



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

LED BENDING MACHINE FIXTURE

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By

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APPROVAL

This thesis submitted to the senate of UTeM and has been accepted as partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering (Robotic & Automation).

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DECLARATION

I hereby, declare this thesis entitled “LED Bending Machine Fixture” is the results of my
own research
except as cited in the reference.

Signature : _____
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DEDICATION

This report is dedicated to all my loved, and the God above.

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other;

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ABSTRACT

This thesis represents a case study in designing a new machine fixture for the electronic industry. Of the various electronics component, the machine fixture will only focus on the LED sector. The new machine fixture would act as a 'holder' to hold the LED securely in the required position for the machine operation. In addition, it would be able to perform the bending and cutting operations simultaneously. By using the machine fixture, the user would be able to bend and cut the LED pin connector to the required shape and length. This design differs from the previous designs because it is able to perform the various tasks/operations on a short duration time. This machine fixture would vastly reduce the cycle time for producing LED's in the current situation. Besides that, it has a higher precision, which directly means better quality in the product produced. The machine fixture would also help reduce the manufacturing cost for each LED. Since the machine fixture is semi-automated, we can reduce a substantial sum in the labor cost. The expenditure spent on quality control for part components can be reduced because the machine fixture would produce LED's, which is of a standard quality range. Other than that, semi-skilled workers can be used to replace the skilled-workers whom are previously irreplaceable using this machine fixture. This fixture would also yield a higher production rate compared to the previous method. Finite element analysis that I use to analyze the structure of the machine fixture include Cosmos Xpress, Festo Pneumatic Software and Machine Design Tool

Keyword: Machine Fixture, LED, cycle time, productivity, automation

ABSTRAK

Kertas thesis ini telah merumuskan sebuah penyelidikan yang mengenai rekabentuk fixture untuk electronic industrial. Dimana dalam project ini, penyelidikan ini telah melibatkan rekabentuk dan implementasi sebuah LED mesin lipat yang digunakan untuk memegang komponen-komponen elektronik dalam lokasi yang betul semasa menjalankan operasi. Selain itu, mesin ini juga mampu melipat dan memotong kaki komponen LED dalam keadaan bentuk dan dimensi yang telah ditetapkan. Pada peringkat awal, saya dikehendaki membuat lakaran mengenai konsep rekabentuk mesin ini dengan berdasarkan maklumat-maklumat yang telah diberikan oleh pihak pelanggan.. Setelah lakaran kosep mesin ini telah disiapkan maka saya akan membuat lukisan rekabentuk mesin sebenar dengan berdasarkan konsep mesin yang telah dipilih. Semasa mereka mekanisme mesin itu, saya juga dikehendaki megambilkira faktor-faktor seperti kelunturan , keteguhan dan daya yang telah dikenakan pada bahagian struktur mesin itu. Dari segi fungsi, LED mesin lipat direka khas untuk melipat dan memotong kaki LED dalam keadaan bentuk dan dimensi yang telah ditetapka. Selain itu, mesin ini juga perlu menyiapkan semua proses operasi dalam masa yang ditentukan. Tujuan mereka bentuk mesin jenis ini adalah untuk mengurangkan masa penghasilan serta menghasilkan komponen-komponen LED yang berkualiti tinggi. Dengan penciptaan mesin jenis ini, ia dapat mengurangkan tenaga pekerja mahir yang diperlukan dalam proses penghasilan manakala ia juga dapat mengurangkan kos pengeluaran.

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CHAPTER I

INTRODUCTION

1.1 Overview

The cost of designing and fabricating fixtures can amount to 10-20% of the total manufacturing system costs. To reduce manufacturing costs, a fixture system is designed to be competent in fixture as many work pieces as possible. In mass volume production, this can be achieved by fixture a large quantity of the same kind of work pieces. In low-to-medium volume production, however, improvement of the flexibility of fixture systems becomes a favorable way to reduce the unit cost of product. On modern manufacturing is able to achieve high productivity and to reduce unit cost. This necessitates work-holding devices to be efficient to increase the rate of loading and unloading to speed up the manufacturing cycle time. [4]

The employment of machine fixtures is an important aspect in workshop engineering, as their application on all but the simplest type of production smaller orders and tool room work. Fixtures are applicants this used in the manufacture or assembly to facilitate the operation to which they are applied. A fixture is the device that used to holds the work piece securely in the correct position great respect to machine/cutter during the operation. There is something a provision for setting that tool with respect to work piece /fixture but the tool is not guided as in Jig. Fixtures are often clamped on the machine table. From here, we also can add some operation functional such drilling, cutting or bending process on fixture devices to increase the production rate of the manufacturing process.

The name of this topic: *Case Study in Designing a machine Fixture for Electronic Industry*. Of the various electronics component, the machine fixture will only focus on the LED sector. The new machine fixture would act as a 'holder' to hold the LED securely in the required position for the machine operation. In addition, it would be able to perform the bending and cutting operations simultaneously. The project is started from initial stage which comes out with sketching design concept of the machine fixture following by the detail drawing of the machine fixture to determine the flexibility and stability of the machine structures and the structure of the machine fixture will be completed at the final stage. By using the machine fixture, the user would be able to bend and cut the LED pin connector to the required shape and length. This design differs from the previous designs because it is able to perform the various tasks/operations on a short duration time.

