DESIGN AND DEVELOPMENT OF BRAKE BLEEDER KIT USING VACCUM PUMP

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Abstract— In this study, a vacuum-type brake fluid bleeder and recovery machine is capable of taking out brake fluid dirt impurities, removing air in the brake system, and detecting water content in brake fluid is designed and developed. This machine can be utilized for brake fluid recovery: extracting air from fluid assisted by an alarm as to when the bleeding task was completed; measuring the amount of destructive water present in the brake fluid; and purifying brake fluid from impurities (dirt) and determining if the fluid is eligible for re-use. This can address the unavailability of appropriate equipment for automotive hydraulic brake maintenance and servicing for automotive service providers. Moreover, this can also be utilized as Laboratory trainer for automotive training centers and schools in the area of automotive servicing, maintenance, and repair. This is an effective and safe machine to use for students' laboratory performance on hydraulic brake system servicing.

Keywords — Brake fluid bleeder, recovery machine, vacuum-type, brake fluids, hydraulic brake system.

I. INTRODUCTION

Of all the systems that make car, the brake system might just be the most important. Its function determined the safety of the driver, passenger and also pedestrian. In the olden days it was also one of the simplest. Over the years as improvements have been made, the system that has evolved isn't so simple anymore.

Brake system work as hard or harder than any other part of the car, however much energy it takes to get the car up a hill, it takes at least as much energy to stop it at the bottom. In general, there are three main functions of a brake system, to maintain a vehicle's speed when driving downhill, to reduce a vehicle's speed when necessary and to hold a vehicle when in parking. When the brakes were applied, the pads or shoes that press against the brake drum or rotor convert kinetic energy into thermal energy via friction.

The cooling of the brakes dissipates the heat and the vehicle slows down. This is all to do with The First Law of Thermodynamics, sometimes known as the law of conservation of energy. This law states that energy cannot be created nor destroyed; it can only be converted from one form to another. In the case of brakes, it is converted from kinetic energy to thermal energy. Assisstant

In the process of performing this function, the brakes absorb either kinetic energy of the moving member or the potential energy given up by objects being lowered by hoists, elevators etc. The energy absorbed by brakes is dissipated in the form of heat. This heat is dissipated in the surrounding atmosphere to stop the vehicle, so the brake system should have following requirements:

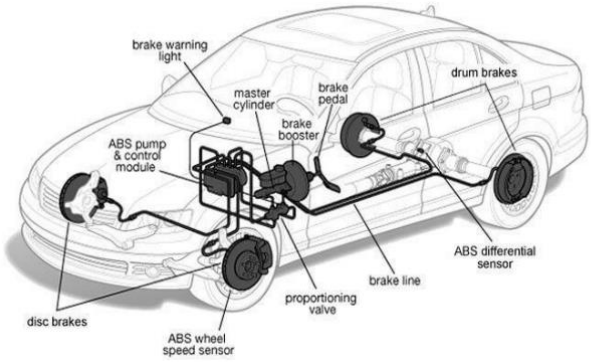
1) The brakes must be strong enough to stop the vehicle with in a minimum distance in an emergency.

2) The driver must have proper control over the vehicle during braking and vehicle must not skid.

3) The brakes must have well anti fade characteristics i.e. their effectiveness should not decrease with constant

prolonged application.

4) The brakes should have well anti wear properties.



Brake bleeder kit

II. LITERATURE SURVEY

A brake is a device for slowing or stopping the motion of a machine or vehicle, or alternatively a device to restrain it from starting to move again. Brakes of some description are fitted to most wheeled vehicles, including automobiles of all kinds, trucks, trains, motorcycles, and bicycles. Baggage carts and shopping carts may have them for use on a moving ramp. Some airplanes are fitted with wheel brakes on the undercarriage. Some aircraft also feature air brakes designed to slow them down in flight. Friction brakes on cars store the heat in the rotating part (drum brake or disc brake) during the brake application and release it to the air gradually The kinetic energylost by the moving part is usually translated to heat by friction. Alternatively, in regenerative braking, much of the energy is recovered and stored in a flywheel, capacitor or turned into alternating current by an alternator, then rectified and stored in a battery for later use. Kinetic energy increases with the square of the velocity. This means that if the speed of a vehicle doubles, it has four times as much energy. The brakes must therefore dissipate four times as much energy to stop it and consequently the braking distance is four times as long. When the brake pedal is depressed, the vehicle's braking system transmits the force from your foot to its brakes through a fluid. Since the actual brakes require a much greater force than the leg could apply with, vehicle must also multiply the force of foot. It does this in two ways; mechanical advantage (leverage) and hydraulic force multiplication. The brakes 8 transmit the force to the tires using friction, and the tires transmit that force to the road using friction also [8]. The modern automotive brake system has been refined for over 100 years and has become extremely dependable and efficient. The typical brake system consists of disk brakes in front and either disk or drum brakes in the rear connected by a system of tubesand hoses that link the brake at each wheel to the master cylinder. When the brake pedal is pressed, it pushed against a plunger in the master cylinder which forces hydraulic oil (brake fluid) through a series of tubes and hoses to the braking unit at each wheel. Since hydraulic fluid (or any fluid for that matter) cannot be compressed, pushing fluid through a pipe is just like pushing a steel bar through a pipe. Unlike a steel bar, however, fluid can be directed through many twists and turns on its way to its destination, arriving with the exact same motion and pressure that it started with. It is very important that the fluid is pure liquid and that there is no air bubbles in it. Air can compress which causes sponginess to the pedal and severely reduced braking efficiency. If air is suspected, then the system must be bled to remove the air.

