UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DESIGN AND DEVELOPMENT OF GOLD BAR STAMPING DIE

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DESIGN AND DEVELOPMENT OF GOLD BAR STAMPING DIE

MUHAMMAD HAZIM BIN MUSA

A thesis submitted
in fulfillment of the requirements for the degree of
Bachelor of Manufacturing Engineering Technology with Honours

Faculty of Mechanical and Manufacturing Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2021

DECLARATION

I declare that this project entitled “Design And Development Of Gold Bar Stamping Die” is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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Name : Muhammad Hazim Bin Musa

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APPROVAL

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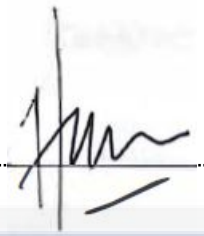
Signature : 

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Date :

DEDICATION

To my beloved family, Musa bin Busu, Jamidah binti Alvi, Muhammad Haziq, Nur Aleya Najiha, Nur Ain Nabila and Nur Aqilah Naili. Their cooperation and understanding were much appreciated.

To my supervisor, Mr. Hassan bin Attan who always put my self beyond my own expectation.

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Finally, to all my colleagues in BMMW for their support and team spirit.

ABSTRACT

Numerous manufacturers want to produce a range of stamping dies in response to the increased demand for gold bars. The purpose of this project is to design and develop a Gold Bar Stamping Die. There are three main steps in the fabrication of Gold Bar Stamping Die which are included design sketching, model slicing and machining process. From the results, Failure Mode and Analysis Effect (FMEA) was done on the Gold Bar Stamping Die model. Design analysis was executed on the Gold Bar Stamping Die prototype to analyze defects. Software analysis was performed to interpret the best Gold Bar Stamping Die prototype printing parameter. Most of the results and analysis was obtained to provide foundation for a future project in the making of Gold Bar Stamping Die.

Keywords: *Gold Bar Stamping Die, design, development, analysis.*

ABSTRAK

Banyak pengeluar menghasilkan pelbagai cop acuan sebagai tindak balas kepada peningkatan permintaan untuk jongkong emas. Projek ini bertujuan untuk mereka bentuk dan membangunkan sebuah cop acuan jongkong emas. Terdapat tiga langkah utama dalam fabrikasi sebuah cop acuan jongkong emas iaitu termasuklah lakaran reka bentuk, penghirisan model dan proses pemesinan. Daripada keputusan, mod kegagalan dan kesan analisis telah dilakukan ke atas model cop acuan jongkong emas. Analisis reka bentuk telah dilaksanakan ke atas prototaip cop acuan jongkong emas untuk menganalisis kecacatan. Analisis perisian telah dilakukan untuk mentafsirkan parameter percetakan cop acuan jongkong emas yang terbaik. Kebanyakan keputusan dan analisis diperolehi untuk menyediakan asas untuk projek masa depan dalam pembikinan sebuah cop acuan jongkong emas.

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LIST OF SYMBOLS AND ABBREVIATIONS

D	-	Distance
d	-	Diameter
mm	-	Millimeter
L	-	Length
W	-	Width
H	-	Height
R	-	Radius

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CHAPTER 1

INTRODUCTION

1.1 Background

Historically, the term ‘stamping dies’ has been used to describe the equipment used to cut and shape any parts or material. The process is also referred to the word ‘pressing’. Different methods have been proposed to classify punching with a machine press or stamping press, embossing, flanging, bending, blanking, and coining are all examples of sheet-metal forming industrial operations. To build and prove-out highly precise, unambiguous designs, they are often generated utilizing computer-aided design (CAD) software and analytical applications.

The term ‘Gold Bar’ will be used solely when referring to a quantity of refined metallic gold in any shape produced by a bar maker under standard manufacturing, labelling, and record-keeping circumstances. By pouring molten metal into moulds, ingots are bigger gold bars. Smaller bars can be made by printing new or stamping gold sheets that have been properly rolled. This demonstrates the need of being clear about what the term 'Gold Bar' means.

Gold has always been regarded as a unique and expensive metal. Gold can now be used as a hedge against both inflation and deflation, as well as a financial value investor. Gold bars can be classified into 55 categories, which include standard, inventive, and uncommon gold bars made all over the world. Weight denomination, shape, design, or a distinguishing trait are used to categorize the items. Diverse type of gold bar leading to different types of stamping dies.

