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SUSTAIN

WORKSHOP & TECHNICAL ASSISTANCE:
PACKAGING

AUGUST 22 - SEPTEMBER 1, 1993

UGANDA

S haring
U nited
S tates
T echnology to
A id in the
I mprovement of
N utrition

A U.S. Private Food Industry initiative
in collaboration with the U.S. Agency for International Development
through a Cooperative Agreement with the National Cooperative Business Association

Upgrading the Food Processing Industries in Developing Countries.

Why SUSTAIN?

SUSTAIN represents a successful collaborative effort between the U.S. food industry and the Agency for International Development (A.I.D.) to upgrade food processing in developing countries. It provides an excellent model for similar private-public sector joint ventures in health, agriculture and other areas of concern to developing countries.

Food processing is a major contributor to development. It serves multiple roles. Food processing can increase the available food supply by extending the life of perishable food products. It can improve the nutritional quality of the diet by making nutritious foods available the year round. It can lead to the growth of related enterprises in transportation, storage, distribution and marketing. And, it can produce much needed foreign exchange by creating value added products both for export and for internal substitution of imported processed foods.

The U.S. food industry has embraced the concept that freely sharing its expertise and knowledge is of mutual benefit to recipient and donor - to the recipient by improving current operations - to the donor by contributing to a healthier global future.

How SUSTAIN Works

A.I.D. missions and trade associations in developing countries publicize SUSTAIN's goals and activities. Executives of U.S. food companies with technical expertise and overall knowledge of the food industry serve as the SUSTAIN Steering Committee, providing guidance and overseeing activities.

Food related companies in developing countries submit their requests to SUSTAIN through the A.I.D. mission or a designated organization in their country. SUSTAIN screens all incoming requests and if necessary asks for additional information. Appropriate U.S. companies are then invited to respond.

Some problems can be readily resolved by providing information. Others require that consultants be sent. When a consultant is sent, the usual assignment is for one to three weeks. Upon completion of the assignment, the consultant prepares a report describing findings and making recommendations. Depending on need, some consultants may return for follow-up visits to ensure that recommendations have been appropriately implemented.

SUSTAIN Helps

Requests are diverse. Help may be needed to solve processing problems, to identify equipment needs and sources of new and used equipment, to train personnel in the use of new equipment and new technologies, to find new uses for indigenous commodities, to establish or improve quality assurance procedures, to control insects and rodents in food processing plants and to improve plant layouts and materials handling.

In the past, U.S. food companies, large and small, have provided technical assistance in the form of information, consultants and training to food processors in Africa, Asia, Latin American and the Caribbean.

SUSTAIN

Sharing U.S. Technology to Aid in the Improvement of Nutrition

WORKSHOP AND TECHNICAL ASSISTANCE:
PACKAGING

Uganda

August 22 - September 1, 1993

by

SUSTAIN Volunteer:

Mr. Donald C. Lindemann
Senior Packaging Engineer, Land O'Lakes Inc.

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TABLE OF CONTENTS

Report

I. Introduction 1

SUSTAIN

Objectives of SUSTAIN Mission

II. Report by Mr. Don Lindemann

Objective & Scope of Work 2

Executive Summary 3

Reccomendations 5

Background 10

Itinerary 11

Details of Visits
Professor Ochieng at EPADU 14
Professor Mohammed L. Sserunjogl, Department Head School of Food Science and Technology, Makerere University 15
Dr. E. Kasirye-Alemu, Executive Director, Uganda Bureau of Standards 15
Mwine Jim Kabeho, General Manager, Mulbox Ltd. 16
Kenneth Kaboyo, General Manager, Associated Paper Industries 16
Saeed A. Chaudry, Printpak Uganda Ltd. 17
Maganjo Grain Millers Ltd. 17
Jewel of the Nile 18
Bonfiface K. Mwamuye & N. Matembe, Uganda Breweries Ltd. 19
Ronnie Mayambala, Engineer, BMK Industries 20
Keith Sherper, Bruno Komakech, Stephan C. Ryner, USAID Mission 20
William Kalema, Francis Nsonzi, Michael Sseguya, entire staff of UMA 21
Richard S.M. Bakojja, Owner, Liberty Dairy Services 22
Ignatius B. Ngobi, Production Manager, The National Dairy Corportation 23
Surjit Singh, Production Manager, Mukwano Industries (UK) Ltd. 24
ROSA BROS. Ltd. 25
A.K. Musisi, Owner, Kampala Jellistone Supplier, Ltd. 26
James Mulwana, President, Ship Toothbrush Ltd. and House of Plastics 27

Summary of 2-day Seminar Presentations 28

Presentation Details 30

Attachment #1 Jewel of the Nile Business Plan
Attachment #2 Liberty Dairy Business Plan
Attachment #3 Nice Toothbrush & House of Plastics Brochure
Attachment #4 Dairy Corporation Information
Attachmnet #5 Correspondence
Attachment #6 High Technology Training Module
Attachment #7 Hand-out on USA Food & Beverage Packaging
Attachment #8 Business Cards
Attachment #9 Photographs of Uganda

III. Report by Uganda Manufacturers Association

Appendices

I. SUSTAIN Description

II. Biography of SUSTAIN Volunteer

I. INTRODUCTION

A. SUSTAIN

The program Sharing U.S. Technology to Aid in the Improvement of Nutrition (SUSTAIN) provides access to U.S. expertise in food processing to help improve nutrition in the developing world. Technical assistance is provided by volunteer professionals from U.S. food companies, universities, and other organizations who donate their time and expertise. In 1991, the Office of Nutrition of U.S. Agency for International Development awarded the National Cooperative Business Association a $2 million, five-year cooperative agreement to work with SUSTAIN's volunteer leadership to improve, expand, and manage the program.

The assistance SUSTAIN volunteers provide contributes to improved health and nutrition through improved food quality, safety, and availability. In many countries, sufficient food is produced but populations are underserved because much of it goes to waste due to inefficient processing and storage. Improper food handling presents a hazard to human health, and improper waste disposal can contribute to environmental degradation. Strengthening manufacturing practices not only captures scarce resources, but also improves food safety and elevates nutritional status.

