

بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِیْمِ



HOSSAM MAGHRABY



شبكة المعلومات الجامعية التوثيق الالكتروني والميكروفيلم



HOSSAM MAGHRABY

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم
قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأقراص المدمجة قد أعدت دون أية تغييرات



يجب أن

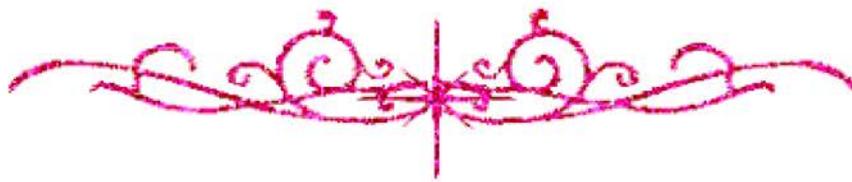
تحفظ هذه الأقراص المدمجة بعيدا عن الغبار



HOSSAM MAGHRABY



بعض الوثائق الأصلية تالفة



HOSSAM MAGHRABY



بالرسالة صفحات

لم ترد بالأصل



HOSSAM MAGHRABY

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

B 14977



DEVELOPMENT AND EVALUATION OF MULTI-CROP THRESHER

BY

AHMED ABD EL-KHALIK ALY EL-BEHERY

M.Sc. AGRICULTURAL MECHANIZATION

1988

THESIS

SUBMITTED IN PARTIAL FULFILMENT OF

THE REQUIRMENT FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

IN

AGRICULTURAL ENGINEERING

Agronomy and Agric. Mechanization Dept.

Faculty of Agricultural Moshtohor

Zagazig University

1995

Approval Sheet

**DEVELOPMENT AND EVALUATION OF
MULTI-CROP THRESHER**

by

AHMED ABD EL-KHALIK ALY EL-BEHERY
M.Sc. AGRICULTURAL MECHANIZATION
1988

This thesis for Ph.D. degree has been approved by:

PROF. DR. ABD EL-AZIM BADR *A. M. Badr*
PROF. OF AGRONOMY, MOSHTOHOR, ZAGAZIG UNIV.

PROF. DR. MOUBARAK M. MOUSTAFA *M. M. Moustafa*
PROF. OF AGRI. ENG., AIN SHAMS UNIV.

PROF. DR. AHMED F. EL-SHRIGI *A. F. El-Shrigi*
PROF. OF AGRI. ENGINEERING, AIN SHAMS UNIV.
(ACADEMIC ADVISOR)

DR. ZAKARIA A. EL-HADDAD *Z. A. El-Haddad*
ASSOCIATE PROF. AGRI. ENG. ZAGAZIG UNIV.
(ACADEMIC ADVISOR)

MARCH 20, 1995

TABLE OF CONTENT

	Page
LIST OF TABLES	
LIST OF FIGURES	
ACKNOWLEDGMENTS	
INTRODUCTION	
1 - LITERATURE REEVIEW	1
1 - 1 Design and Developmen	1
1 - 2 Crop Properties, Air Flow and Grain Separation	13
1 - 3 Crop Moisture Content and Crop Feed-rate Effect Grain Loss, Grain Damage and Grain Separation.	24
1 - 4 Threshing Effectiveness Effected By Crop Feed-rate, Cylinder Speed And Concave Clearance.	39
1 - 5 Energy Requirements And Efficiencies	47
2 - THEORETICAL ANALYSIS	51
2 - 1 Threshing Mechanism	51
2 - 2 Horsepower Requirement	55
2 - 3 Exhaust Fan Design	56
2 - 4 Belt Conveyor Design Background	58
3 - PROBLEM IDENTIFICATION	59
3 - 1 Feeding Mechanism	59
3 - 2 Machine Top Cover	59
3 - 3 Straw Outlt	59
3 - 4 Thresher Cylinder	60
3 - 5 Straw Fan Design	60

TABLE OF CONTENT

	Page
LIST OF TABLES	
LIST OF FIGURES	
ACKNOWLEDGMENTS	
INTRODUCTION	
1 - LITERATURE REEVIEW	1
1 - 1 Design and Developmen	1
1 - 2 Crop Properties, Air Flow and Grain Separation	13
1 - 3 Crop Moisture Content and Crop Feed-rate Effect Grain Loss, Grain Damage and Grain Separation.	24
1 - 4 Threshing Effectiveness Effected By Crop Feed-rate, Cylinder Speed And Concave Clearance.	39
1 - 5 Energy Requirements And Efficiencies	47
2 - THEORETICAL ANALYSIS	51
2 - 1 Threshing Mechanism	51
2 - 2 Horsepower Requirement	55
2 - 3 Exhaust Fan Design	56
2 - 4 Belt Conveyor Design Background	58
3 - PROBLEM IDENTIFICATION	59
3 - 1 Feeding Mechanism	59
3 - 2 Machine Top Cover	59
3 - 3 Straw Outlt	59
3 - 4 Thresher Cylinder	60
3 - 5 Straw Fan Design	60

