DESIGN OF A HYDRAULIC JACK BENCH VISE TO INCREASE THE EFFICIENCY AND EFFECTIVENESS OF PRACTICUM IN POLTEKBANG SURABAYA

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ABSTRACT
This research aims to design and develop a clamping tool or vise that uses a hydraulic jack system to improve the efficiency and effectiveness of practicum at Aviation Polytechnic Surabaya. Modifications to this vise aim to shorten processing time, increase safety, and minimize work accidents. Testing of hydraulic jack vise tools is done with two types of tests, namely testing time efficiency and testing the effectiveness of comfort of use. With the conclusion of this study, the hydraulic jack vise tool succeeded in meeting the goals of efficiency and effectiveness of practicum at Poltekbang Surabaya with the average results obtained when clamping around 9.70 seconds and this is 1.58 seconds faster than the conventional vise. Also obtained is the average time generated when opening about 2.07 seconds and this is 0.18 seconds faster and 88% of the 64 respondents who stated this tool was comfortable as indicated by filling out a questionnaire to be used during practicum and help prevent work accidents. This vise modification is expected to be a solution to increase productivity and safety in the machining work process in the aviation world.

Keywords: Vise, Hydraulic jack, Spring

1. INTRODUCTION

To achieve competence, the Aircraft Engineering study program combines theory (40%) and practice (60%). In the practicum, the clamping tool or vise is very important and functions to grip the workpiece during the bench work process or manual work process, and can be used in machining processes such as the cutting process. In the world of aviation, time efficiency isindispensable. Therefore, modifications to the vise are needed to shorten processing time and minimize work accidents. So that research was conducted on "Design of A Hydraulic Jack Bench Vise To Increase The Efficiency And Effectiveness Of Practicum In Poltekbang Surabaya".

A bench vise is another clamping device that holds a workpiece in place and allows work to be done on it with tools such as saws and drills. The vise consists of two fixed or adjustable jaws that can be opened or closed by a screw or lever. The size of the vise is measured by the width of the jaws and the capacity of the vise when the jaws are fully open. The bench vise also relies on a screw to apply pressure, but its textured jaws increase gripping ability beyond that of a clamp.

Vise is also used as a holder device on various other types of machine tools. The process of working on an object will be processed faster if the vise or clamp runs effectively. But it is different if the vise is not working properly, as in some workshop locations it was found that most mechanics who use vise tools use a hammer to increase the grip produced on the vise jaw, especially on the vise type vise. Because sometimes limited mechanical power is channeled to the vise tool perfectly (Chougoule, 2015).

The workings of the vise lie in the movement of the handle and screw. When the two components are rotated counterclockwise, the clamping jaws will open so that the object can be removed from this part. If the handle and screw are rotated clockwise, the clamping jaws will move forward and then close. The object will be attached to the clamping jaws and will not move during the working

process (Erick Yosua, 2021). The author will modify the shape and workings of the vise.

2. METHODS

This research was conducted from September 2022 to April 2023. In this research, the research methodology was carried out as in the previously designed flowchart.

2.1 Tool Design

The design of this hydraulic jack vise tool aims to practice basic workshop theory a course in the general workshop hangar lab of Poltekbang Surabaya.

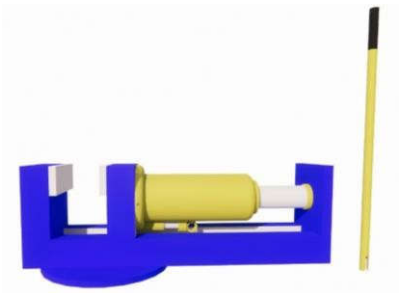

Figure 1 3D Design of Hydraulic Jack Vise

Part of the Hydraulic Jack vise consists of a body, moveable jaw, hydraulic tank, ram, spring, saddle, base, release valve, lever, and handle.

2.2 Tool Testing Technique

In the testing stage of this hydraulic jack vise tool to find out whether the vise can clamp properly and from the efficiency of time faster than the vise in general by using a time indicator. In this test, the research instrument that will be used is a stopwatch used to calculate the time required during the pumping process on the jack lever so that the vise jawcan clamp perfectly.

2.2 Data Analysis Technique

The data analysis technique used for the hydraulic jack vise tool is comparative data. To determine the time efficiency of the hydraulic jack vise tool, comparative data was collected by testing the vise in general with a hydraulic jack vise. Time efficiency testing was carried out by three groups, each group containing 2 cadets.

To determine the level of safety and comfort of the hydraulic jack vise tool rather than conventional vise in general, testing was carried out by making a questionnaire in the form of a statement regarding the safety and effectiveness of the comfort of the hydraulic jack vise tool to Aircraft Engineering cadets class 7 and 8 with a total of 63 cadets who had carried out Basic Workshop Theory course practice using a hydraulic jack vise tool in the general workshop hangar lab of Aviation Polytechnic Surabaya. In the safety test and the effectiveness of tool comfort, data analysis is carried out by making a questionnaire containing statements about safety and the level of comfort in using the hydraulic jack vise tool using the Likert scale technique.