B. Objectives of SUSTAIN Mission

SUSTAIN volunteer Mr. Don Lindemann, Senior Packaging Engineer, Land O'Lakes, Inc. traveled to Uganda on August 22 - September 1, 1993 to deliver workshop presentations on packaging and to conduct site visits to deliver individualized technical assistance to local organizations and food processors. Improvements in packaging of food products can lead to the improvement of shelf-life, quality, safety, and nutritional value of locally produced foods. This helps alleviate nutritional deficiencies and health related problems and promotes consumption of safe, nutritious foods by the local population. Improvements in packaging also help expand opportunities for these products on local, regional, and international markets. This should lead to increased sales and economic growth, which in turn alleviates poverty.

The organization of the workshop and site visits were a collaborative effort between SUSTAIN and Uganda Manufacturers Association (UMA). Over 90 food professionals participated in the workshops. The packaging workshop followed-up the March 1993 assessment mission to Uganda by SUSTAIN volunteer Dr. John Nelson (Vice President-Science and Technology, McCormick & Company). In conjunction with UMA, Dr. Nelson identified packaging as one of the technical assistance and training needs for food processors, government, and university personnel.

II. REPORT BY MR. DON LINDEMANN

OBJECTIVE

To bring detailed Packaging information to the people of Uganda based on what their assessed needs may be in an effort to improve packaging and the products.

SCOPE OF WORK

* **To provide on site consulting services to manufacturers and to assess current packaging needs including systems, materials, supply sourcing, and packaging business opportunities for the Ugandan people.**

* **Industries to be visited include Baking Industries, Dairy Industries, Fruit Processing, Grain Milling Industries, Meat & Fish Processing, Oil Processing, Peanuts, Coffee, Soy Processing, Beverage and Spice Industries.**

* **Consulting services will also be provided to the packaging material manufacturers as requested including polyethylene blowers and plastic bag makers, paper bag makers, corrugated shipper makers, waxed paper, blow molded bottles, cups for fruit and ice cream, and plastic packaging used for milk.**

* **To deliver a 2-day seminar to a large audience of government leaders, business leaders and technical staff on the importance of proper packaging and how to improve packaging methods and materials so that the quality of the products is acceptable on regional and international markets.**

* **The seminar is to include how to produce cost effective, functionally effective, and operationally effective packaging for a wide range of food products. Of special interest is the need to extend product shelf-life and packaging that can overcome infrastructure limitations.**

EXECUTIVE SUMMARY

Uganda, for the most part, is an Agricultural economy. There is much food grown in the country and, it is grown year around due to the temperate climate. The soil is fertile and produce grows well, without fertilization. Still, many people go hungry or are not eating nutritionally balanced diets. Further, in many neighboring countries people starve. The reasons are as follows:

Uganda produces tons of quality food annually that is lost to vermin and spoilage due to a lack of food processing and packaging.

FACT:

> **Packaging is the key to ELIMINATING starvation, and malnutrition in Uganda and neighboring countries.**
>
> **Between 30-50 percent of the food produced in Uganda is lost between the producer and the consumer. This is not unique to Uganda, but is true for many developing nations. In the US by contrast, that figure is less than three percent.**
>
> **According to a study conducted by the United Nations,**
>
> **"Improved packaging and handling could immediately reduce crop loss by 5% in all developing countries. Just that improvement alone would increase the world food supply by 39 million tons each year, nearly twice the annual 20 million ton world wide food deficit. This savings is in the absence of any other method of food processing."**

The food produced in Uganda could feed not only the Ugandan people but neighboring countries as well....and in the process, significantly contribute to the economic well being of the people.

With regard to Packaging, the problems fall into three broad categories as follows:

1. **<u>They need information.</u> Books videos, magazines, and technical experts and consultants to teach and explain all facets of packaging. As a packaging generalist with a teaching background and several years of industry experience using a wide variety of materials and systems, I was, by default, well qualified for this first visit to Uganda. Specialist in specific industries may be more suitable in future visits. The seminar was able to acquaint people with the importance of packaging, the function of packaging and various processes.**

EXECUTIVE SUMMARY Cont.

2. **They need technology and access to materials. There is not even a single canning line in all of Uganda. Retort packaging systems such as canning will be essential to capturing food lost to vermin and spoilage and will be necessary to prepare foods for export. There may be a unique opportunity to get donated used equipment from US packaging machinery manufacturers and their customers, the food giants of America. USAID may only have to be concerned with shipping cost and training. See the recommendations section for more information.**

   The country has huge forest reserves for making paper and they have all the resources necessary to make glass, but no technology to do so. They need affordable sourcing of cans, jars, plastic resins, adhesives, tapes and countless other packaging materials. There is an immediate need for a company to produce high quality pressure sensitive labels.

3. **They need Capital. There are some immediate entrepreneurial opportunities I have identified where small investors in the 300K to 500K range could do extremely well. There are also some big capital requirements that would need thorough research on markets in all of central Africa to meet feasibility such as a glass bottle factory, or Aseptic packaging technology such as a Tetra-Pak or Combi-bloc applications. Even businesses well positioned for growth with clearly identified markets have trouble acquiring capital.**

RECOMMENDATIONS

I recognize that some of the recommendations I make in this report may not be within the scope of what USAID and SUSTAIN can do. I make them nevertheless, because they will become critical to effect real results in improving Packaging and it's societal impact on Uganda.

Follow-up Visit:

The most effective end to the work begun in Uganda includes a follow-up visit by myself or another Packaging professional who specializes in specific areas. They should be well briefed before going about all aspects of the country, so they can address their specific needs.

Many requests were made for information on certain processes, specific materials and access to the materials. The need to put samples in peoples hands and discuss the various options and there associated advantages or disadvantages can only be done one on one if results are to be expected.

Need for Educational Materials

Books, industry related magazines, video tapes, training apparatus and instrumentation is needed and welcomed as donated gifts. They could be used by the UMA and their training efforts as well as the University. I am convinced that all these items can be obtained as gifts and donations and they would be invaluable to start-up industries.

Materials Sourcing:

Sourcing raw materials for manufacture is a major challenge. As a landlocked country, imported materials must pass through neighboring countries, often times charging exorbitant taxes.

The raw materials alluded to include food processing additives such as flavorings, preservatives, and stabilizers to packaging materials such as paper, plastic resin, adhesives, glass and metal containers.

> **If there is a published resource guide listing materials manufacturers throughout Africa, India, Asia and Europe it would be useful to the UMA in helping manufacturers meet their needs.**

Feasibility Studies:

A variety of studies should be undertaken to determine the technical & economic feasibility of producing a variety of materials with the countries borders.