This machine fixture would vastly reduce the cycle time for producing LED's in the current situation. Besides that, it has a higher precision which directly means better quality in the product produced. The machine fixture would also help reduce the manufacturing cost for each LED. Since the machine fixture is semi-automated, we can reduce a substantial sum in the labor cost. The expenditure spent on quality control for part components can be reduced because the machine fixture would produce LED's which is of a standard quality range. In addition, the usage of machine fixture saves operator labor through simplifying operation process and makes possible the replacement of skilled workforce with semi-skilled labor, hence effecting substantial saving in labor cost which also translates into enhanced production rate. Furthermore, the use of well-structured machine fixtures with higher locating and clamping rigidity would allow for increase in bending and cutting speeds and feeds, thereby reducing time, hence improving production rate. Besides improving the productivity in terms of the rate of production it also decreases expenditure on quality control of part component as machine fixture facilitates uniform quality in manufacturing.

There are several important roles that should be considered for this project and they include:

- a) Machine design
- b) Design of machine element
- c) Process manufacturing of the machine parts components
- d) Applications of the electro-pneumatic system in machine fixture
- e) Applications of the PLC to control the actuator and sequence process on machine fixture.

During implementation of the project, knowledge in mechanical, manufacturing and electrical engineering should be applied. During research, design and development of the machine, many factors will affect the alignment, mechanism and strength of material of machine. These factors must be detected and eliminated to make sure the machine function well. Several factors also must be taken into consideration, such as design for assembly (DFA) and design for manufacturing (DFM).

1.2 Problems Statement

Nowadays manufacturing plays an important role in achieving high productivity and reducing unit cost. This necessitates machine fixture to be efficient to increase the rate of loading and unloading or automated the machine fixture to speed up the manufacturing cycle time. To improve production rate, which also means reducing the cycle time of the manufacturing process, we need to analyze the machine fixture operated by operator to lower manufacturing lead-time and reduce the jam and breakdown time of the production. From here, the aim of this project is to study the machine fixture operative in electronic industry. So the responsibility on this project is to come out with a new design concept of the machine fixture to increase the productivity of LED components. From here, a new design with the concept of the LED

bending machine fixture, which is able to increase the productivity of the PCB board manufacturing industry, is going to produce.

Before producing the LED component as shown in figure below, operator needs a long cycle time to proceed, by using the jig fixture by manually to bend and cut the length of pin connector for LED component. The cycle time for complete process to produce LED as requirement below is more than 1 minute and operation sequence process by using that jig fixture is quite complex. From here, all of this phenomenon will reduce the production rate of the production and also the thorough time of the manufacturing process. This will contribute to low production quantity, which is below 50 000 unit per year.

Besides that, skilled worker must operate this jig fixture because only they can bend the shape of pin connector on requirement dimension. This situation will cause an increase in direct skilled labor required to operate the fixture. From here it will indirectly increase the production cost of the production because the factory needs to pay the skilled workers.

Other than that, LED produced manually by operator will increase the expenditure on quality control of part component as fixtures facilitate uniform quality in manufacturing. Sometimes operator cannot produce the shape of the LED as required and will damage the LED due to part defects. Therefore it will increase the production cost and affect the following processes.

If the jig and fixture is handled manually, it will damage the part easily. This is because of the human errors such as friction between the part and the machine elements. Therefore it will increase the maintenance cost. As a result the unit cost will be increased.

1.3 Objectives

- To design a flexibility machine fixture system that used to speed up the manufacturing cycle process and to reduce the manufacturing cost of each LED.
- To bend and cut the LED pin connector to the required shape and length and able to perform the various tasks/operations on a short duration time.
- To save operator labor through simplifying operation process and makes possible the replacement of skilled workforce with semi-skilled labor.
- To decrease expenditure on quality control of machined parts as fixtures facilitate uniform quality in manufacturing

1.4 Scope of Project

A structure of LED Bending machine fixture will be generated at the end of this project. It was designed based on requirement from PCB board electronic industry which bends and cuts the length of the LED pin connector in desired shape and dimension. Beside that this machine fixture needs to complete all sequence process in a fixed duration. The machine consists of three main mechanisms, which include: LED holding devices, bending mechanism and cutting mechanism. These three mechanisms will be combined to provide the function operation process to produce the LED on high production rate.

- The cycle time to complete process is lower than 20 sec per unit and production quantity is 100,000 units per year.

- The machine fixture is able to bend and cut the length of LED pin connector in requirement shape and dimension below.

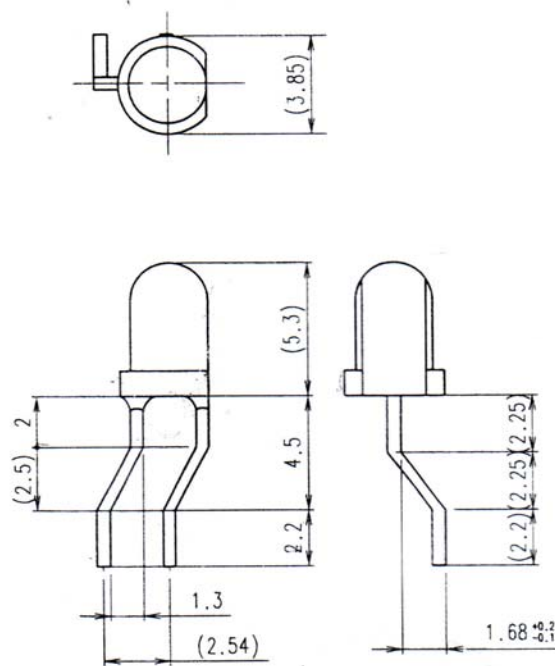


Figure 1.2: Dimension requirement of the LED

1.5 Thesis Outline

This paper summarizes the latest studies in the electronic field of flexible LED bending machine fixture design and automation. First, chapter one (1) will describe a brief introduction on this research area that included discuss an overview of the project, problem statement, the content of this thesis and also the main objective of doing this project. Secondly, chapter two (2) where compound all information about jig and fixture, the design consideration of the LED Bending machine fixture, introduction of PLC (Programmable Logical Control), and mechanical devices that used in machine fixture