



**BUSITEMA  
UNIVERSITY**  
*Pursuing Excellence*

**FACULTY OF ENGINEERING**

**DEPARTMENT OF AGRICULTURAL MECHANIZATION AND  
IRRIGATION ENGINEERING**

**DESIGN AND CONSTRUCTION OF A MANUALLY  
OPERATED MILKING MACHINE**

**LUBEGA DANIEL**

**BU/UG/2011/102**

Contact: +256 70 5255369

Email: [lubegadaniel@ymail.com](mailto:lubegadaniel@ymail.com);



**SUPERVISOR(S)**

**MAIN SUPERVISOR: Mr. KIMERA DAVID**

**CO-SUPERVISER: Mr. SARANJAYE WILBERFORCE**

*A Final Year Project Report Submitted to the Department of Agricultural Mechanization and Irrigation Engineering as a Partial Fulfillment of the Requirements for the Award of a Bachelor of Science in Agricultural Mechanization and Irrigation Engineering*

**JUNE 2015**

**DECLARATION**

I LUBEGA DANIEL do declare that this project report is the work of my hands and has never been submitted to any university, college or any other Institution for any academic award.

LUBEGA DANIEL

Date



## **APPROVAL**

This report has been submitted in for examination after the approval of the following supervisors

Mr. Kimera David

Date:

Signature:

Mr. Saranjaye Wilberforce

Date:

Signature:

**DEDICATION**

To Muwanguzi Jonathan and ms. Namaganda Marion

## **ACKNOWLEDGEMENT**

I thank my Supervisors, mr. Kimera David and Mr. Saranjaye Wilberforce for their dedicated time in helping me out with this project proposal. It could really be tiresome to have this proposal without their guidance.

I extend my sincere acknowledgement with gratitude to ms. Kajumba A., mr. Rutaro G., mr Mutumba R. mr. Bitalo T.M., mr Amoti T. and mr. Suuna R.. These are people with whom I spent most time during my proposal incubation and they really helped me with great ideas. It is an amazing team of engineers all together. God bless you all.

Acknowledgement goes to the university that has been able to provide wonderful lecturers, engineers, doctors and professors that have continuously helped us in this tidy academic life

## **ABSTRACT**

Milking a cow is more of taking the calf's milk from its mother, therefore milking has to be more natural trying to mimic the cow's udder as though it is the calf suckling its mother. Milking started in a more lowly manner by human with an intention of fully utilizing the benefits of rearing cattle. However with the realization of the potential of milk to the farmers' income through milk products, a large amount of cattle has to be taken care of to increase returns. As the number of cattle increase on the farm, the farmer needed more efficient ways to increase returns through milking. Milking machines were introduced and these have been under rigorous research for the past century

In this report proposal a research is carried out to design and construct a manually operated milking machine. Since the milking machine technology has not just surfaced yesterday, there is need to review the existing literature about the machines in detail as seen throughout the following sections or chapters. Milking by a machine is by a vacuum that should be done carefully without hurting the cow otherwise the quantity would be little or less as the cow would kick off the equipment off her udder. Research indicates that there is a maximum of the vacuum that can be applied by the milking machine for milking by a machine to be successful. A farmer needs an affordable way of getting the milk without getting so much tired and at the same time not hurting the cow. These two traits are the most desired ones on a dairy farm if a milking machine is to be opted for. Uganda as a nation depends on agriculture to feed most of its fast growing population and with increasing demand. This implies that mechanisation of farm operations is needed to feed the increasing demand. Looking at the majority of the dairy farmers in Uganda, there is little capital to afford the existing technology in milking machine but this does not mean that they cannot benefit when there are other alternatives like manually operated machines. The farmer as an individual has to realize that there is need to save time and reduce the fatigue caused by the too much labor on the farm. The manually operated machine in the report proposal helps a low income farmer reduce on the stiff shoulders and weakness in fingers and saves time for other farm operations.

# TABLE OF CONTENTS

DECLARATION .....	i
APPROVAL.....	ii
DEDICATION .....	iii
ACKNOWLEDGEMENT .....	iv
ABSTRACT.....	v
LIST OF TABLES .....	VIII
LIST OF FIGURES .....	IX
CHAPTER I: INTRODUCTION.....	1
1.0 INTRODUCTION.....	1
1.2 Background.....	1
1.3 Problem statement.....	2
1.4 Aim of the study.....	3
1.4.1 Main objective.....	3
1.4.2 Specific objectives .....	3
1.5 Justification.....	3
1.6 Significance of the study.....	4
1.7 Scope of project study.....	4
1.7.1 Time scope.....	4
1.7.2 Conceptual scope .....	4
CHAPTER II: LITERATURE REVIEW.....	5
2.0 INTRODUCTION.....	5
2.0 Background of the milking machines.....	5
2.1 Problems associated with milking machines.....	5
2.2 Milk production.....	7
2.2.1 Internationally .....	7
2.2.2 Dairy production in Uganda.....	8
2.2.3 milking machines .....	10
2.2.4 Vacuum lines.....	10
2.2.5 Liners.....	11
2.2.6 Claw pieces .....	13
2.2.7 Air bleed.....	14
2.2.8 Cyclic fluctuations .....	14