Note:

> **Countries like Denmark have almost no raw materials of their own; nevertheless, they are able to make affordable quality products for export all made from imported raw materials. They of course have friendly trade status with all their neighbors and "fair" taxation occurs.**

Uganda has abundant natural resources that if tapped, could help liberate them economically.

For Example:

> **In a discussion I had with one of the Professors at the University, I learned that all raw materials to make glass and glass containers were present within the borders of Uganda; ie, silica sand, feldspar, aluminum trioxide, and soda ash. If the market in Central Africa is large enough, perhaps it becomes economically feasible to make the capital investment required to produce jars and bottles. Not only would they be able to meet the needs of local manufacturers but would create an excellent export product.**
>
> **The same scenario may be true for paper and paperboard making, metal can making, adhesives and others packaging media.**

Appropriate Technology:

While the country could sustain a few large capital endeavors such as a glass factory, the majority of what must be accomplished in the next 10 years will happen in what we term "cottage industries." Scaled down versions of our factory equipment, more akin to those used in our pilot plants or labs are needed to produce a large variety of low volume goods. More importantly perhaps, these are the only kinds of equipment that are even remotely affordable.

A concentrated effort to identify small scale equipment and materials for a wide variety of packaging applications is necessary for them to make informed choices that best meet their needs.

Obstacles to Overcome:

One of the big obstacles is the glaring shortage of capital required even for the most modest endeavors. Secondly the infrastructure in all it's forms, electric, water, sewer, telephone, roads, and transportation is only fairly reliable in the most urban locations. This is an obvious obstacle to serious manufacturing endeavors.

Since refrigeration is a luxury enjoyed by few, foods prepared, packaged and marketed for shelf stability must be emphasized.
There seems to be an aversion to canned foods.

A School of Packaging

Background:

In 1989 I became involved with the PMMI (Packaging Machinery Manufacturers Institute) in Washington DC in an effort to expand training at the Wisconsin Indianhead Technical College to include a two year Automated Packaging Systems program. The program stated in 1976 basically to offer some courses in Packaging. I was recruited to expand the program to a 2 year degree program.

As the program materialized, more than $5MM worth of Packaging machinery was donated to the school for the purpose of instruction by the 330 corporations that comprise PMMI and their customers which include most of America's Fortune 500.

Donated equipment was often new, a proto-type, bench-top models or equipment that had recently been replaced by next generation models. Some companies donated component parts including PLC controllers, switches, motors, conveyors, check weighers, labelers etc. Other companies donated complete canning lines, bottling, vertical and horizontal form fill seal lines, Aseptic fillers (Tetra-Pak), injection molded container equipment, cartoners, corrugated case packers, auto-palletizers, shrink and bundle wrap equipment etc.

The school became well equipped to teach students all aspects of packaging machinery including installation, maintenance, operation, modification, rebuilding and interfacing within a variety of packaging forms and applications.

Although the school was capable of performing contract packaging for industry, this was not within the scope of the program.

Students graduating from this program are some of the highest paid technical school graduates in the US with some past graduates earning in excess of 70K annually.

The school provided the infrastructure to make the program a success; ie, the proper space (floor space and ceiling clearance) the power requirements, drainage, disposal etc.

Proposition:

Why couldn't a similar program be set up in Kampala, Uganda?

Machinery could be solicited worldwide with special request for target equipment. Perhaps USAID to work with the government to create a tax break or subsidy of some kind to be offered to participating companies as an incentive to donate machinery.

It may be possible to get PMMI (packaging machinery manufacturers Institute) an International organization, to donate used packaging machinery for the purpose of setting up a Pilot Plant and a training center at Makerere University. The school would not only provide the technical training necessary to operate and maintain the sophisticated equipment, but provide opportunities for entrepreneurs to create a packaged product for a small fee for test market purposes. Business plans prepared with data from local test markets are more effective in acquiring capital than plans without this information. It could also be used for co-packing, creating an income for the school.

PMMI has done this for a number of Universities domestically. It might be possible to get assistance if it were presented as a Key to ending starvation in Central Africa (See letter from William Kyamuhangire - department head at Makerere - attachment #5)

It is my experience that much used equipment exist throughout corporate America and is lying idle in warehouses. It may not be cutting edge technology, but nevertheless, it is perfectly functional.

For Starters:

As indicated earlier in this report, there is not a single canning line in all of Uganda. I am certain that with only a modest effort, a complete used canning line could be donated for training purposes. A reliable source of tinplate for making cans would have to be identified and/or a reliable can maker to be set up with the canning line. Food cookers and steamers would also be a identified.

Green Giant produce packers has a used canning line complete and in-tact lying in storage. They offered to donate the entire system to the Packaging School at WITC.

There was no room for such a big piece of equipment and we turned the offer down. The equipment was still being warehoused as of the spring of 1994.

One request made of me from a coffee producer I visited in Kampala was information on used high quality roasters, pouch formers and sealers.

Coincidentally, Fisher nut, a large peanut roaster and packager located in the twin cities was recently purchased by Proctor & Gamble. The Fisher Nut plant was closed down in March 1994 and production moved to an east coast location. The entire place is replete with high quality roasters and packaging equipment that will be expeditiously sold and/or disposed.

These natural gas roasters are of the highest quality and may be obtained for little or no money. Shipping costs would be another matter. The roasters were previously used for roasting peanuts and cashews at the Fisher Nut Corporation but were originally designed to be coffee roasters. There are 38 roasters and all are natural gas roasters. There is some discussion of having an auction, but it is unlikely that all roasters will be sold.

If there were some tax incentives granted for donating the equipment to USAID I am sure it would go a long ways in getting Proctor and Gamble to give away the equipment. P&G is in the coffee business and may consider Uganda roasters a competitive threat. Some diplomatic efforts may be required to assure them that Uganda coffee producers could not present a threat for many years and well beyond the time this technology will be obsolete to P&G.

The Packaging equipment includes bottle fillers and cappers Vertical form/fill/seal pouch machines, case packers, banders, hot melt adhesive applicators and more.

If you wish to contact the people directly the information is as follows:

Fisher Nut Company - St. Paul, MN. USA

Contact: Paul Boyd or Palmer Peterson
Telephone # 612-645-0635
FAX # 612-646-6023

I have also attached some curriculum outlines as well as a complete High Tech Training Module. It has my permission to be donated to Makeere University if such a school should ever be attempted. See Attachment # 6.

