HIGHER TECHNICAL INSTITUTE

MECHANICAL ENGINEERING COURSE

DIPLOMA PROJECT

DESIGN AND CONSTRUCTION OF THE CARTRIDGE METAL HEAD DIES

M/604

BY: PSIMOLOPHITIS STYLIANOS-ELIAS

JUNE 1992



ACKNOWLEDGMENTS

Primarily I would like to express my gratitude to my project Supervisor Dr. L.G. Lazaris, lecturer at the HTI, who has been very helpful and encouraging throughout the preparation of my project.

I also want to thank G and L Calibers LTD, for the use of their facilities in executing the construction phase of my project.

CHAPTER 1

Introduction

1.1 Need Identification

The purpose of this project, was to design the dies required for producing the metallic head of a cartridge by using conventional manufacturing techniques.

The hunting cartridges or shotshell ammunitions as they are called, consist of the following parts:

- An external tube of plastic or paper (A)
- A metallic head (H)
- A base wad (G)
- Propulsive powder (E)
- Internal wad and/or lead container (D)
- Lead or steel shot or single bullet (C)
- Primer (F)

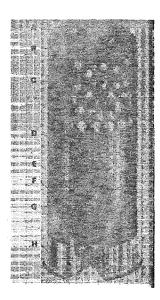


Fig 1.1 - Main parts of a typical shotshell

CONTENTS

ACKNOWLEDGMENTS	
CONTENTS	
CHAPTER 1 - INTRODUCTION	
1.1 Need Identification	1 - 3
1.2 Introduction to Metal Forming	3 - 5
1.2.1 Piercing and Blanking Operations	5 - 7
1.2.2 Drawing Operation	7 - 9
1.2.3 Forming Operation	9
1.2.4 Trimming Operation	10
CHAPTER 2 - DESIGN CONSIDERATIONS	
2.1 Material Strip Selection	11 - 12
2.2 Blank Development	12 - 15
2.3 Determination for the number of draws required	15 - 16
2.4 Fundamental rules for designing drawing dies	16
CHAPTER 3 - STRESS & FORCE ANALYSIS	
3.1 Shear action in metal cutting	17 - 19
3.2 Displacement of metal in drawing	19 -21
3.3 Force required for each operation	21 - 22
3.4 Pressure pad load	23
3.5 Press selection	23 - 27

(contents continued)

CHAPTER - DESIGN AND MANUFACTURE OF THE DIES	•
4.1 Material selection for the dies	28
4.2 Heat treatment of dies	28
4.3 Machining considerations	28
4.3 Design of the dies	29 - 57
CHAPTER 5 - DESIGN AND CONSTRUCTION OF THE DI	IE SET
5.1 The different types of die sets	58 - 59
5.2 Die set components	59 - 61
5.3 Die set design	62 - 65
CHAPTER 6 - THE PROGRESSIVE DIE	
6.1 Introduction	66 - 67
6.2 Strip development for progressive die	67 - 68
6.3 Progressive die design	68 - 71
6.4 Automatic stop and feed systems	72 - 73
6.5 Press selection for the progressive die	73 - 75
CHAPTER 7 - GENERAL PRESSWORKING CONSIDERA	TIONS
7.1 Die setting and maintenance	76 - 77
7.2 Carbide dies	77 - 78
7.3 Press working lubrication	79 - 80
CHAPTER 8 - PRESSWORKING TERMINOLOGY	81 - 100

(contents continued)

REFERENCES

APPENDICES

steels

Appendix I - Correction factor for determining the curve length for bend parts

Appendix II - Recommended blank holder pressure during deep drawing

Appendix III - Properties and uses of irons, plain-carbon steels, and alloy

Appendix IV - Selected ISO Fits - Hole Basis

Appendix V - International metric standard screw threads

Appendix VI - Open front mechanical presses - Capacity ratings and dimensions

Appendix VII - Recommended lubricants for pressworking operations