



Research Article

HYDRAULIC BRAKE AND CLUTCH BLEEDER

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ABSTRACT

The study aimed to construct a device that will be helpful for every automotive mechanic in terms of bleeding automobiles brakes and clutch system. The Hydraulic Brake and Clutch Bleeder was fabricated from locally available materials making it more cost effective. The device is operated by one person that simplifies the task of bleeding the system, and with less chance for the wear and tear of parts that may occur during the process. The device is users friendly with fewer operation procedures.

The Hydraulic Brake and Clutch Bleeder was evaluated by the experts and automotive technician from the various automotive shop and also persons who have knowledge about automobile. It was evaluated based on three (3) criteria such as functionality, efficiency and effectiveness, and safety. The Hydraulic Brake and Clutch Bleeder was rated by 30 respondents from the academe and industry. It gained an overall rating 4.55 which means that the device is highly acceptable.

KEY WORDS: Hydraulic, brakes, clutch, bleeder

INTRODUCTION

The advance of technology creates hundreds of opportunities to perform some service in a new improved manner. Technology includes the use of materials, tools, techniques, and sources of power to make life easier or more pleasant and work more productive. This application of knowledge to the practical aims of human life or to changing and manipulating the human environment is the paradigm that leads the researchers to conduct this study. Whereas science is concerned with how and why things happen, technology focuses on making things happen. [1]

Despite the increasing industry demand for new technology and improving educational backdrop, many public higher education institutions have to keep up with both industrial and educational trends and challenges. The shortfall of teaching devices is a common problem in most state universities and colleges including Bulacan State

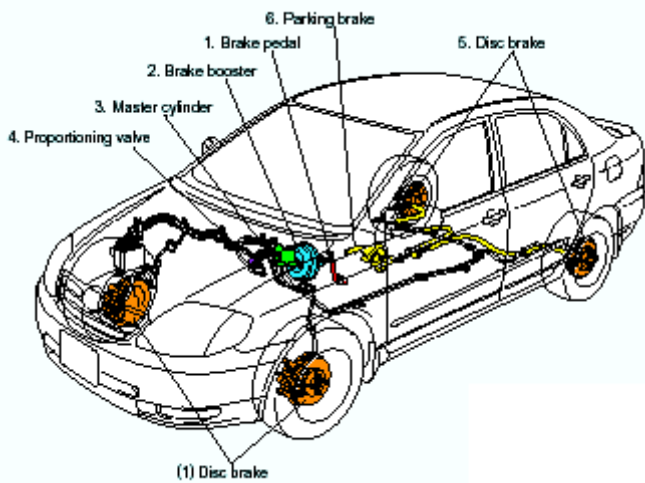
University due to national budget-cut. Resorting to the idea of fabricating devices from supplies and materials locally available is one of the considerations. Improvisation of the device is a practical response to the call of the time for cost-cutting measures.

Explicitly, Automotive Technology courses and subjects must be made more effective and meaningful in the learning process, despite budgetary constraints. Appropriate demonstration and satisfactory laboratory tools and equipment should be made available since the course; Automotive Technology needs more attention with respect on this aspect.

One of the most common tasks in automotive servicing, particularly under chassis work is on servicing the brake system. The automobile braking system is used to control the speed of the vehicle. The system must be designed to enable the vehicle to stop or slow down at the driver's command. The brake system is composed of many parts as shown in Fig.1, which includes the master cylinder,

friction pads on each wheel, wheel cylinders, brake lines and hydraulic control system .[2]

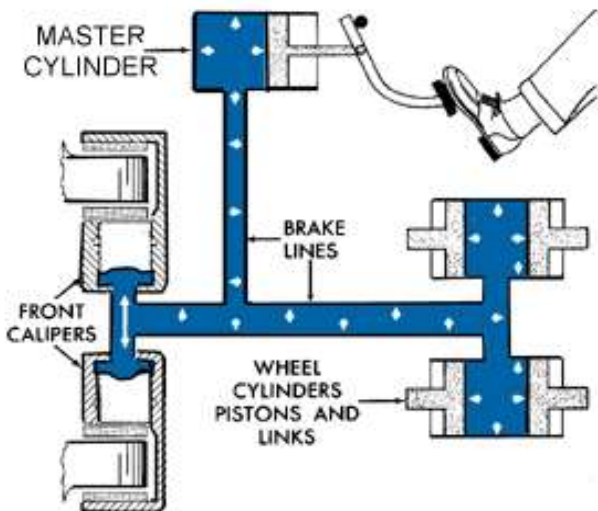
Figure 1: Typical Automotive Braking System (Toyota Motors Corp.)