BACKGROUND:

My perception of the Bantu are that they are a lovely, gentle, and soft spoken people. There are thirty-two tribes in Uganda, the largest of which is the Buganda followed by the Acholi and Langi. A Buganda King was recently coronated as the King of Uganda and is accepted by all tribal kings as such.

The majority of development by aliens was achieved by Asians, some Indians and some Arabs, most of whom were driven out of the country by Amin in the 70s. The International Commission of Jurist have estimated that more than 100,000 people were murdered during Amins reign. Since 1985, some aliens have slowly returned.

President Museveni took power in 1986 and is taking important steps in revitalizing the country. Systematic privatization of government projects is underway including the National Dairy Corporation.

Throughout the country the private sector is in the early stages of rebuilding. The people are very enthusiastic about developing their country and the energy level is very high.

Much of the country's infrastructure, notably it's transportation and communication systems were destroyed by the war and neglect. It must included in the plan in order for serious enterprise to be undertaken.

Price stability and inflation is presently under control and is reported at 1% increase in 1993 as opposed to 300% in 1987 and as much as 30% in 1990.

Itinerary

My itinerary is attached. It was just a general outline of my activities however. We did not see some of the companies on the list and visited many that were not on the list.

The most significant deviation from the itinerary is that I decided to stay an extra 3 days and learn more about the country and visit additional industries. I flew out of Entebbe on Sept 1, 1993.

Itinerary

VISIT TO UGANDA BY Mr. Don Lindemann
August 22 - September 1, 1993
PROPOSED PROGRAMME

Sunday, August 22, 1993

10:00 a.m.	Arrival

Monday, August 23, 1993

9:00 - 9:45 a.m.	Meeting with James Mulwana, Chairman, Uganda Manufacturers Association at Plot 10 Kalitunsi Road, Bugolobi
10:00 - 11:00 a.m.	Meeting with USAID Mission Director, and other key USAID staff, at 42 Nakasero Road
11:15 a.m. - 12:15 p.m.	Meeting with Director, Export Policy Analysis and Development Unit, EPADU, Professor Erisa Ochieng
2:00 - 3:00 p.m.	Meeting with Executive Director, Uganda National Bureau of Standards, Industrial Area, Dr. Evelyn Kasirye-Alemu
3:15 - 4:15 p.m.	Meeting with Acting Head, Food Science and Technology Department, Makerere University, Mr. Mohammed Serunjogi
4:30 - 5:30 p.m.	Meeting with Director, UMA Consultancy and Information Services, Dr. William Kalema at Kalitunsi Road, Bugolobi

Tuesday, August 23, 1993

9:00 - 10:00 a.m.	Nge-ge Fish Processing Company, Luzira, Mr. Krishna Keddy
10:30 - 11:30 a.m.	Maganjo Grain Millers Ltd., Mr. Wilson Bahemuka
2:30 - 3:30 p.m.	Associated Paper Industries Ltd, Jinja, Mr. K. Kaboyo
3:45 - 4:45 p.m.	Printpak (U) Ltd, Jinja, Mr. P.K. Kabagambe

Wednesday, August 24, 1993

8:00 a.m.	Registration
9:00 - 10:15 a.m.	Plenary Session Chairman: Dr. William Kalema, UMA
9:00 - 9:30 a.m.	Keynote Address: Hon. Henry Kyemba, Minister of State of Agriculture, Animal Industry, and Fisheries
9:30 - 10:15 a.m.	Executive Session, Address by Mr. Don Lindemann (Audience: Company Executives, Policy Makers, etc.)

10:15 a.m.	Break
10:45 - 12:45 p.m.	Introduction, Product Packaging, Mr. Don Lindemann
12:45 p.m.	Lunch
2:00 - 3:15 p.m.	Group Discussions Groups will represent the food processing sector in Uganda. Each group will have participants from a given food processing sector such as dairy, meat processing, fruit juice processing, cereals, edible oils, packaging companies, and others.
3:15 p.m.	Break
3:30 - 5:00 p.m.	General Discussion and review of the points raised in the various group discussions
Thursday, August 26, 1993	
9:00 - 10:45 a.m.	Product Packaging, Mr. Don Lindemann
10:45 - 11:15 a.m.	Break
11:45 a.m. - 12:45 p.m.	Product Packaging, Mr. Don Lindemann
12:45 p.m.	Lunch
2:00 - 3:00 p.m.	Group Discussions Groups will represent the food processing sector in Uganda. Each group will have participants from a given food processing sector such as dairy, meat processing, fruit juice processing, cereals, edible oils, packaging companies, and others.
3:00 p.m.	Break
3:30 - 4:30 p.m.	General Discussion and review of the points raised in the various group discussions Closing and Reception
Friday, August 27, 1993	
9:00 - 10:00 a.m.	Africa Basic Foods (U) Ltd, Gaba
11:00 a.m. - 12:00 p.m.	Liberty Dairy Services Centre, Entebbe, Director, Ms. R. Bakoja
3:30 - 4:30 p.m.	Debriefing with USAID Mission staff
Saturday, August 29, 1993	
9:00 - 11:00 a.m.	Mukwano Industries Ltd. Kampala, Director, Mr. Ali Khan Karmali
Sunday, August 29, 1993	
10:40 a.m.	Departure

Meeting with Professor Ochieng at EPADU

I met with Professor Erisa O. Ochieng, the director of EPADU - Export Policy Analysis and Development Unit which is part of the Ministry of Finance and Economic Planning. Joining Professor Ocheing was Paschal Nyabuntu a post harvest and marketing specialist who shared his views on post harvest losses, and Barnabas M. Sekabembe an agricultural economist who was very articulate on the agricultural economic potential.

EPADU in general was very interested in Packaging and explained that even the most basic information is needed to meet the export expectations of developed nations. Professor Ocheing expressed his concern that no source of Packaging expertise is available in the country. He further indicated that extended training is needed. The need is broad in that it includes information for consumer goods, food & beverage, pharmaceutical, industrial and hazardous material handling and equally important information on Packaging Systems. EPADU is specifically interested in meeting packaging export laws and requirements.

Uganda has a wealth of items it can export and since Uganda is uniquely poised for large exports of exotic flowers, I took time to demonstrate what is required, not only for product protection, but by law in some countries. I left Professor Ocheing with a book which included a 39 page published explanation for effective fresh flower packaging for export.

