

RESEARCH ARTICLE

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DESIGN AND DEVELOPMENT OF A COLLAPSIBLE FOUR VALVE SPRING COMPRESSOR

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ABSTRACT

This study aims to design and develop a Collapsible Four Valve Spring Compressor and assess its functionality in terms of design, construction and operating performance. The study employed a descriptive - development design, weighted mean as the statistical tool, questionnaire and actual observation to gather data. Based on the findings of the assessment, the researcher concluded that the Collapsible Four Valve Spring Compressor is highly functional in terms of design, construction and operating performance.

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INTRODUCTION

According to Alanis 2005, that for some reasons, replacement or removal of many parts of the engine is necessary because these parts wear out over the time. The traditional procedure to replace or remove particularly the valve stem seals in the valve springs which will wear out over the time is much time consuming, tedious, and perilous taking into consideration the number of parts to be initially removed. Pecaso 2018, added that in most internal combustion engines, valves are disassembled and re-installed using mechanical type or hydraulic type of valve spring compressor one at a time. Orilles et al. 2011, emphasized that, if the removal or installation of the valve springs is done manually, there is a that accidents may happen and injury or the parts will be lost or damage. It needs to have proper tools or equipment to make the job safe, flawless and precision. Beyond the current valve designs, a better tool design is needed. The challenge to current research program is to develop an application tool to achieve longer valve life. Mohite et al. 2015, added that many efforts have been done in the past to provide tools for the removal or installation of the valve springs. According to Duarte et al. 2010, there is a need to design and develop a new valve spring compressor apparatus for the removal and installation of the valve springs.

In order to address this issue, the researcher aim to design and develop a Collapsible Valve Spring Compressor, test and assess its functionality in terms of design, construction and operating performance.

Conceptual Framework

The conceptual paradigm showing the variables of the design and develop Collapsible Four Valve Spring Compressor [CFVSC] which guided this study is depicted below. The input includes the idea based on the design, construction and operating performance of the existing single valve spring compressor [SVSC] and the dual valve spring compressor [DVSC]. This also includes the bill of materials, supplies, and development cost. The process of this study includes planning and designing, fabrication, testing, revising and assessment of functionality. The output will be the completed and highly functional Collapsible Valve Spring Compressor.

METHODS AND MATERIALS

To achieve the objectives mentioned above, the following activities/procedures were undertaken: Baseline information on the design, construction and operating performance of the existing single valve spring compressor and dual valve spring compressor. Steps on the removal and installation of valve springs including the time consumed were documented.

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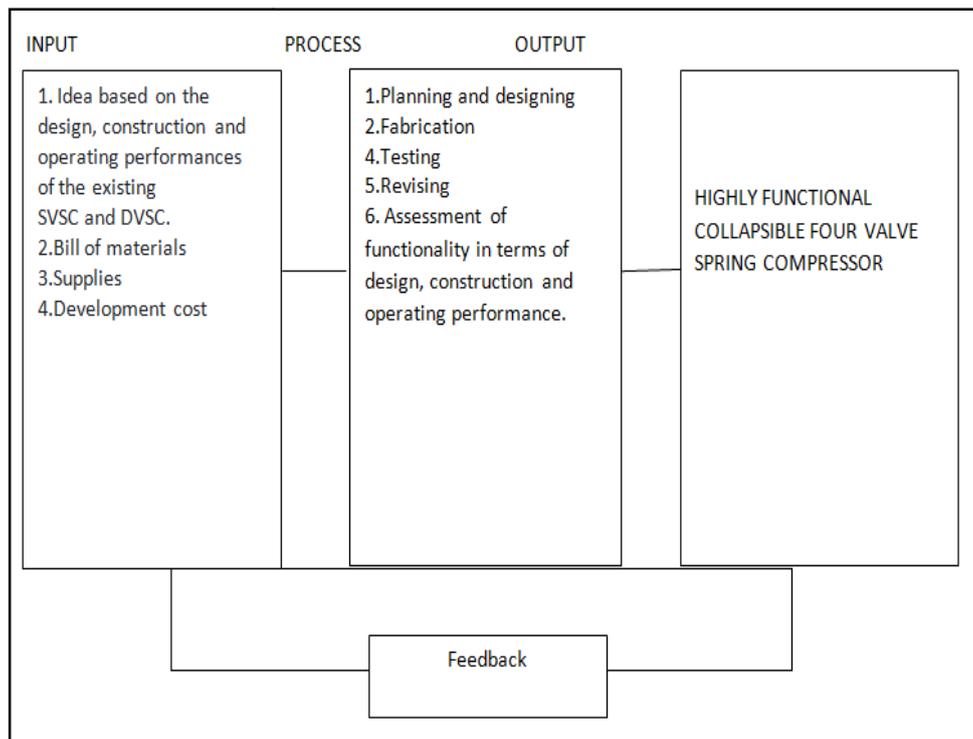