The system starts at the brake pedal which is attached to a master cylinder. When force is applied to it, forces the hydraulic fluid through series of brake pipes and flexible hoses to the wheel cylinder of each wheel. Fluids play an important part in the braking system as it transfers the motion of operator’s foot to the cylinders and piston at each brake as illustrated in Fig. 2. Because hydraulic fluid cannot be compressed unlike gasses which are compressible, it is very significant that the fluid is pure liquid and that there are no air bubbles in it. This will reduce the amount of force that can be transmitted. Air can be compressed which causes sponginess to the pedal and severely reduced braking efficiency. [3]

If air is suspected in the brakes, then the system must be bled to remove the air. This is called *bleeding* the brake system. Brake system provides “bleeder screws” at each wheel cylinder and caliper for this purpose.

Figure 2: Shows how brake fluid works in the system (www.carparts.com)



Brake bleeding as one service procedure performed on hydraulic brake systems whereby the brake lines (the pipes and hoses containing the brake fluid) are removed of any air bubbles. The procedure is necessary because, while the brake fluid is an incompressible liquid, air bubbles are compressible gas and their presence in the brake lines greatly reduces the hydraulic pressure that can be developed within the system. The same methods practice for removing air is also used, whenever the old fluid is replaced with new fluid, which is a necessary maintenance. The procedure can be performed either by one person or with an assistant, as such; the operation may need simple tools to a more complicated expensive piece of equipment to perform with the same results.

Amidst in this situation, technical education that focuses on the transfer of technology through innovations is the primary concern of this study.

OBJECTIVE OF THE STUDY

The general objective of this study is to design and construct a Hydraulic bleeder that can be used by the technicians in automotive shops for removing air from the brakes system without difficulty, so as to ensure proper function and smooth operating condition of automotive brakes and clutch.

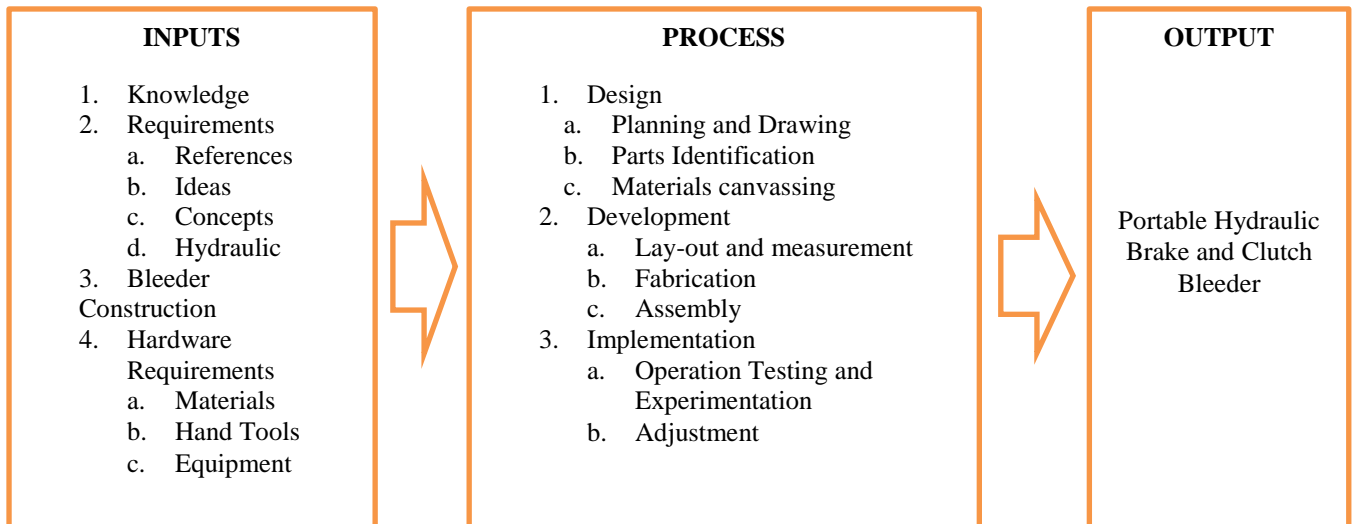
Specific Objectives

1. Determine a suitable design for a hydraulic bleeder that will simplify the task of bleeding brakes and clutch system.
2. Construct the design bleeder from locally available materials.
3. Outline significance of the device as an innovative shop and teaching tool for instruction and laboratory.
4. Conduct an objective evaluation of the device by the different end users regarding the following criteria:
 - 4.1 Functionality
 - 4.2 Efficiency and Effectiveness
 - 4.3 Safety

RESEARCH METHOD

The conceptual model that guided the researchers in conducting this study is presented hereunder. It shows the inputs, the process or throughputs and the output of the study which serve as the guide in the development of the project. [4]

Figure 3: Conceptual Framework of the Study



The **INPUTS** are the manual, textbooks and other learning material used in automotive technology as well as the unstructured interview conducted among automotive instructor and expert in the field. Several designs were conceived, exchanges of ideas were expounded and the best out those were selected, thus the idea of developing brake and clutch bleeder was conceptualized.