Professor Ocheing also expressed an interest in information on the production, processing and packaging of "Catfish". I discussed the success of Arkansas Catfish farmers and how they have exported the technology to India, China and others.

Professor Ochieng would like to be contacted by the Arkansas Catfish Farmers Association for the purpose of bringing this technology to Uganda.

Meeting with Professor Mohammed L. Sserunjogl

Professor Sserunjogl clearly articulated the great need for specific studies in Packaging pointing out the lack of knowledge of what specific material should be used for optimal packaging of any given product. He also expressed an interest in export Packaging of Horticulture products, fresh fish products and produce. He further expressed a keen interest in Aseptic processing and packaging and reflected on the great need for more information and expertise in these areas. He expressed an immediate need for more information on food grade plastics required for packaging and information on which plastic structures (polyethylene, polypropylene, polyester, etc.) and co-extrusions of each impart which barrier characteristics needed for specific food applications. I was able to cover some of this information in my presentation and left a good book with UMA that addresses these questions on Plastic structures.

Meeting with Dr. E. Kasirye-Alemu

Dr. Kasirye-Alemu's communicated that her charge ultimately is to ensure the safety and protection of life. She is developing standards for Processing, Handling, Promotion and Manufacturing. She had a particular interest in information regarding the use of Food Grade Plastics packaging. To make the point she provided samples of food products that appeared to be distributed in reused clorox bottles.

She needed published information on food grade plastics both for injection molding applications and film rollstock for use with form/fill/seal applications. Her interests also include specifications on paperboard differences and chemicals used in paperboard production. She needs information on corrugated and how varieties of corrugated board should be specified for a given application in boxes and shippers, ie; what weight board should be specified for a shipper requiring a given volume and weight to provide adequate protection. I was able to address some of these questions in my presentation but she requires published information for reference.

She was interested in more information on measuring and assuring effective sterility in Aseptic packaging applications.

Dr. Kasirye-Alemu has an immediate need for a complete set of published ASTM standards available in the US. (American Standards for Testing Materials) to use as a bench mark for some of the work she is trying to accomplish.

Mwine Jim Kabeho, General Manager - Mulbox Limited

Mulbox is a corrugated box manufacturer located in Jinja. They are the only corrugated manufacturer in Uganda except for Mukwano Industries. They have older technology but fairly effective. They are only capable of making B-Flute containers however. They could add significant strength to their boxes and meet an overall greater general population of need by modifying there equipment with a C-Flute corrugator. Paperboard roll stock is imported from the U.K. and it appears to have a moisture control problem in that it is high in moisture content and contributes to warping and gluing problems. The plants capacity is 30-35 tons/month of output.

They have expressed a need for a die cutter with a pattern for making self-locking shippers. They need pricing, availability of used equipment and a way to get it to their plant.

They also have a problem with the adhesives they use, in that it is often inconsistent. They would like access to hot-melt adhesives and hot melt applicators.

They have customers which require multi-colored printing capability for which they have none at this time. Information on corrugated printing presses is needed. They are mostly interested in water based ink systems to prevent environmental damage as a result of using oil or lacquer based inks.

Kenneth P.M. Kabovo-General Manager - Associated Paper Industries

API is a paper bag manufacturer located in Jinja. They import paperboard from Kenya, Tanzania and Sweden. They are presently limited to making bags in the 1 Kg to 25 kg. range. They have identified a large market for bags up to 50 Kg. but are not capable of making such bags due to their machinery limitations.

They specifically asked for used machinery quotations that would meet their needs for bag making in all sizes. They also have markets requiring a 4 color printing press. They presently make quality bags of bleached kraft paper with a fine finish and have been focussing on that business. Their current equipment is made by Windmoller and Holsche. The electrical requirements are 3-phase, 380volt, 50 KHZ.

Saeed A. Chaudhry - Printpak Uganda Limited

Printpak is a carton box manufacturer located in Jinja. They are in the process of privatization after a period of government management which nearly brought the plant to ruin. They have high quality cartoning and printing equipment. They have some outside label business, but need to bring their quality up to grow this business. They have foreign financial backers and are trying to develop new markets for their products. The management staff are clearly technical and management professionals. The future looks solid for this company.

Maganjo Grain Millers Ltd.

This was a very interesting, well managed, labor intensive, yet simple and clean operation. They produce a high quality, protein rich dry cereal. The primary package is a one color printed glued paper bag lined with a 2 MIL Low Density Polyethylene bag. The secondary packaging consists of RSC style corrugated shippers.

The products include a maize flour, soy flour, millet flour, and soy-millet flour.

The soy is roasted in top loaded roasted which use wood for fuel. They are switching to coffee husks when available.

They are facing handling problems specifically with their export markets. Packaging often fails, breaking open and spilling product. They have requested specific information on a Packaging machine which folds and sews the top of the bag closed. I have since identified a Doboy machine that may be available as a donation by the Doboy Company in New Richmond, WI.

(See pictures enclosed - Miganjo Grain Millers)

Jewel of the Nile

This small company and the women who ran it were some of the most endearing people I met. They produce a high quality Jam and Jelly product and have identified markets for packaged fruit juices. There primary flavors are pineapple and papaya. As a fledgling new company they face many challenges. In spite of this, they have been relatively successful due largely, to their own hard work.

They have a long list of needs. They presently order jars from Burundi which are recycled, blue tinted and often have rusty and/or dented caps. With the current struggle in Burundi, their supply has been cut off. They need high quality clear jars with new caps in the 500 gram to 1000 gram size range. I have identified jars and pricing in the US for them but it appears that shipping costs would make them impractical unless they could order a two year supply in one order which would bring the unit cost way down. Perhaps jars from India need to be sourced.

The labels used on their jars are adequate for domestic markets but must be upgraded to meet export expectations. Again there is a need for a quality label manufacturer in Uganda.

They need a commercial blender. They need a consistent supply of high quality food grade Pectin rated at 200-250. They need a bigger scale. They would like information on a jam boiler and capper. They have identified markets in the food service restaurant and airline industries for portion packaged jam and jellies in the 14 gram range. They would like to identify inexpensive packaging equipment and fillers.

They have identified markets for portioned juice packages specifically in the schools. They would consider blow molded plastics bottles or aseptic packaging, or hot fill, foil pealable lidstock on plastic cups. (Similar to juice or spring water drinks served on airlines in the US)

They need information, sourcing and pricing on preservatives such as Sodium Benzoate and BHT.