Fig. 1. The Conceptual Paradigm of the Study

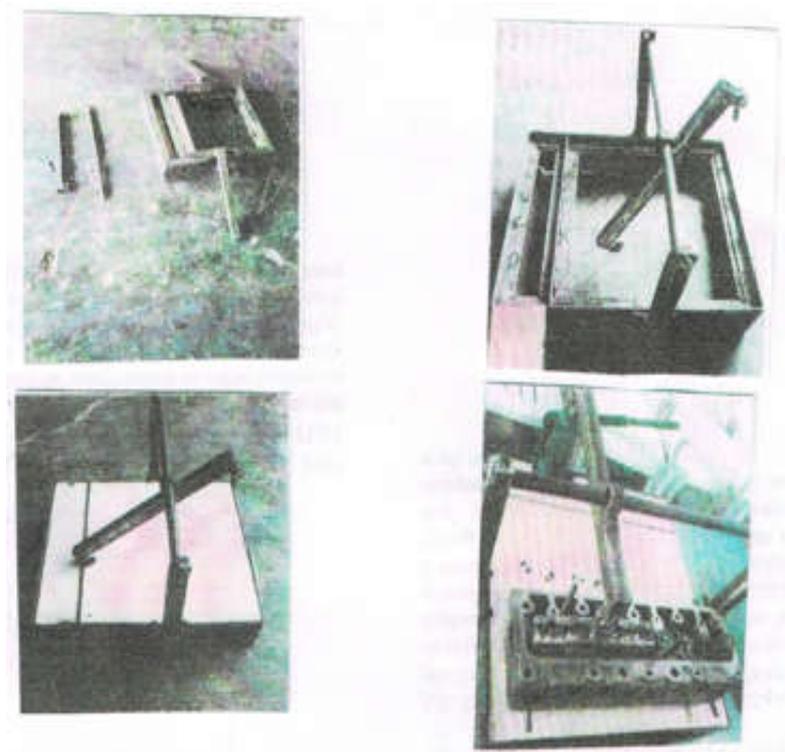


Fig. 2. Shows the assembly phase of Collapsible Valve Spring Compressor

Relevant information acquired from the activities serve as the bases for the design and development of the collapsible four valve spring compressor.

Design, Develop, Test and Revision: Working design was based on the existing SVSC and DVSC. Modification and improvement for the development of the compressor was being made to actually apply to the work. Fabrication was being done in the Automotive Workshop of SLSU, Main Campus, Sogod, Southern Leyte, after which initial testing was

done/conducted. Necessary revision for development was being done to make the collapsible four valve spring compressor workable.

Materials, Tools and Equipment

Angular bars	Steel square	Welding machine
Round bar	Pull-push rule	Portable grinder
Plyboard ½" thick	Vise grip	Electric drill
Welding rods	Hacksaw	Portable hydraulic jack
Emery cloth (sand paper)	Open end wrench	

