PROJECT NO. HIGHER TECHNICAL 1559 INSTITUTE

DESIGN OF A PORTABLE TRENCH EXCAVATOR

Project Report Submitted by

CHRYSOSTOMOU CHRISTAKIS

In partial fulfilment of the requirements for award of the diploma of Technician engineer in Mechanical Engineering of the Higher Technical Institute,Cyprus.

JUNE 1989

#### SUMMARY-CHRISTAKIS CHRYSOSTOMOU

The aim of this project is to design a portable trench excavator.

The portable trench excavator was designed to be powered by an Internal Combustion engine and making a ditch of dimensions 40 by 40 cm.

The excavator is suitable for personal use as well as for production purposes.

The approach followed is an engineering approach developed recently. The approach is a design process in which creativity, decision making and optimization design phases are applied to the problem to be tackled.

By applying these three phases of design first identify the need - A portable trench excavator - and then "create" out a number of possible solutions. Finally by combining some of the possible solutions and taking into consideration some of them terminate to the best solution which satisfies the objectives of the project.

After deciding the solution to be used , design calculations, selection procedures and detailed manufacturing drawings were carried out.

LIST OF CONTENTS

Page No

\_\_\_\_\_

ACKNOWLEDGEMENTS

SUMMARY

INTRODUCTION

CHAPTER Τ THE PHASES OF DESIGN 1.1 Needs statement 1 1.2 Definition of problem 1 1.2.1 General statement of need 1 1.3 Engineering statement 1 1.3.1 Objectives 1 Terms and conditions 1.3.2 2 1.4 Creativity phase 2 Morphological analysis Solution A 2 Solution B and B1 3 Solution C and C1 ..4 Solution D and D1 5 6 Solution D2 and E 7 Solution F 8 Solution G Solution J and K 9 1.4.1 Decision making 9 1.5 Summary 12

### CHAPTER II

EXCAVATOR'S BUCKET

2.1	Dimensioning of the bucket	13
2.2	Estimation of the excavating force	13
2.2.1	Estimation of the bucket surface area in shear	14
2.3	Estimation of the power required to generate a ditch	14
2.4	Design of the teeth	14
2.4.1	F.B.D of the bucket tooth	15
2.4.2	Stress analysis	15
2.5	Design of the bucket	18
2.5.1	Reinforcing plates	19
2.6	Design of the screws	20
2.6.1	F.B.D of the tooth	20
2.7	Other stresses	23

### CHAPTER III

## ESTIMATION OF ALL THE FORCES NEEDED IN THE DESIGN

### PAGE NO

3.1	Presentation	and layout of the design	25
3.2	F.B.D of the	bucket & bucket linkage	26
3.3	F.B.D of the	back linkage	27
3.4	F.B.D of the	overhead linkage	27
3.5	F.B.D of arm	1	28
3.6	F.B.D of arm	2	30
3.7	Summary		31

## CHAPTER IV

### DESIGN OF THE LINKAGES & ARMS

4.1	Design o	of the	bucket linkage	32
4.2	Design o	of the	back linkage	34
4.3	Design o	of the	overhead linkage	36
4.4	Design o	of arm	` <b>1</b>	42
4.5	Design o	of mem	ber 1	48
4.6	Design o	of arm	2	53

### CHAPTER V

### DESIGN OF THE WELDS

PAGE NO

5.1	Weld of the cutter	61
5.2	Weld of the side cutters	63
5.3	Weld all round the bucket	64
5.4	Weld on member 1	66
5.5	Weld on arm 2	73
5.6	Weld on member 2	74
5.7	Weld on the bucket linkage	79

CHAPTER VI

# HYDRAULIC SYSTEM

6.1Introduction846.2Selection of the hydraulic cylinders856.3Design of the pin866.4Design of the bushes93

,÷~

PAGE NO

### CHAPTER VII

#### COST ANYLYSIS

7.1	Introduction	95
7.2	Raw Materials cost	95
7.3	Equipment cost	97
7.4	Labour cost	98
7.5	Total cost	98
7.6	Summary	99

•

PAGE NO

CONCLUSIONS

REFERENCES

APPENDICES

MANUFACTURING DRAWINGS