The **PROCESS or the THROUGHPUTS** are the supplies and materials use in the development of the gadget, which are found locally available in the market. Tools and equipment in the construction of the project are also accessible. The needed materials for the development and construction of the project were prepared in accordance by the specifications.

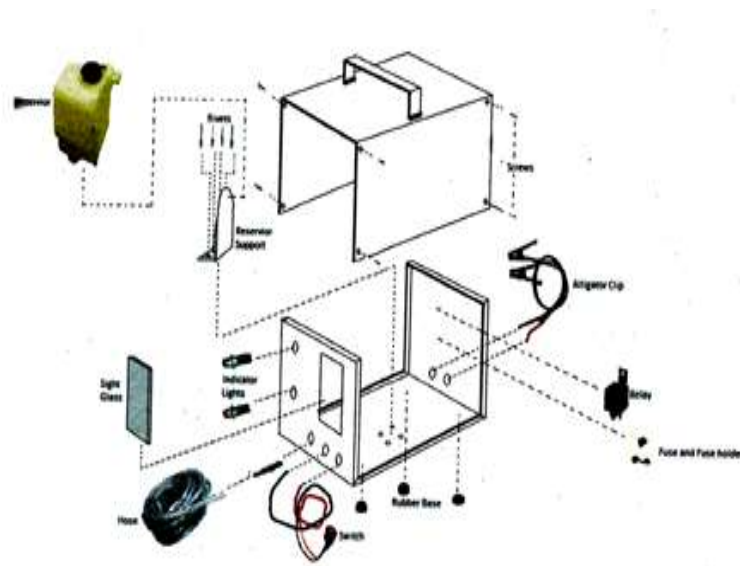
The **OUTPUT** is the finished **HYDRAULIC BRAKE and CLUTCH BLEEDER**, which will be evaluated by the different group: namely the professors and students in automotive technology and automotive technicians in the field.

PROJECT DESCRIPTION AND CAPABILITIES

Project Description

The device, Hydraulic brake and Clutch Bleeder provide an economical, easy to use brake and hydraulic clutch bleeding tool that utilizes the laws of physics that air rises in fluid. It is designed similar to the purpose of hypodermic needle. Hydraulic brake and clutch bleeder works on cars, truck motorcycle, and even heavy equipment. The device work on anything with a master cylinder and bleeder valve. Basically, the hydraulic brake and clutch bleeder bleeds brakes lines and hydraulic clutch by injecting the brake fluid through the low point, particularly the wheel cylinder, caliper bleeder valves or the clutch slave cylinder. The usage of the device bleeds in reverse procedure in the traditional method, by pushing the air UP. It extremely saves time because it can bleed complete brake system or hydraulic clutch system in less the 15 mins.

Figure 4: Shows the disassemble parts of the bleeder



Project Structure

The device dimension was designed as compact as possible with length of 24cm, width of 16.5 cm, and height of 19 cm. The project was made like a first aid kit box with the light weight of 1.5 kg. and easy to carry because of its size. All the coverings are made of metal and attached with a small piece of acrylic glass that serve as to sight the volume of liquid inside the reservoir. It has cover of black carbon fiber. Every materials were properly mounted by screws, rivets and nuts to ensure toughness and stability. The device was provided with 185 cm cable of wire use an a handle switch to control the unit when the signal light is ready to use and when the fluid goes through the reservoir of master cylinder. The purpose of this switch is to avoid spilling brake fluid in the body of the car. Most type of brake fluid is harmful to automotive paint so special care must be taken in handling them.