1.2 Problem Statement

Owing to the increasing for gold bars, many manufacturers plan to develop a variety of stamping dies. It is fixated to the design or the form of the dies which can produce numerous gold bar. This poses great challenges to analyze parameter that need to be used, including the size and the shape.

Another thing that the manufacturer need to consider is that material selection allows designer more creative freedom during the design process. The designer might experimenting with a variety of designs to see how each material performs. As the manufacturer learns more about how each material behaves, the designer can tweak or improve the technique or design. This is extremely useful for avoiding future failures.

1.3 Project Objective

The main aim of this project is to design and develop Gold Bar Stamping Die. Specifically, the objectives are as follows:

a. To design a Gold Bar Stamping Die applicable to functional usability.

b. To produce an end product prototype of Gold Bar Stamping Die by using 3D printer.

1.4 Scope of Project

The scope of this project are as follows:

- Involving in the processing of physical gold based on different manufacturer.
- MY Bullion Trade, Bank Muamalat, UOB Malaysia are the name of the manufacturer that produce gold bar.
- Research on each manufacturer logo to provide different design of stamping die.

- Investigation on each details of materials that are suitable to be used for Gold Bar Stamping Die. This include the failure mode and effects analysis (FMEA) on each stamping die created.
- Exploration about the machine parameters and type of machine that are suitable to be used to build a stamping die.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

A stamping die is a custom-made, yet another precision tool used to cut and mold equipment to a specific form or profile. The cutting and shaping components are often made of tool steel, a kind of harden able steel. Cutting and shaping portions composed of carbide or other strong, wear-resistant materials can also be found in dies.

Die sizes range from those used to produce microelectronics, which can fit in the palm of your hand, to those used to build entire automotive body sides, which are 20 feet square and 10 feet thick. For a number of reasons, dies and molds, which are vital equipment for making designed items, generally fail or become outdated after a time of usage.

2.2 Types of Die

Stamping dies come in a variety of shapes and sizes, but they always do the same thing: cut, form, or both. Line dies are dies that are manually or robotically loaded. Automated progressive and transfer dies are available.

2.2.1 Cutting

The most often performed process in a stamping die is cutting. The metal is severed by putting it between two skipping tool steel parts with a little space between them. The cutting clearance refers to the gap or distance between the blades. Cutting tolerances vary according on the kind of cutting operation, the metal's properties, and the component part's necessary edge quality. Frequently, the cutting clearance is expressed as a percentage of the metal thickness.

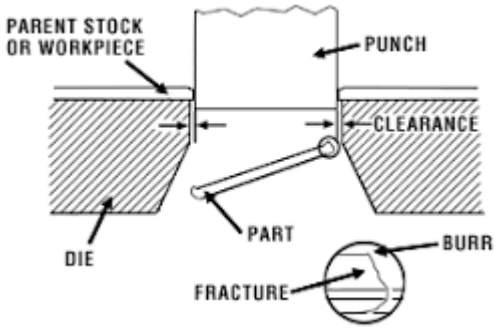

Figure 2.1 Cut edge of stamped part

2.2.2 Trimming

To give the component part the desired profile, The produced component's or flat sheet metal's outside perimeter is cut away. Excess material is typically dumped as scrap.

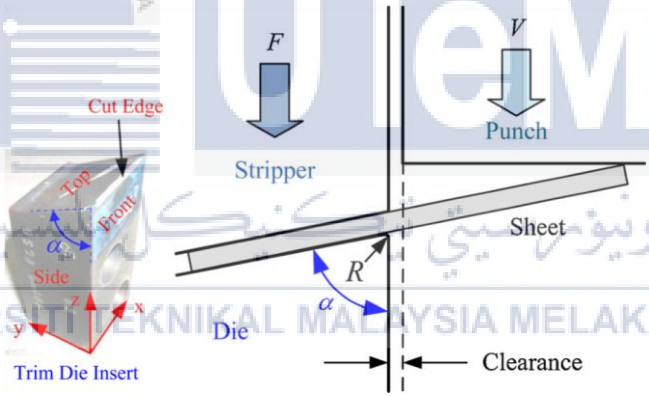

Figure 2.2 Trim Die Insert (Li et al., 2020)

2.2.3 Notching

Notching is a progressive cutting process performed on the outside of a sheet metal strip in order to create a specific strip profile.It is usually connected with progressive dies.

