on to indicate that the brake is working smoothly. However, in case of failure, even after the brake is applied, red LED keeps on glowing and buzzer doesn't sound.

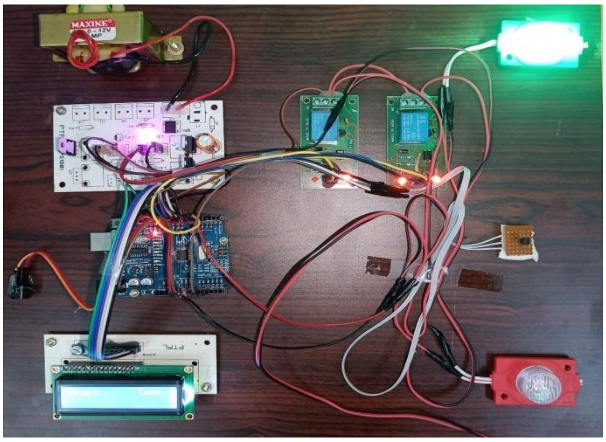

Figure 2.1: Circuit

2.2 POWER SUPPLY

All digital circuits require regulated power supply. In this article we are going to learn how to get a regulated positive supply from the mains supply.

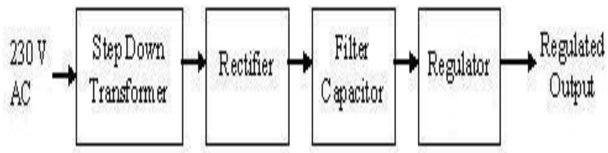

Figure 2.2 Basic block diagram of a fixed regulated power supply.

2.2 TRANSFORMER

A transformer consists of two coils also called as "WINDINGS" namely PRIMARY & SECONDARY. They are linked together through inductively coupled electrical conductors also called as CORE. A changing current in the primary causes a change in the Magnetic Field in the core & this in turn induces an alternating voltage in the secondary coil. If load is applied to the secondary then an alternating current will flow through the load. If we consider an ideal condition then all the energy from the primary circuit will be transferred to the secondary circuit through the magnetic field. So

$$P_{primary} = P_{secondary}$$

$$I_p V_p = I_s V_s$$

The secondary voltage of the transformer depends on the number of turns in the Primary as well as in the secondary.

2.3 RECTIFIER

A rectifier is a device that converts an AC signal into DC signal. For rectification purpose we use a diode, a diode is a device that allows current to pass only in one direction i.e. when the anode of the diode is positive with respect to the cathode also called as forward biased condition & blocks current in the reversed biased condition.

2.5 VEHICLE FRAME

Square Bar is a metal bar that has a square cross section. These bars are widely used in many industries for general assembly or manufacturing. They are also used for general repairs of plant equipment and railings. Common applications include ornamental iron work, gates and protective barriers on windows

By using Arc Welding the fabrication of the frame is done. Arc welding is awelding process that is used to join metal to metal by using electricity to create enough heat to melt metal, and the melted metals, when cool, result in a binding of the metals. It is a type of welding that uses awelding power supplyto create anelectric arcbetween a metal stick ("electrode") and the base material to melt the metals at the point of contact. Arc welders can use eitherdirect(DC) oral ternating(AC) current, and consumable or non-consumable electrodes.

Figure 2.3: Welding of Frame

The welding area is usually protected by some type ofshielding gas(e.g. an inert gas), vapor, or slag. Arc welding processes may be manual, semi-automatic, or fully automated. First developed in the late part of the 19th century, arc welding became commercially important in shipbuilding during the Second World War. Today it remains an important process for the fabrication of steel structures and vehicles. The Rear Wheel is attached to the Iron Bars by using spindle. This spindle will rotate the wheel. The size of the tyre is 2.75-18. Motorcycle tyres provide the only contact with the ground and play a very important role in how a motorcycle responds to acceleration, steering, braking, handling, absorbing road undulations and carrying the load of the rider and passenger. Riders should learn how to care for tyres to keep them in good condition and more importantly, when to replace old or worn outtyres for safety and control.