III.EXPERIMENTAL DETAILS

MATERIALS & METHODOLOGY

GREY CAST IRON:

Grey cast iron is the material most commonly used in passenger cars andcommercial vehicles: EN-GJL-150, EN-GJL-200, EN-GJL-250 and in part also EN-GJL-300(flake graphite

cast iron). The casting compound is adapted to the specific application in the vehicle by adding various alloying components such as silicon and manganese. Explanation of designation: GJL = flake graphite cast iron, 250 = minimum tensile strength 250 N/mm2

HIGH-CARBON BRAKE DISCS {HIGH CARBON}:

The brake discs or the friction ring on composite brake discs are made of grey cast iron with higher carbon content for improved heat transfer. The brake disc heats up more uniformly in the braking process and, conversely, also cools down more uniformly. This results in lower thermal deformation of the brake discs with a positive effect on the judder characteristics of the brake. Due to the casting compound, the wear propertiesand tensile strength of high-carbon brake discs are slightly higher than those of conventional cast iron break discs. Example: EN-GJL-200 HC

STAINLESS STEEL:

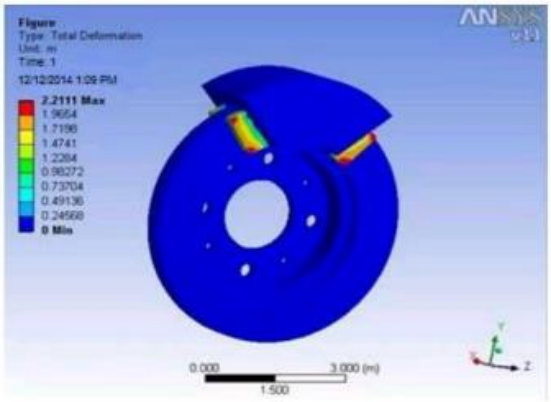
Brake discs made from stainless steel are mainly used on motorcycles as well as bicycles. Brake pads made of sintered metal or semimetal is used in connection with such discs. Drilled and slotted versions of stainless steel brake discs are also available. Two brake discs are sometimes used on the front wheel of high-powered motorcycles. The brake discs can be mounted in a floating arrangement to isolate vibration.

CARBON CERAMIC:

Carbon ceramic brake discs are around 50% lighter than conventional brake discs made of cast iron. This reduces the unstrung mass of the chassis, thus having a positive effect 45 on the handling characteristics of the vehicle. Carbon ceramic brake discs are made up of a basic body and two friction layers on both sides. Both the basic body and the friction layers are made of carbon fiber-reinforced silicon carbide. Extremely hard – the carbon fibers increase its strength and fracture toughness – the impact strength however is low.

The intricate process to produce carbon ceramic brake discs takes about 20 days and is extremely cost-intensive. Consequently they are considerably more expensive than cast iron brake discs and are predominantly used on luxury and sports cars.

A Structural analysis calculates deformations, stresses, and strains on model in response to specified constraints. A static analysis gives certain information about model. For example, a static analysis tells us if the material in our model will stand stress and if the part will break (stress analysis), where the part will break (strain analysis), and how much the shape of the model changes (deformation analysis). In this project work two different pad material – Ceramic& composite Fiber are analyzed using FEM Software ANSYS. The present study can provide a useful design tool and improve the brake performance of disk brake system based on the strength and rigidity criteria.



