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Workpiece Clamping Device Pulley Maicn Clutch NC131

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ABSTRACT - To create a workpiece clamping device, Pulley main clutch NC131, by developing a workpiece clamping device for use in the drilling and tapping process at the same time by keeping the diameter of the drill hole in the same diameter after installing the workpiece clamping device, comparing the average working time, it was found that the production time was reduced by 11.7 minutes/piece, the average working time was 7.41, while the production cost after installing the workpiece clamping device was 238.10 baht/piece, which was reduced by 37 baht/piece. In terms of efficiency, it was referenced from measuring the size of the workpiece with a CMM machine, with the measurement results being within the standard set by the customer, which was a control value of 166.00 mm, allowing a maximum tolerance of 166.50 mm and a minimum of 165.50 mm, and when calculating the payback period, there was income from the production of Pulley mainclutch 131, 240 pieces per day, at a price of 238.1 baht per piece, totaling 57,144 baht per day, after deducting the cost of materials, equipment, labor costs and electricity used for production of 32,000 baht, the income was equal to 25,144 per day which is more than the capital, so the payback period is 1 day and the payback rate is 100%

I. INTRODUCTION

Currently, small and medium enterprises (SMEs) play a very important role in the country's economy because they have penetrated many businesses, including manufacturing, retail, wholesale, and service industries. They account for 98 percent of the total number of industrial plants nationwide and generate 74 percent of all employment in the industrial sector. This helps to cope with unemployment problems and also helps to slow down the movement of labor from the provinces to find work in the capital. Therefore, they play an important role in helping develop the countryside and spreading prosperity to the production regions. When considering in terms of cost and production performance, most agricultural machinery parts manufacturing industries are small and medium-sized industries, which are the main industries that support the production process of various parts used for manufacturing or repairing machinery for domestic use or export abroad.

BOS Engineering Company It is a company that operates a business in the production of agricultural machinery parts. In order for the production process to be highly efficient, it is necessary to develop processes and procedures to keep up with the demand and future growth. The CNC1 department is responsible for producing agricultural machinery parts. Therefore, in order to solve the problem and develop the production process, the project developer sees that the development of workpiece holding devices is an important part in helping to increase efficiency and solve the problem of outsourcing by developing and creating workpiece holding devices in the CNC1 department. This comes from the fact that the company was hired to produce agricultural machinery parts called Pulley mainclutch NC 131, which was produced in the turning process only. Then, it was sent to the employer to drill holes and tap threads by themselves. Later, the customer wanted BOS. Engineering Co., Ltd. to produce all the parts, which means that B.O.S. Engineering Co., Ltd. had to complete the process. Therefore, it was necessary to invent and create workpiece holding devices for the drilling and tapping process for all 6 holes at the same time, with the diameters of all 6 holes being the same diameter to increase the potential in the agricultural machinery parts production system.

II.EXPERIMENTAL DESIGN

2.1 Study of the production process

By studying this preliminary data, we studied data from the production process of the Pulley mainclutch 131 of the company. The

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original production process is that B.O.S. Engineering will only turn the workpiece with a CNC machine. As for the drilling and tapping process, we have to hire an outside agency.

Fig1.1. Shows a picture of the Pulley mainclutch NC 131.

Currently, the production of the Pulley mainclutch 131, B.O.S. Engineering will only turn the workpiece with a CNC machine. As for the drilling and tapping process, we have to hire an outside agency. The area for improving the clamping device to the drilling and tapping machine is in the CNC production building 1 and CNC 2, the production department, which is suitable for placing the drilling and tapping machine to facilitate the employees' work and to minimize the movement of the workpiece from the turning process to the drilling and tapping process.

2.2 Study the design guidelines for clamping devices

Study the design guidelines for machinery, mechanical parts, and clamping devices to design clamping devices that can facilitate the customers and organizations to reduce the working time for employees. And it is a complete production process, namely making molds for casting parts Pulley mainclutch NC 131, casting parts by hiring an outside agency, turning, drilling and tapping, plating (EDP) to meet customer needs.