They also requested information on plastic jar alternatives for their Jam business that can withstand sterilization temperatures and hot filling without distortion.

Boniface K. Mwamuye & N. Matembe - Uganda Breweries Limited

Uganda Breweries is located in Kampala. I found the operation to be clean, and well managed. The beer is of high quality (and high alcohol content @ 4.0 - 4.5% compared to US beers @ less than 3%). The staff is proud of their quality and attribute a large part of their success to the water they use from Lake Victoria.

Each bottle contains 5 Liters and there are 25 bottles per case. The plants capacity is 160,000 cases annually. They do not always run at full capacity because of the taxes the local government imposes on their products, especially export items. This situation raised in a big flag in my mind as to a policy implemented by the government for ostensibly good reasons, but has, in effect, worked against economic expansion.

The specific packaging problems discussed included a high percentage of the recycled bottles coming back to the plant with the "finish" chipped. (ie; the bottle opening where the cap is seated and sealed) thus causing a high level of leakers. It was ironic this came out in that just the day before, I had made a personal observation in my journal as to how many people I observed opening bottles with nails, other capped bottles, or any number of metal devices other than bottle openers across the entire country. There simply are not enough "church keys" distributed nationwide and people are chipping the finish attempting the open the bottle. I discussed this with the Chief Executive and suggested a promotional campaign wherein 1000s of low cost bottle openers with "Uganda Breweries" printed on them be distributed one with each case sold. I suggested not only would this solve their problem but it would also be a great advertising tool.

We also discussed twist off beer caps as an alternative. I promised to send some samples to their attention but have since learned that in order to use twist off caps they would require a different bottle as well, with a different finish than they presently have.

Again this company expressed displeasure with the quality, price and availability of good labels. They import their labels from Kenya and pay a premium. They are applied with casein glue.

They expressed an interest in gaining access to information on processing technologies used in other parts of the world, specifically pasteurizing techniques wherein beer is brought to 0 degrees C. then pasteurized at 60 degrees C. and brought back down to 38 degrees C.

Ronnie Mayambala - Engineer - BMK Industries

BMK Industries is a polyethylene film blowing company that converts their film into bags of various sizes to meet their customers needs. A young Engineer working in the plant Mr. Mayambala seemed to be the only one who really understood the operations although there were many layers of "bosses" above him.

He was presently having a problem with brittleness. Some bags had high variability in puncture resistance. He was trying some experimentation to determine if the variability was in their process or if it was in the plastic resin from their supplier.

Mr. Mayambala also recognized market opportunities if they had co-extrusion capability. Presently they can only extrude single layer polymers or polymer blends. He would like information and pricing on dies with 3-layer co-extrusion capability.

Again....an expressed problem with labels was identified. In this case however, BMK was interested in vinyl labels. I have been able to locate and price vinyl labels in the USA and use them in some of LOL operations, but export issues make them impractical at the volume BMK would use.

Keith W. Sherper - Director - USAID Mission

I met with Bruno Komakech who spent a good deal of time orienting me to AID projects in Uganda. I met Keith in his office and he reviewed the work and his staff were involved with. He assured me that people would be very receptive to all my ideas and encouraged my involvement.

Steven Ryner discussed the work he was doing on HIV tracking and indicated a mandatory testing program presently being conducted on the Ugandan Army indicates that one in three are testing positive and Hepatitis B was present in 98% of the population tested; a very sobering revelation. Malaria, Yellow Fever, Cholera and a host of other diseases also plague the people. It would appear that many Ugandan people are destined for short lives.

Bruno continued to stay in touch through out my stay and I found him most helpful and courteous.

Dr. William Kalema - Uganda Manufacturers Association

Fred Zake and Francis Nsonzi met me at the Entebee Airport on my arrival Sunday and escorted me to my Hotel; The Fairway (see pictures). I met the entire staff on Monday morning before beginning my tours. As I got to know the staff over the week and one half I was in Uganda, I came to understand them as being incredibly competent and hard working. They earned my deepest respects. Dr. Kalema had brought together a very impressive team indeed.

Near the end of my stay in Uganda I was introduced to the UMA chairman James Mulwana who is also the president of Ship Toothbrush Limited and the House of Plastics. Chairman Mulwana invited me to consider working in Uganda as a consultant to UMA on a one year contract to address the needs of several of the bigger manufacturers. I told him I would give his generous offer serious consideration.

Francis Nsonzi and Michael Sseguya spent much time with me through-out the stay attending all the plant tours and presentations. They were particularly good to me and I feel grateful for all their help in making my trip a success.

Michael has since attended a seminar in Wisconsin and upon completing his work, spent a weekend at my home touring the local sights and visiting my work place at Land O' Lakes.

Richard S. M. Bakojja - Owner - Liberty Dairy Services

Richard is one of the more unusual people I meet in Uganda. He is a consummate business man with an economics degree from the University of Maryland. He is the owner of Liberty Dairy, a large Dairy producer on the shores of Lake Victoria. In addition to producing liquid milk he makes some of the finest Gouda Cheese I have ever tasted. He has reached capacity with all the milk coming into his business and is uniquely positioned to expand into other dairy products. The next step however, requires a relatively large infusion of cash. Therein lies the problem since capital is so scarce.

Richard has a unique business in that he gives two cows to a qualified neighboring farmer, teaches them how to care for, feed, breed, and milk them in exchange for the following:

1. **They must milk the cows twice daily and bring him the milk from the morning milking for two years.**

2. **They must also deliver the first born calf back to Richard so that he can continue to increase his herd.**

When both requirements have been satisfied the cows, all the milk, and future calves belong to the new farmer. To date he has 14 satellite farmers who he has put into business and who in turn, have become self-sufficient.

Mr. Bakojja is also experimenting with fields of a Garlic Hy-bred which he hopes to export to Israel.

His business plan for expansion is included.

See Attachment # 2

Ignatius B. Ngobi - Production Manager - Dairy Corporation

Mr. Ngobi gave me a detailed tour of the Dairy and a great deal of background information on the services they provide and their needs in general.

The Dairy Corporation is a government managed business in Kampala. Since I work in the Dairy industry, I found this tour very interesting. They have a clean, modern facility with modern processing equipment, but expressed a lack of technical knowledge to keep everything operating efficiently. They are interested in privatizing the dairy if they can find a suitable buyer.