Types of Solution Methods

Two solution methods are available for solving structural problems. ➢ The h-method

➢ The p-method

The h-method can be used for any type of analysis, but the p-method can be used only for linear structural static analyses. Depending on the problem to be solved, the h method usually requires a finer mesh than the p-method. The p-method provides an excellent way to solve a problem to a desired level of accuracy while using a coarse mesh. ANSYS automatically calculates all measures valid for a static analysis.

Following points are important when specifying loads and constraint sets for static analyses:

➢ If you delete a constraint or load set that you included in an analysis, you also delete that set from the analysis. Even if you create a new set with the same name as the set you deleted, you must edit the analysis and reselect the set. Otherwise, you may invalidate the analysis and any design studies in which you included the analysis. ANSYS calculates results separately for each load set you include in the analysis.

VI. RESULT

The two different pad material – Ceramic & composite Fiber are analyzed using FEM Software ANSYS following are details of structural Analysis. These materials have proven to have advantages and disadvantages regarding environmental friendliness, wear, noise and stopping capability. Asbestos pads caused health issues and organic compounds can't always meet a wide range of braking requirements. Unfortunately, the steel strands used in semi metallic padsto provide strength and conduct heat away from rotors also generate noise and are abrasive enough to increase rotor wear. Since they were first used on a few original equipment applications in 1985, friction materials that contain ceramic formulations have become recognized for their desirable blend of traits.

This allows the ceramic pads to handle high brake temperatures with less heat fade, provide faster recovery after the stop, and generate less dust and wear on both the pads and rotors. And from a comfort standpoint, ceramic compounds provide much quieter braking because the ceramic compound helps dampen noise by generating a frequency beyond the human hearing range.

Another characteristic that makes ceramic materials attractive is the absence of 48 noticeable dust. All brake pads produce dust as they wear. The ingredients in ceramic compounds produce a light-colored dust that is much less noticeable and less likely to stick to the wheels. Consequently, wheels and tires maintain a cleaner appearance longer. Ceramic pads meet or exceed all original equipment standards for durability, stopping distance and noise. According to durability tests, ceramic compounds extend brake life compared to most other semi-metallic and organic materials and outlast other premium pad materials by a significant margin - with no sacrifice in noise control, pad life or braking performance.

V CONCLUSION

A vacuum-type brake fluid bleeder and recovery machine (VBFBRM) is successfully designed, developed, and fabricated to be utilized for brake fluid recovery: extracting air from fluid assisted by an alarm as to when the bleeding task was completed; measuring the amount of destructive water present in the brake fluid; and purifying brake fluid from impurities (dirt) and determining if the fluid is eligible for re-use. All these unified functions and capabilities of this machine make this project very viable with the presence of locally available materials.

VI FUTURE SCOPE

In Regenerative braking system instead of wasting the kinetic energy of vehicle in the form of heat it is converted into electrical energy to be stored in batteries and capacitors or as mechanical energy of a flywheel having large moment of inertia. In thisway a large proportion of energy of vehicle is saved only to be used later for either accelerating the vehicle or for different electrical purpose. This type of regenerative system is used in electrical or hybrid electrical vehiclesas it makes use of electric motors. The drive shaft of vehicle is connected to a motor, when current is supplied to motor it starts rotating and in turn rotates the drive shaft of vehicle. When brakes are to be applied, the driver presses the brake pedal which cuts off the current supply to motor.

Now motor is no longer providing torque to the

drivingshaft, instead the inertial kinetic energy and momentum of vehicle drives the motor, electric motor now starts acting as a generator resisting the inertial rotational motion ofvehicle to slow down the vehicle besides producing electricity.

This electricity can be stored in battery or capacitor. This regenerative braking system consists of a flywheel having a large moment of inertia, so that it requires a large torque for rotational acceleration. There is a provision for engagement and disengagement of flywheel with the drive shaft. When driver needs to slow down or stop the vehicle, the flywheel is engaged with the drive shaft with the help of gears.

As flywheel gets engaged power now goes divided between driving shaft and flywheel, flywheel having a large moment of inertia absorbs the power from engine in the form of rotational kinetic energy and brings the vehicle to halt and this rotational kinetic energy of flywheel can be used further to accelerating the vehicle. Since it has huge momentum so it takes a great deal of stopping and changing its speed takes a lot of effort. If an engine supplies power intermittently, the flywheel compensates for surplus or deficit power. So flywheel helps to smooth out the power wheel receives. The Adaptive Headlights System is a system which regulates automatically the light distribution of a vehicle.

Logic behind developing new headlight system is simply to turn the headlight according to the rotation of the steering. Few critical design factors considered during inception stage were ease of availability, affordability and reliability of the components use. It is also observed that the system can be accommodated in the current low cost models without major changes.

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