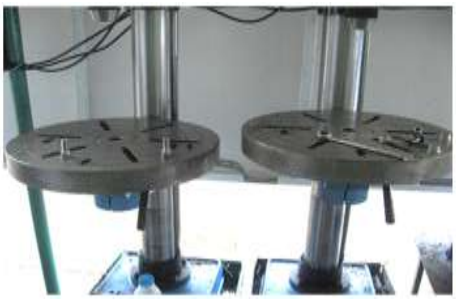

Fig 1.2 Shows the drilling and tapping machine before installing the clamping device.

Hired to build every piece of fixture as designed. The construction process has a limitation in hiring, which is hiring a manufacturer of fixtures according to the design designed by B.O.S. Engineering Co., Ltd. only. The material used to build the fixtures is specified as hardened S50C steel. When the work is complete, return all data to B.O.S. Engineering Co., Ltd.

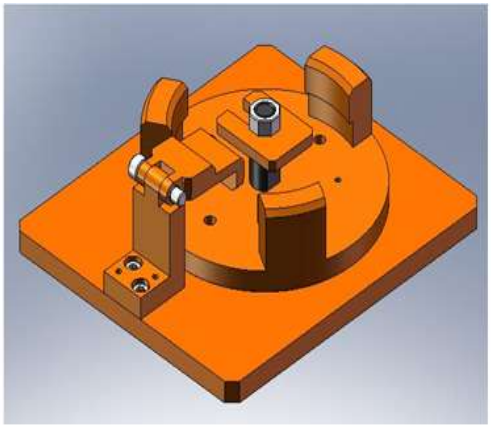

Fig 1.3 shows the design using a computer program used in the design.

The test was conducted by assembling the fixtures with the drilling and tapping machines. The center distance was adjusted for 6 holes at a time by using the Plate guide to adjust the drilling and tapping positions. The test was conducted and the data was collected.

Fig 1.4 shows the installation of the fixtures with the drilling and tapping machines.

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Collect drilling and tapping data by having the drilling and tapping staff collect data and record the results in the data recording form. Check the workpiece after installing the equipment into the drilling and tapping machine, which is based on the work plan specified by the customer.

Fig 1.5 shows drilling and tapping using the created clamping device.

2.3 Method of recording data

When the hundred-way drilling and tapping experiment was completed, the workpiece that had gone through the drilling process was sent. Tap has the quality control department check the PCD distance with a CMM machine to confirm the efficiency of the equipment to provide information for adjusting and adjusting the center points of all 6 holes according to the customer's work drawing.

Fig 1.6 Shows a CMM machine for checking PCD distance in drilling and tapping.

III.RESULTS

3.1 Process analysis results

Table 1.1 Analysis table of the production process of Pulley main clutch NC 131 before improving the workpiece clamping device Pulley main clutch NC 131

Step	Details	Symbol	Time (Minutes)	Price (Baht/ Piece)
1	Pick up workpiece from crate into lathe		0.05	
2	Clamp workpiece Check/Test grip		0.08	
3	Close machine door/Press Start button		0.02	
4	Turn workpiece Process 1 with CNC machine		4.20	157.5
5	Open machine door/Pick up workpiece		0.03	
6	Blow off lathe chips		0.05	
7	Walk to lathe 2		0.08	
8	Insert workpiece into lathe 2		0.05	

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9	Clamp workpiece Check/Test grip						0.08	
10	Close machine door/Press Start button						0.02	
11	Turn workpiece Process 2 with CNC machine						2.15	80.6
12	Open machine door/Pick up workpiece						0.03	
13	Blow off lathe chips						0.05	
14	Sanding with sandpaper						0.08	
15	Checking the workpiece						0.08	
16	Packing the workpiece in a box to prepare for delivery						0.03	
17	Moving the workpiece to the truck						0.01	19.25
18	Hiring an external agency to drill						12*	17.75
19	Receive the complete workpiece to store at STORE						0.02	
	Σ						2.15	80.6

Workpiece clamping equipment used for drilling and tapping Pulley mainclutch NC131 It can be seen that the total production time per piece is 19.11 minutes per piece. The production cost per piece is 275.1 baht per piece.