Uganda's milk drinking population is approximately 17 million. There are about 4.4 million cows in production. Milk consumption in 1993 was 24 liters/person/year, but in 1972 consumption was 42/liters/person/year.

They believe their quality and image as a dairy has suffered and has led to the decline. A new marketing strategy is being implemented to increase sales along with a plan to increase quality. They want to call their product "Fresh Dairy" and have requested help in getting better quality labels, a new logo and some general marketing expertise. They want to expand their product lines in the areas of butter, yogurt, ice creams and flavored milks. These products are presently packaged in pre-formed polystyrene containers imported form Great Britain at a high cost. They have asked for recommendations for reduced cost package alternatives.

They want to conduct a study with improved packaging on extending shelf-life of their products and need help with an effective test plan. They want to identify what variables in the process contribute to their problems and would like expertise to help them correct them. The current shelf-life in Uganda is only 4 days in refrigerated conditions in contrast to a 21 day shelf life capability in the U.S. "Speculated differences" have to do with product handling, time between milking and processing, and lastly, the packaging process.

They are looking for short term capital of approximately $2MM and can demonstrate a 3 year payback. Capital would be used for pasteurization equipment upgrades, milk tankers, coolers, butter churns and packaging machinery upgrades.

See Attachment # 4

Specifically discussed, was a project involving restocking the farmers in their co-operative and the need for farming specialist who understand how to maximize production.

They need access to better equipment, better procurement and transportation methods.

There was an interest expressed in portion packaging equipment for consumer and foodservice markets. Presently there are no such products in the country. Mr. Ngobi was interested in receiving literature on packaging machinery and materials required for portion packaging. I have since received a letter specifically requesting more information. See correspondence attachment # 5.

Specific packaging concerns include poor and inconsistent labels. They are presently purchased from Printpak Industries. Currently all natural cheeses are packaged in LDPE (Low Density Polyethylene) and they could achieve better freshness and shelf-life with a more sophisticated co-extrusion of nylon, or polypropylene with a saran and acrylic coating (Mobil ASB-X film in a 1.50 MIL) might be recommended.

Surjit Singh - Production Manager - Mukwano Industries (U) Ltd.

Mukawno Industries is essentially a Manufacturer of Soap and Edible Oil. The most remarkable and striking characteristic about this company is that it is totally vertically integrated. Whatever is needed in their process it is acquired within. They make there own labels, boxes, plastic bottles, glues, etc. They purchase cotton seed, sunflower seed and other domestic seeds on contract futures from farmers. I was given a detailed tour of the facility which included a compound where all the factory workers are housed on the premises. The products produced in this facility met a fairly high standard of quality and were positioned well for export. There was a need expressed in gaining access to hot melt glues to increase the quality and speed of production. They also had an interest in upgrading there labeling equipment for faster higher quality color printed labels.

(See Pictures attached.)

ROSA BROS LTD.

This is a tidy little retail food store business with the potential to expand into a chain of franchises or a centrally managed store chain. Well managed and driven by quality and service they could become the first "Super Value or Red Owl" equivalent in Uganda.

They have purchased meat processing and Vacuum-pack packaging equipment in Britain. They buy slaughtered beef by the sides, cut it, grind it, and package the product on a tray and vacuum packed in a clear plastic. The products are displayed in refrigerated coolers in the store front. They incorporate a similar process with Fish & produce and make their own bakery and deli goods as well.

They would like access to styrofoam or other plastic trays instead of paper trays for better protection and to avoid the problems of juices in meats and fish from being absorbed into the paper.

They want to buy a tray thermoformer to make their own trays. They need information on tray formers pricing and resin options, including availability and pricing.

They understand that for them to grow, they need better freezers, display cases etc. They specifically asked me to help them get better labels for their products which would include a logo and a space to write the product and quantity on the surface.

This small business represents an investors dream. With relatively small capital and access to better packaging, marketing and additional store locations. I believe this well managed business has huge growth potential.

A.K. Musisi - Owner - Kampala Jellitone Suppliers Inc.

My experience with Mr. Musisi and his family owned Coffee producing company was quite unforgettable. Mr. Musisi attended the seminar and insisted that I come see his operation. I was amazed to see that he had an entire coffee grinding, roasting and packaging operation made from hand fabricated parts and equipment. His father and him gathered junk metal "stuff" from all over Kampala and cut and welded together metal pieces to make all the fabricating equipment they needed. They made hand sealers for sealing bags with an old clothes irons. The most amazing thing was that the coffee was truly excellent tasting.

The amazement doesn't stop there however. He asked me what material they should be using to maximize shelf-life. I recommended a metallized polyester for cost effectiveness, better graphics, sealability and product protection. As I was flying out of Addis Abbaba a few days later I met him in the airport. He was just returning from India where he had purchased a six month supply of printed metalized polyester packaging for his new pouches. I was shocked to say the least, since we did not discuss web thickness or sealant surfaces, nor had any testing been done. Fortunately it all worked out beautifully, and he sent me some of his new packaging.

See pictures and sample package attached.

Note:

During my visit he wanted to improve his coffee bean consistency by purchasing a used gas burning roaster (see correspondence Attachment # 5) and more sophisticated pouch formers and sealers.

Coincidentally, Fisher nut, a large peanut roaster and packager located in the twin cities was recently purchased by Proctor & Gamble. The Fisher Nut plant was closed down and production moved to an east coast location. The entire place is replete with high quality roasters and packaging equipment that will be expeditiously sold and/or disposed.

I have contacted the company and they may be interested in making a donation. (more on this later)

James Mulwana-President-Ship Toothbrush Ltd. & House of Plastics

Ship Toothbrush and House of Plastics is a Ugandan company that would humble some of the best plastic blow molders in the USA. They have a well managed, modern manufacturing facility that incorporates in-line Quality Control, Statistical Process Control, and high standards for material specifications, safety and cleanliness. They do a terrific job marketing their products and use a variety of quality advertising methods. In addition to toothbrushes the company makes plastic plates, bowls, cups, and jars. The company also makes a quality line of pens and a variety of plastic packages.

See brochure attachment # 3.