2.2.4 Blanking

Blanking also is a cutting procedure that is frequently done on a bigger scale in procedures where the slug is kept for subsequent press working. It can also be used to

separate final piece pieces from sheet metal. The blank, or initial piece of sheet metal from which further cuts or mouldings will be made, is the profiled sheet metal slug extracted from the sheet by this process.

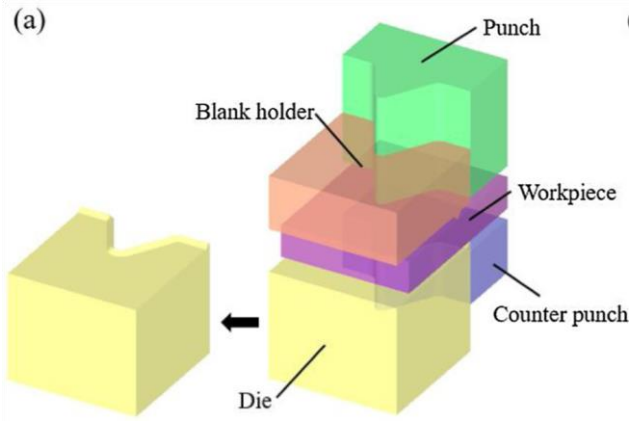

Figure 2.3 3D-FE Blanking Die Model (Y. Liu et al., 2018)

2.2.5 Piercing

Piercing is a metal cutting process that creates a round, square, or special-shaped hole in flat sheet metal or a formed object. It is also known as perforating. The fundamental distinction between piercing and blanking is that the slug is employed in blanking, whereas the slug is thrown as junk in piercing. The cutting punch that produces the hole is called the pierce punch, and the hole the punch enters is called the matrix.

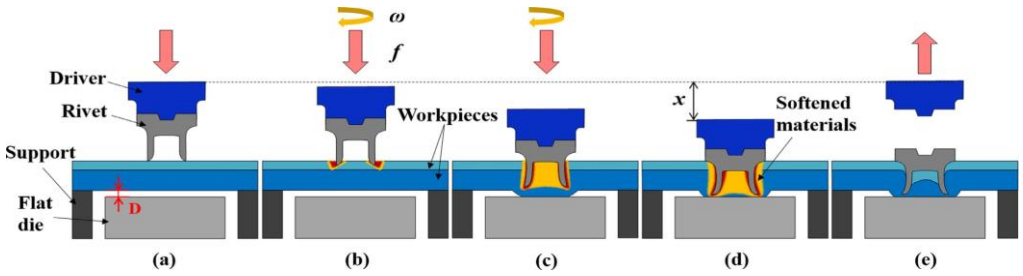

Figure 2.4 Schematic diagram of the fiercing die (a) Positioning, (b) softening, (c) deforming, (d) stopping, and (e) releasing. (Yang et al., 2021)

2.2.6 Lancing

Lancing is the process of slicing or slicing metal in order to remove it from the strip without separating it. Lancing is commonly used in progressive dies to form a flex or stretch web, which is a component carrier.

2.3 Stamping Die Framework

To develop an intelligent system capable of designing and manufacturing stamping dies for the sheet metal industries, a combination of computer aided design (CAD), computer aided process planning (CAPP), and computer aided manufacturing (CAM) is required.

The system takes a CAD file of a sheet metal item as input, and then all activities related with the design and manufacturing of stamping dies are automated by system modules. Modules are written in Visual Basic (VB) and created on the AutoCAD software platform (Hussein & Kumar, 2014).

2.3.1 Introduction

Stamping die design is regarded as an art rather than a science in the sheet metal industry. The improvement of computer assisted design (CAD) of stamping dies has been impressive since the early 1970s. The development of an intelligent system for automated stamping die design and manufacture is a pressing need in the sheet metal industry. This sort of system may be created utilizing expert system applications in stamping die CAD, CAPP, and CAM.

2.3.2 The Proposed Framework of Intelligent System

There are four primary components to this structure.

1. Interest in feature extraction and process design.