Figure 5: Shows the wiring diagram of the electrical component of the device

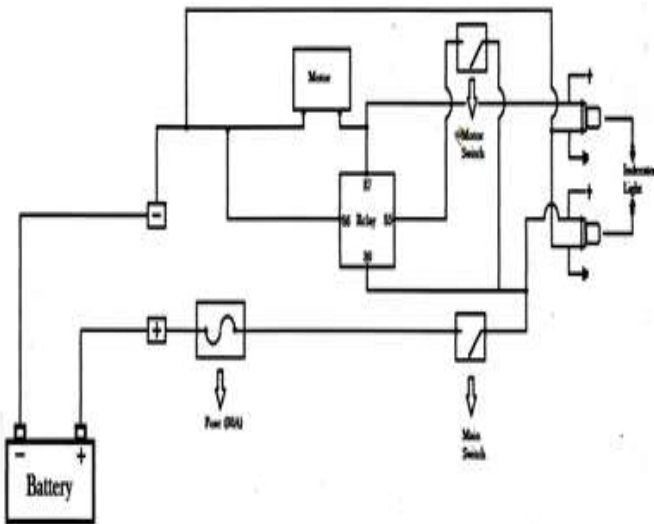


Figure 6: Actual Hydraulic Brake and Clutch Bleeder



Hydraulic Brake Bleeding Procedures

- i. Drain the brake master cylinder reservoir of fluid, either by vacuum sucking or loosening the brake bleeder valve screw.
- ii. Fill up the hydraulic bleeder reservoir with fluid from the master reservoir or new fluid.
- iii. Connect and tighten hydraulic bleeder hose to bleeder screw. Brake hose line may be cleaned first by applying air pressure in the system.
- iv. Clip the device to the battery
- v. Turn the main switch on and check if the warning light is on.
- vi. Hold the motor switch and switch on while observing the master cylinder.
- vii. Switch off when the fluid reaches the master reservoir.
- viii. Close tightly the bleeder screw, repeat procedure 3, 5-8 in the other brake cylinder.

Project Capabilities and Limitations

The device was designed to operate the job in bleeding process by one person only and without assistance from other co-workers. It can be used in many types of vehicle such trucks, AUV, PUV and other small light vehicle.

The reservoir of this bleeder can hold a maximum volume of one liter only. Complete bleeding process of brake and clutch system takes less than 15 minutes when using this device as compared with the traditional method of bleeding the system. The device uses the car battery as its external source of power.

RESULTS AND DISCUSSION

Evaluation of the Project

The project was evaluated by subjecting the device to measure the functionality. An evaluation form was used to test the acceptability of the project.

An evaluation form with three (3) criteria, answerable by a scale of 1-5 was used. The evaluators who rated the acceptability of the project consisted of 30 respondents from the different work position in the automotive field.

Table 1: Distribution of Respondents

Position	Number of Respondents
Professor/Instructor	8
Students	10
Technicians/Mechanics	12
Total	30

The respondents were chosen on the basis of their involvement in experiencing the difficulty during the performance of bleeding task. Prior to evaluation, demonstration of usage and actual operation was carried out in front of the evaluators. Its salient points were discussed and explained how it works and how to operate it as well as the limitation of the device.

Table 2: Summary of Mean Scores for Criteria used in the Acceptability Evaluation

Criteria	Mean	Interpretation
Functionality	4.67	Excellent
Efficiency and Effectiveness	4.59	Excellent
Safety	4.40	Very Good
Over-all Mean Rating	4.55	Excellent

The result of the evaluation of the device resulted in a rating with a mean of 4.55, the **Hydraulic Brake and Clutch Bleeder** proved to be suitable to the demand of the University and Industry with new and innovative tools, gadgets and equipment.

Table 3: Performance time

Vehicle Type		Method	
		2 Person M	HBB
4 Door sedan	Car 1	30 mins	
	Car 2		10 mins
	Car 3	25 mins	
	Car 4		12 mins
AUV	Car 1	20 mins	
	Car 2		13 mins
SUV	Car 1	30 mins	
	Car 2		12 mins
Light Trucks	LT 1	45 mins	
	LT 2		15 mins

On the basis of time and motion study, the above table shows the summary of result that compares the performance time of bleeding brake doing the normal two (2) person pump method against the hydraulic brake bleeder device.

SUMMARY OF FINDINGS

The Hydraulic Clutch and Brake Bleeder was designed, constructed, tested, and developed as a low-cost and environment-friendly innovative laboratory and teaching tool specifically intended for Automotive Technology Department of the College of Industrial Technology at Bulacan State University.

The Hydraulic Clutch and Brake Bleeder may be used as an innovative laboratory and teaching tool for the different public higher education institutions (PHEIs), particularly Bulacan State University for encouraging the use of locally available materials for innovations of existing and expensive tools and equipment.

The Hydraulic Clutch and Brake Bleeder was evaluated on the level of its acceptability based on the following criteria:

- i. Functionality
- ii. Efficiency and Effectiveness
- iii. Safety

CONCLUSIONS

Based from the summary of findings, the following conclusions were reflected by the researchers:

- i. The Hydraulic Clutch and Brake Bleeder aids teaching and learning situation more tangibly because of applied and manipulative practices coupled with theoretical discussions of the system.
- ii. The Hydraulic Clutch and Brake Bleeder can be replicated by other higher education institutions that may benefit from its advantages.
- iii. The Hydraulic Clutch and Brake Bleeder can be manufactured for interested users meant for whatever it may serve them its purpose.
- iv. The Hydraulic Clutch and Brake Bleeder can be fabricated from locally available materials at low price.
- v. The Hydraulic Clutch and Brake Bleeder require simple and minimal operation and maintenance.

RECOMMENDATIONS

Based on the foregoing findings and conclusions, the following recommendations were drawn by the researchers:

- i. Provide a complete illustrated user’s manual to guide the users in using Hydraulic Clutch and Brake Bleeder.
- ii. Future researchers should further improve the capability and features of the completed Hydraulic Clutch and Brake Bleeder.

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