3. WORKING PRINCIPLE

In this Project we are using control unit to check the Brake condition and Engine heat. Here we are sending the signal voltage through the Brake Wire from one end to other end. At the other end in the wheel the signal conditioning unit checks that whether the signal voltage in the Brake wire is available or not. If the Brake Wire is in the good condition the signal and conditioning unit check that in coming small voltage signal. If any cut in the Brake wire there is no voltage signal in the braking end so signal and conditioning unit send the signal to control. Now the control unit activates the alarm through the driver circuit. The alarm gives the audible Indication to the Rider. In the same, if an engine temperature increase, heat sensors detects the temperature difference and activates the alarm through control unit.

3.1 BLOCK DIAGRAM

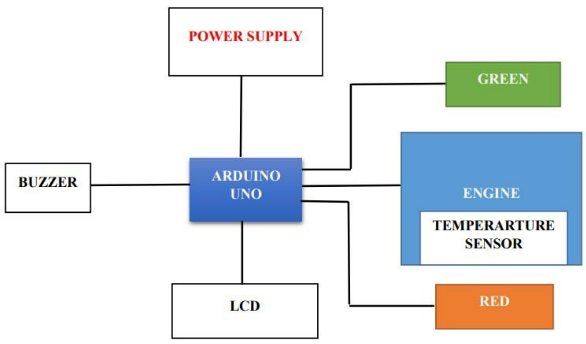

Figure 3: Block Diagram

3.2 DESIGN

As the goal is to monitor the brake condition and engine temperature (which we will discuss in the coming paragraphs), we will first design a frame for the wheel attachment. The design of the frame is simple. This frame is done by using 1x1 hollow square iron bar. After the successful completion of the frame, the wheel is attached to the frame with the help spindle. This frame is completely fixed to the frame by help welding this wheel is attached to the frame. It is simulation project, so that in this project we place a simple hollow square box to show that the engine is attached. The simulation of engine is shown in shown in Figure 4.14. After the design of frame, next the design of automatic brake failure indicator and engine overheating alarm circuit is designed. This circuit is placed infront of the wheel.

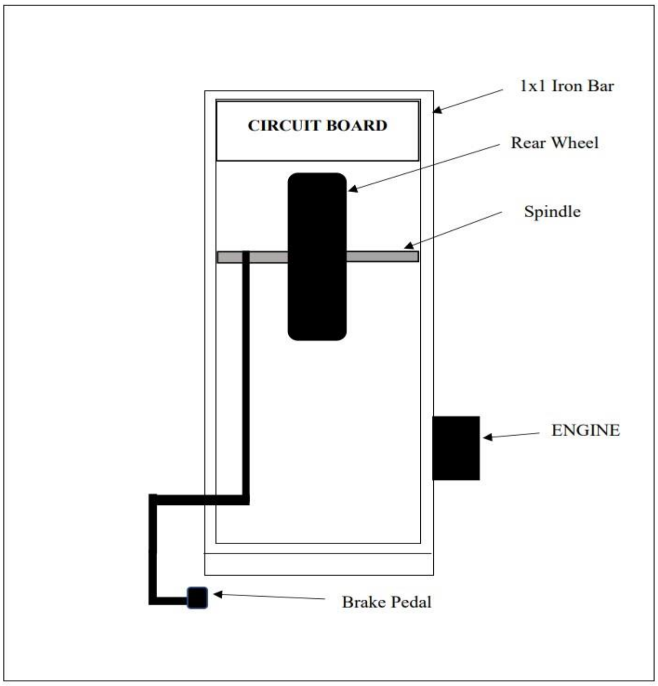

Figure 3.1: Design of Vehicle Frame

The simulation of the Engine is shown in the above Figure. The engine is attached to the vehicle frame. The LM35 Temperature sensor is placed nearly 1cm to the engine. This Temperature sensor is sense the temperature of the engine, it sense the temperature from -55 degrees Centigrade to 150 degree centigrade. If the temperature of the engine is less than or near to 80 degrees then the Temperature of the engine is in good condition and shows in the LCD that the engine is OK. If the temperature of the engine is above 150 degrees centigrade then the engine condition is not OK and the we get the indication in the LCD and Beep sound will come and red light indication also come.