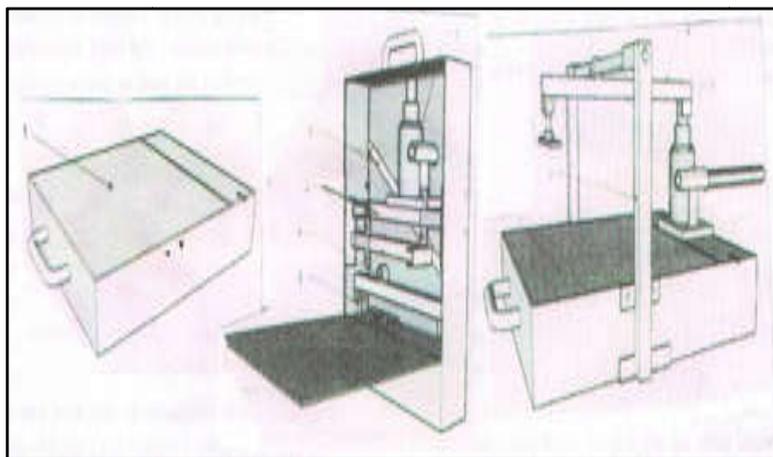


Fig. 3. Shows the Collapsible Valve Spring Compressor

Table 1. displays the sample statistics in the assessment of Collapsible Four Valve Spring Compressor (CFVSC), Single Valve Spring Compressor (SVSC) and Dual Valve Spring Compressor (DVSC) in terms design, construction and operating performance.

Parameter	Valve Spring Compressors	Mean	N	Standard Deviation	Standard Mean
DESIGN	CFVSC	4.8	45	31.84	4.75
	SVSC	3.9	45	26.46	3.95
	DVSC	3.6	45	23.88	3.56
CONSTRUCTION	CFVSC	4.9	45	31.84	4.75
	SVSC	4.9	45	28.52	4.58
	DVSC	4.2	45	27.88	4.26
OPERATING PERFORMANCE	CFVSC	4.8	45	31.84	4.75
	SVSC	3.3	45	21.89	3.27
	DVSC	3.3	45	21.86	3.27

Table 2. Displays the results on the assessment of the collapsible valve spring compressor (CFVSC), single valve spring compressor(SCSC) and dual valve spring compressor (DVSC) in terms of design, construction and operating performance

Valve spring compressors	parameters					
	Design		Construction		Operating performance	
	Mean	Remarks	Mean	Remarks	Mean	Remarks
cfvsc	4.8	Strongly agree	4.9	Strongly agree	4.8	Strongly agree
svsc	3.9	agree	4.3	strongly agree	3.3	agree
dvsc	3.6	agree	4.2	Strongly agree	3.3	agree

Assembly Phase: The angular bars, round bar and plyboard were being cut according to the specifications of the design. Rough welded joints and surfaces were being grinded, filed and sand papered. The plyboard was being laid on the base as flooring and the portable hydraulic jack was being installed. Testing was being conducted in the Automotive Workshop of SLSU, Main Campus, Sogod, Southern Leyte. Necessary revision was being made to make the device workable. There were 45 respondents composed of 3 Automotive Technology instructors/professors, 2 Mechanical Engineers and 40 Automotive Technology students taking Engine Overhauling subject at SLSU, Main Campus, Sogod, Southern Leyte who are the potential consumers or end users assessed the functionality of the device according to their perception in terms of design, construction and operating performance. Questionnaire was being used and actual observations were being documented. Data were being tabulated using the appropriate statistical tool.

RESULTS AND DISCUSSION

The designed and developed collapsible four valve spring compressor has the following features or developments; it has two legs that could be secured inside the box if not used and swing outside if used supported by bolts to increase the

strength and stability; it has spring seat bracket with four jaws that can remove and install four valve springs at the same time; it has 10 tons manually operated hydraulic jack; the construction is small table type wherein the cylinder head is securely position; the base is made of plyboard to protect the cylinder head from wear out; it has a movable rocker arm with push rod and it is portable that it can easily be move and transfer from one place to another.

The results implied that the Collapsible Four Valve Spring Compressor (CFVSC) enhances or improved the functionality of the Single Valve Spring Compressor (SVSC) and Dual Valve Spring Compressor (DVSC) in terms of design, construction and operating performance. As stated by Orilles et al. (2011), the results may have been attributed to the modification and improvement of the CVSC that enhances its functionality.

Conclusion

The Collapsible Four Valve Spring Compressor (CFVSC) is highly functional and is strongly agree by the respondents in terms of design, construction and operating performance.

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