3 - 6 Power Requirements	61
4 - TEST MATERIAL AND INSTRUMENTATION	62
5 - PROCEDURE AND METHODS	77
5 - 1 Machine Modifications	77
5 - 2 Threshing System (axial-flow)	91
5 - 3 Thresher balans	104
5 - 4 Intial Testing	111
5 - 5 No-Load Lab Testing	114
5 - 6 Field Testing	115
5 - 7 Final Modification and Testing	117
6 - RESULTS AND DISCUSSION	120
6 - 1 Belt Conveyor Evaluation	120
6 - 2 Threshing Efficiency	122
6 - 2 -1 Wheat Crop Throughput, Grain Output and Grain Loss	122
6 - 2 - 2 Soybean Throughput, Seed Loss and Seed Damage	129
6 - 2 -3 Corn Throughput, SeedLoss and Seed Damage	129
6 - 3 Straw Fan-Air-Flow	136
6 - 4 Energy Requirements and Efficiency	140
6 - 4 -1 Laboratory Test	140
6 - 4 -2 Field Test	146
7 - REGRESSION ANALYSIS	151
8 - ECONOMICAL ANALYSIS	153

9 - SUMMARY AND CONCLUSION	156
10 - LIST OF REFERENCES	158
11 - ARABIC SUMMARY	
12 - APPENDICES	

LIST OF TABLES

Table	Page
1 Power Required Based On Drum Length.....	9
2 Typical Horizontal Belt Capacity And Power.....	57
3 Typical Bulk Flow Capacity And Power.....	58
4 Grain To Straw Ratio Data.....	128
5 EL-Shames Model Data 1993.....	151
6 Assumed Values.....	155

LIST OF FIGURES

Figure	Page
1 The Axial-Flow Teeth Angles.....	10
2 Tractor Driven Thresher.....	62
3 P.T.O Shaft.....	63
4 Thresher Concave.....	65
5 Notebook Computer.....	66
6 Fluke Data Acquisition.....	67
7 Torque Meter.....	68
8 Balance Pac Instrument.....	69
9 Air-velocity Meter.....	70
10 Speedometer.....	71
11 Grain Pan Collector.....	73
12 Grain Screen Catch.....	74
13 Scales.....	75
14 Straw Chopper.....	76
15 Concave Belt Speed Used in Tests (m/min.).....	112
16 Machine Performance at 800 Cylinder rpm and m.c. 17.8%.....	124
17 Thresher Grain Losses At 800 Cylinder RPM.....	125
18 Grain Separation Analysis along Cylinder.....	127
19 Wheat Straw Length VS. Group Number.....	130
20 Soybean Seed Losses Percent at 40 kg/min. Feed rate and m.c. 13.8%.....	131

21 Soybean Seed Damage in Percent.....	132
22 Corn Seed Loss at 100 kg/min. Feed rate and m.c. 15.8%.....	133
23 Corn Seed Damage at 100 kg/min. Feed rate and 15.8%.....	135
24 Thresher Fans-Air Velocity, Air-Velocity VS. Cylinder RPM.....	137
25 Thresher Fans-Air Velocity, Air Velocity VS. Cylinder RPM.....	139
26 Power Required from LabTest at No-Load..... (Cylinder, Bagging Fan, Separation Fan and Grain Sieve).....	141.
27 Power Required from Lab-test at No-Load..... (Cylinder, Separation Fan and Grain Sieve).....	142
28 Power Required from Lab-Test at No-Load..... (Cylinder and Grain Sieve).....	143
29 Power Required from Lab-Test at No-Load..... (Cylinder Only).....	144
30 Power Required from Lab-Test at No-Load..... Test # 1, Test # 2, Test # 3 and Test # 4.....	145
31 Power Required from Lab-Test of Each Component at No-load..... Test # 1, Test # 2, Test # 3 and Test # 4.....	147
32 Power Required for Wheat Threshing At 3600 kg / h Feed rate and m.c. 15.8 %..	148