The workpiece production is done by studying the time. Normal working time => R 100 NT = 19.11 minutes per piece If the time for personal necessity = 5%Fatigue allowance (constant) = 4 %

The standard time of this production is equal to Standard time = Normal working time + Allowance time

= NT + (NT x % all)

= 19.11 + (19.11 x (5 + 4)%)

Standard time = 20.82 minutes per piece

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Table 1.2 Analysis table of the production process of Pulley main clutch NC 131 after installing the workpiece clamping device Pulley main clutch NC 131

Step	Details	Symbol ○ ⇨ D □ ▽	Time (Minutes)	Price (Baht/ Piece)
1	Pick up workpiece from crate into lathe 1		*0.05*	
2	Clamp workpiece Check/Test grip		*0.08*	
3	Close machine door/Press Start button		*0.02*	
4	Turn workpiece Process 1 with CNC machine		*4.20*	*157.5*
5	Open machine door/Pick up workpiece		*0.03*	
6	Blow out turning chips		*0.05*	
7	Walk to lathe 2		*0.08*	
8	Insert workpiece into lathe 2		*0.05*	
9	Clamp workpiece Check/Test grip		*0.08*	
10	Close the machine door/Press the Start button		*0.02*	
11	Turn the workpiece Process 2 with the CNC machine		*2.15*	*80.6*
12	Open the machine door/Pick up the workpiece		*0.03*	
13	Blow off the turning chips		*0.05*	
14	Sand the edges with sandpaper		*0.08*	

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Step	Details	Symbol ○ ⇨ D □ ▽	Time	Price (Baht/ Piece)
15	Walk to the drilling and tapping machine		0.05	
16	Pick up the workpiece and put it in the jig		0.08	
17	Lock the workpiece to prevent rotation		0.01	
18	Lock the workpiece to prevent movement		0.03	
19	Move the jig to the drilling position		0.02	
20	Press the Drilling Start button		0.01	
21	Drill the workpiece		0.11	
22	Move the jig to the tapping position		0.03	
23	Press the Tapping Start button		0.01	
24	Tap workpiece		0.05	
25	Remove workpiece from Jig		0.04	
26	Place workpiece in crate		0.02	
	Σ		**7.41**	**238.1**

From Table 1.2 the production data after installing the workpiece clamping device used for drilling and tapping the Pulley mainclutch NC 131 workpiece, it can be seen that the total production time per piece is equal to 7.41 minutes/piece. The production cost per piece is 238.1 baht per piece. The workpiece production time study is Normal working time =>

R 100 NT = 7.41 minutes per piece. If the time for personal necessity = 5%, the time for fatigue (constant) = 4 %

The standard time for this production is equal to

Standard Time = Normal Time+Allowance Time

= NT + (NT x % all)

= 7.41 + (7.41 x (5+4) %)

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Standard Time = 8.07 minutes per piece

3.2 Summary table

Table 1.3 Summary table recording production data before and after installing the workpiece clamping equipment used for drilling and tapping. Pulley mainclutch NC 131 workpiece reduced value.

Details	Time (minutes /piece)	Cost (baht/ piece)
Before installing the workpiece clamping device	19.11	275.10
After installing the workpiece clamping device	7.41	238.10
Difference reduction value	11.7	37

From Table 1.3, it was found that the cost decreased after installing the workpiece clamping device used for drilling and tapping, Pulley mainclutch NC 131, in terms of time, by 11.7 minutes/piece, and the cost decreased after installing the workpiece clamping device used for drilling and tapping, Pulley mainclutch NC 131, by 37 baht/piece.