For the weight of the value of each statement, the value percentage index can be calculated so that an answer comes out in the form of a percentage, with the formula and information for each answer result is an answer index that uses a Likert scale.

$$\text{Rumus Index \%} = \frac{\textit{Total Skor}}{X} \text{ x 100}$$

Description:

Total Score = Total multiplication of each indicator by the total.

X value = Total multiplication of all respondents with the highest indicator.

3. RESULTS AND DISCUSSION

3.1 Tool Making

The purpose of the results of this study is to determine the results of the state of the tools that have been made, so that it is known that the condition of the tools that have been made can function properly and in accordance with what has been designed and expected. For the purposes that have been planned and expected, the results and discussion will be measured and analyzed the tools that have been made. This is done as proof of the correctness of the work of the tools that have been designed starting from the material that has been made from the previous chapter to the testing stage to get the desired results.

a.) Body assembly stage of hydraulic jack tool
1. Cutting materials of C channel iron and plate iron.
2. Connecting C channel iron and plate iron using welding tools.
3. Cut or perforate the path for the moveable jaw using a grinder.
4. Attach a small iron to the bottom of channel iron C as a spring hook.
5. Install the stand for the hydraulic jack.
6. Install the holder or base of the hydraulic jack vise tool by welding.

b.) The finishing stage of the hydraulic jack vise tool
1. Clean the weld joints using a grinder with a fine grinding blade.
2. Painting the body of the hydraulic jack vise tool.
3. Painting the hydraulic jack.
4. Painting the base or tool holder of the hydraulic jack vise tool.

3.2 Testing Results

Testing of hydraulic jack vise tools is done twice, namely by testing the efficiency of time and testing the effectiveness of comfort in using hydraulic jack vise tools. The purpose of this test is to find out which hydraulic jack vise tool is more efficient in terms of time and to find out how comfortable the hydraulic jack vise tool is when used.

Based on the results of the research, the hydraulic jack vise tool is able to clamp the workpiece with an average time of about 9.70 seconds and 1.58 seconds faster than the conventional vise, and the hydraulic jack vise is able to open the moveable jaw with an average time of 2.07 seconds and this is 0.18 seconds faster than the conventional vise, requiring man power consisting of only 1 person.

Analysis of testing the effectiveness of tool comfort is made to determine the safety and comfort of use of the Hydraulic Jack vise tool. The method used by making a questionnaire in the form of a statement regarding the safety and comfort level of the Hydraulic Jack vise tool with the value indicators shown in the table below.

Indikator Nilai *Likert*	Bobot Nilai
Sangat Setuju (SS)	5
Setuju	4
Netral atau Cukup	3
Tidak Setuju	2
Sangat Tidak Setuju (STS)	1

Figure 2 Table of Likert Value Indicators

There are 6 questions that have the results in the table below.

Indikator / Pernyataan	SS	S	N	TS	STS
1	38	19	7	-	-
2	35	23	6	-	-
3	33	26	5	-	-
4	34	23	7	-	-
5	35	23	6	-	-
6	31	26	7	-	-

Figure 3 Table of Question Results for the Tool Comfort Effectiveness Test

From the results of the 6 questions shown in the table above the percentage index column generated from statement 1 to statement 6 with 64 respondents, the average result is 88%. Therefore, it can be concluded that the results of the percentage index using the Likert scale technique of the Hydraulic Jack vise tool are more safety and the level of comfort is as expected which is used during practicum during the cutting, filling and drilling processes in the general workshop. So that the tool is useful and feasible to use.

4. CLOSING

4.1 Conclusion

From the overall results of testing and analyzing the respondents of the hydraulic jack vise tool to the practicum process, it can be concluded as follows:

1.) The hydraulic jack vise tool is made by uniting several components, namely the main body of the vise, hydraulic jack, jack lever, spring, and base or holder.
2.) The hydraulic jack vise tool is used in the general workshop lab which has a designated place on the work table which is used to assist the practicum by pumping the hydraulic jack connected to the hydraulic jack vise body by using the hydraulic jack lever until maximum clamping so that the cadets feel safe and comfortable in carrying out the practicum.
3.) Based on the results of the research, the hydraulic jack vise tool is able to clamp the workpiece with an average time of about 9.70 seconds and 1.58 seconds faster than the conventional vise, and the hydraulic jack vise is able to open the moveable jaw with an average time of 2.07 seconds and this is 0.18 seconds faster than the conventional vise, requires man power consisting of only 1 person and the hydraulic jack vise tool is more safety and comfortable than the conventional vise that already exists in the Surabaya Aviation Polytechnic hangar.
4.) An indication that the hydraulic jack vise tool is in accordance with K3 is indicated by filling out a questionnaire on the effectiveness of the tool comfort test

with a total of 64 respondents with an average result of 88%.

4.1 Suggestions

Realizing that the design of the hydraulic jack vise tool is still not perfect. For the future, development needs to be done. There are suggestions submitted for the perfection of the tool, namely:

1. The design can be developed with a new design that is more compact or lighter because the weight of the hydraulic jack vise weighs 12kg.
2. The design can be developed by making the movement of the moveable jaw automatic or electrically by adding a motor to the hydraulic jack lever.

AUTHORS' CONTRIBUTIONS

Iriandhika Yoga Pratama fully contributed in carrying out all research procedures starting from design, tool making, data analysis, and up to the preparation of scientific papers.

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