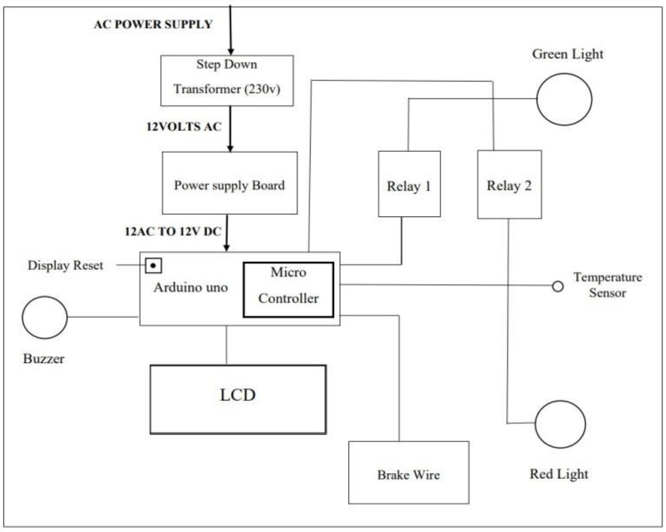

Figure 3.2: Circuit Diagram

3. Calculations

1. Step Down Transformer
2. Converts 230volts to 12volts AC
3. LM35
4. Minimum Temperature Sensed = 2° C
5. Maximum Temperature Sensed = 150° C
6. Less than 80°C
7. Output = Green Light
8. More than 80°C to 150°C
9. Output = Red Light With Beep Sound
10. Distance between Engine and Sensor = 1CM
11. Bridge Rectifier
12. Converts 12v AC to 12v DC
13. Code Dumped in the Microcontroller = Embedded C
14. Brakeshoe Thickness
15. Maximum Thickness = 12mm
16. Minimum Thickness = 6mm

TRAIL 1:

Engine Temperature = 30^0 C
Brake Condition = NORMAL
RESULT:
Engine Condition OK & Brake Condition OK
GREEN LIGHT ON & NO BEEP SOUND

TRAIL 2:

Engine Temperature = 50^0 C
Brake Condition = Brake Wire Cut
RESULT:
Engine Condition OK & Brake Condition OK
RED LIGHT ON & BEEP SOUND ON

TRAIL 3:

Engine Temperature = 80^0 C
Brake Condition = Fail
RESULT:
Engine Overheated & Brake Failed
RED LIGHT ON & BEEP SOUND ON

TRAIL 4:

Engine Temperature = 30^0 C
Brake Condition = Fail
RESULT:
Engine Overheat & Brake Failed
RED LIGHT ON & BEEP SOUND ON

4. CONCLUSION

In this Project we are using control unit to check the Brake condition and Engine heat. Here we are sending the signal voltage through the Brake Wire from one end to other end. At the other end in the wheel the signal conditioning unit checks that whether the signal voltage in the Brake wire is available or not. The braking system of a vehicle is undoubtedly one of its more important feature. The aim of this work is to create a better braking system with indicator. Brake failure occurs only because of worn out of brake shoe and cut in liner. It consists of two sensors. One sensor is connected with the brake shoe. The other sensor is the brake liner. The signal from the two sensors is given to a microcontroller. When the brake shoe is worn out, the sensor senses signal to the microcontroller. Also if the brake liner is cut, the sensor sends signal to the microcontroller. The aim of this research is to design and develop an experimental model that can be automatically minimize the break failure and control engine overheating by utilizing Microcontroller and temperature sensor, while the objectives of this research to develop and implement a Vehicle brake failure and engine overheating system, to develop a control and monitoring unit consisting of a network of sensors and embedded hardware system, to develop an IOT based system for remote monitoring of the car brake failure and engine overheating system and finally to test and analyze the performance of the developed system.

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