Table 1.4 Summary table of production data recording after installing the workpiece clamping device used for drilling and tapping the workpiece Pulley main clutch NC 131, percentage value decreased from the original.

Details	Time reduction per piece	Cost reduction per piece
After installing workpiece clamping device	44.1%	7.2%

From Table 1.4, it was found that the percentage of reduction after installing the workpiece clamping device used for drilling and tapping, Pulley mainclutch NC131, in terms of time, was reduced by 44.1% from the original time. In terms of cost, after installing the workpiece clamping device used for drilling and tapping, Pulley mainclutch NC131, it was reduced by 7.2%.

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Table 5 Summary of drilling efficiency of the workpiece clamping device used for drilling and tapping the NC131 clutch pulley workpiece.

Shift Staff	Before		After	
	Mean	SD.	Mean	SD.
Shift A	166.004	0.0013	166.19	0.03
Shift B	166.004	0.0012	166.15	0.04

From Table 1.5, it can be seen that the workpiece holding device's efficiency is referenced from the workpiece size measurement results comparing the workpiece size of shift A and shift B employees. Both shifts have the size measurement results within the standard specified by the customer, which is a control value of 166.00, allowing a maximum tolerance value of 166.50 and a minimum of 165.50 (in millimeters)

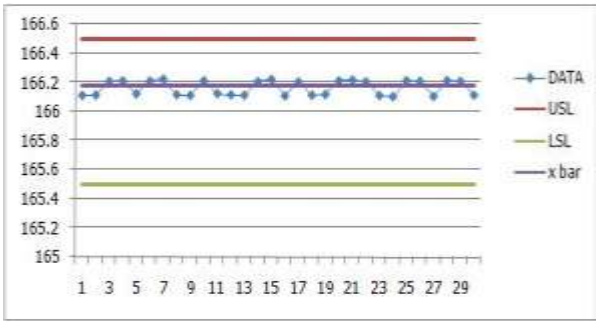

Fig 1.7 Graph showing measurement results after installing the equipment of employees of Shift A.

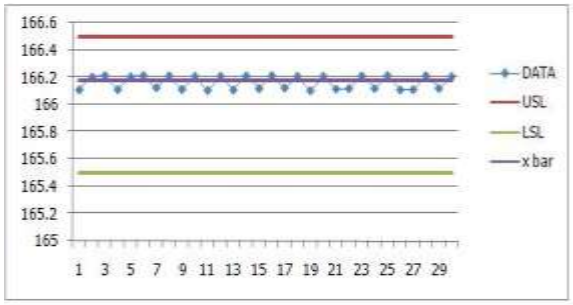

Fig 1.8 Graph showing measurement results after installation of equipment by employees of Shift B.

IV. CONCLUSION

In the investment, design and construction of the workpiece clamping device used for drilling and tapping, Pulley mainclutch NC131 workpiece was constructed with materials and equipment with an investment of 25,000 baht. It is expected to have a service life of 10 years. The income from the production of Pulley mainclutch NC131 workpieces is 240 pieces per day, with a price of 238.1 baht per piece, or 57,144 baht per day. After deducting the cost of materials, labor, and electricity used in production of 32,000 baht, the income is 25,144 per day. The production time is 1 day, 2 shifts (8 hours), and the annual maintenance cost is 10,000 baht. The depreciation is straight-line without considering the salvage value. The economic value can be analyzed as follows:

Annual depreciation = Cost / Lifespan
= 25,000 / 10
= 25,000 baht/year
Revenue from sales of parts = 240×238.10
= 57,144 baht/day

Deduct cost used in production
= 32,000 baht/day
= 57,144 - 32,000
Profit from sales of parts = 25,144 baht/day
Breakback rate = Profit - Cost
= 25,144 -25,000
Remaining = 144
= 100%
Breakback period = 1 day

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