CHAPTER III: METHODOLOGY .....	15
3.1 INTRODUCTION.....	15
3.2 Collecting data .....	15
3.3 Design of the manually operated milking machine.....	15
3.3.1 Introduction.....	15
3.3.2 At the udder.....	16
3.3.3 Conceptual design .....	16
3.3.4 Design of the frame.....	16
3.3.5 The vacuum pump.....	20
3.3.6 Foot pump.....	21
3.3.7 Milk can .....	22
3.4 Milk.....	22
3.4.1 Shell and liners.....	22
3.4.2 Action of the liners.....	23
3.5 Construction of the milking machine.....	23
3.5.1 Production of different components by drawing.....	24
3.5.2 Selection of the material.....	25
3.6 How the machine is operated.....	25
CHAPTER IV: TESTING OF THE MACHINE.....	27
4.0 Testing of the machine.....	27
4.1 Project cost analysis .....	28
4.2 Discussion of results .....	29
CHAPTER V: Challenges, Conclusions and Recommendations.....	31
5.1 Challenges.....	31
5.2 Conclusions.....	31
5.3 Recommendations;.....	31
REFERENCES.....	32
APPENDIX.....	33



## LIST OF TABLES

Table 2.1 Airflow rates in different galvanized pipes .....	10
Table 3 .1 Vacuum ranges.....	21
Table 5. 1 NPV Analysis.....	29
Table 5. 2 Project cost.....	30

## LIST OF FIGURES

Figure 3.1 Prototype Frame.....	19
Figure 3.2 Teat cup assembly.....	24
Figure 3.3 Milk Machine.....	25

## **CHAPTER I: INTRODUCTION**

### **1.0 INTRODUCTION**

Farming for a long time has been the back-bone of Uganda as a nation but within there are a few emerging sectors that are really impacting a change to people's lives financially and socially. These sectors need careful attention with rigorous research to address the existing problems to increase the farmers' outputs the more.

This chapter presents looks at the insight of the problem at hand and proposed solution

In order for the farmer to increase in production, the problem for too much labor has to be addressed by applying mechanization of the many activities for example milking of the cattle

### **1.2 BACKGROUND**

Domestic animal production has proven to be a good source of food all over the world, and a rapid growth in milk and dairy consumption has been seen in many developing countries over the last ten years (FAO, 2002). Milk is produced by all mammals; for human consumption mainly by goats, sheep, cattle, buffaloes and camels and 90% of the milk consumed by humans is from dairy cattle (FAO 1990).

Milk production in cattle can be greatly improved by continuously improving on breeding, feeding and management practices.

According to David W. and Rashid N., (2008), Dairy Investment Opportunities in Uganda, the dairy sector in the eastern and southern Africa is dominated by the smallholder producers who keep a few pieces of land, usually less than 3 ha and often under a mixed crop livestock production system. In Uganda, smallholder producers own over 90% of the national herd of about 7.5 million cattle and almost all the small ruminants and produce over 80% of the milk in the country

The dairy sector is the most time consuming and laborious activity on the farm and it calls for skilled and experienced labor if the farmer is to benefit from it financially. The Dairy Development Authority has a lot of quality controls which are sometimes so difficult for a

## REFERENCES

Wozemba D. and Rashid N., (2008), Dairy Investment Opportunities Report in Uganda-Report

Lowe F. R., (1981), Milking Machines, Pergamon Press Ltd.

[www.fao.co.ug](http://www.fao.co.ug), 5<sup>th</sup> November 2014

Koning K. and Rodenburg J., (2004), Automatic Milking: State Of The Art In Europe And North America,

New Vision 28<sup>th</sup> June 2013

Gupta J.K. and Khurmi R.S., (2005), A Text Book Of Machine Design, Eurasia Publishing House (Pvt.) Ltd., Ram Nagar, New Delhi-110 055

Vacuum Technology Know How, Pfeiffer Vacuum manual at [www.pfeiffer-vacuum.net](http://www.pfeiffer-vacuum.net) on 15<sup>th</sup> November 2014.

Journal of Dairy Science, (1981), vol. 64 article 6

Mein G. A., Thiel C. C., and Akam D. A., (1972), Mechanics of the teat and teat cup liner during milking, National Institute for Research in Dairying, Shinfield, Reading RG2 9AT

Daniel N. O., (1987), Teat Cup Assembly

Ekou J., African Journal of Agriculture Research, (2014) vol.9 issue 10 Dairy Production and marketing in Uganda: Current Status constraints and way forward, Busitema University Department of Animal Production and Management.

Uganda Investment Authority, UIA, (2007), Invest In Uganda's Dairy Sector, Twed Plaza, plot 22B, Lumumba Avenue.

Balikowa D., (2011), Dairy Development in Uganda: A review of Uganda's dairy industry

Budynes-Nisbett, (2006) Shigley's Mechanical Engineering Design, McGraw-Hill