Product Packaging Workshop
August 25 - 26, 1993

Uganda International Conference Center

Summary of Presentations

Wednesday Aug. 25, 1993

Dr. William Kalema opened with a welcome speech and introduced the Hon. Henry Kyemba, Minister of State for Agriculture, Animal Industry and Fisheries. The essence of Mr. Kyemba's presentation was encouraging in that he articulated the administrations commitment and support in improving processing and packaging as part of his vision for the future of Uganda.

Dr. Kalema introduced me and I gave an executive summary session on the importance of Packaging. There was then a presentation given by a speaker from the National Bureau of Standards, discussing some of the concerns arising nationally as a result of improper packaging.

I gave the second portion of my presentation introducing specifics of food packaging. I encouraged the audience to ask questions by pinning up a $100.00 bill on the podium and telling them I would give the $100.00 to anyone who could ask a dumb question. I was teased a few times with some unusual questions and I would rattle the $100 dollar bill and say that was close but not dumb enough. Later in the day I told the audience that I once tried this technique at a conference in the states and after a break came back and the money was missing. A hand in the back of the room was raised and I was asked if I wanted it back. I said: "NOW THAT'S A DUMB QUESTION!" The point is, that the humor broke up the tension in the room and many industry specific questions began to be asked. This was very helpful in better orienting me to the kind of information that would be most helpful to them.

During this session I handed out numerous samples of food packaging in a variety of forms and had the audience open and close them, and taste the products. Many samples included aseptically packaged products that were more than six months old.
During the afternoon session we broke up into different groups and I set-up a number of video presentations showing packaging systems used in the United States. Included were canning lines, bottles, cartons, automated case packing, aseptic packaging, and reviewed products packaged in a wide variety of industries including, meat, poultry, fish, spices, produce etc.

The one problem with the video's, is that for the most part the technology seemed so far from reach to the people viewing them. It pointed out the need to focus on "appropriate" (simpler, smaller scale) technologies.

Based on the number of questions about food Packaging in the USA I prepared a hand-out in the evening that was given out the next day. See Attachment # 7.

During my presentation on the following day, I got much deeper into material specifics, applications and packaging systems. This part of the presentation was particularly well received, although for some, it left them feeling quite uncomfortable with what they presently do and what technologies are available to them.

In the afternoon, I concluded my materials and technology presentation and showed a slide presentation. It consisted of a walk through one of the large "super market" food stores showing all the different kinds of packaging used.

Again, some of the feedback received embarrassed me. The audience was completely overwhelmed with all the food possibilities. They could not believe this was all in one store.

Fortunately, I also had packaging slides from South America and Eastern Europe which was closer to the packaging use in central Africa.

Based on feedback received from the conference attendees, the presentations were relatively successful. What seemed particularly effective was walking around and engaging the people in my presentation with numerous samples of materials and finished product I would ask them to taste, or empty containers for them to dissect and understand the composition. They could then see and feel what I was talking about.

The session ended with a final question and answer period and a friendly closing speech by Dr. Kalema.

Presentation Details:

Definition:

Packaging may be defined as a unifying system for applying the fragmentary operations of many other disciplines such as Mechanical Engineering, Food Technology, Industrial Engineering, and Chemical Engineering to the total problem of delivering goods from the source to the point of use with maximum efficiency.

Packaging is not merely a means of containing products, but rather in it's broader sense, it involves all aspects of handling, storage, preservation, distribution, advertising, sales, promotion, display, dispensing, preparation and various other facets of the Industrial System from which the product is born. It is art and science; materials and equipment; it is protection, promotion, law, logistics, manufacturing, and materials handling all rolled into one.

The design of the package is also not an isolated thing, but part of a larger effort to carry products to their end use successfully. As such, the package must fit into the manufacturing-marketing system and contribute it's share to the effective operation of all the segments of the whole process. Therefore, the design of the package must be measured against the capabilities of engineering, advertising, distribution and the final application conditions for which it is intended.

There are three broad categories of Packaging that require very different technologies and talents for their accomplishment:

(1) consumer packaging,
(2) industrial packaging, and
(3) military packaging.

Consumer (retail) = importance of visual appearance is emphasized

Industrial = protection, cost, convenience, and appearance emphasized in about that order.

Military = Protection emphasized

My discussions will focus on consumer packaging, including food pharmaceutical, soft goods, hardware and cosmetics, toiletries, and more. I will spend proportionately more time however, addressing food packaging concerns.

Problem Solving

Know Your Product: Get all available information.

Analyze the Market: Get a clear understanding of the segment of the Market for which the Package is expected to serve. It is necessary before a good design can be created. Whether the potential customer is a male or a female, young or old, rich or poor, urban or rural will often affect the type of design to be recommended.

Competitive Packaging: The appearance of a Package may look far different on the drawing board or on a round table for discussion than it does sitting on the shelf. It is wise to view a new package on the shelf beside others. It is often times recommended to your product stand-out on the shelf by being taller or having a contrasting color.

Recognize needs: A well designed package will cater to the needs of the purchaser. These may be psychological or practical needs. The package design must show at once the intended use, method of dispensing or application, and promised results or satisfaction of needs.

EX: Talcum Powder in a scouring powder container
Face Cream in Shoe Polish container
Pancake mix in Laundry Soap box

All five senses should be considered when designing the Package and not merely the visual impact.

Innovations: In some cases the Package becomes part of product. Containers and closures that measure, mix, or dispense the product can be considered an integral part of the product concept. Ex: Popcorn in a disposable cooking utensil. A radical design concept carries risk, but often is more likely to bring an outstanding success over mediocre success.

Small or Large Volume: The requirements of the package design depend largely on the quantities involved.

The small volume item, will not justify special molds and sophisticated equipment, but utilize stock containers where available, and semi-automatic or manual assembly operations.

This type of assignment is not easier; on the contrary, the limitations of the small volume tax the knowledge and skill of the developer.

Export Problems: The hazards of transportation sharply increase. Handling of goods off and on ships can put considerable strain on the package. Slings and considerable hand labor increase the hazard. Consider unitized packaging. Often a rule of thumb is to increase the Package strength by 150%.

Note on Vending Machines: Rigid package much more easily dispensed than flexible pouch or bag. Very thin items are difficult to dispense. Oversized is a problem.

Functions of Packaging

Notes used in Presentation:

Historical Perspective Summary:

Contain
Carry
Dispense

As time went on, other requirements were added such as:

preserve
measure
communicate
display

Today we want to add:

motivate
promote
glamorize
build-up.

Elements of Packaging

Structure
Style
Aesthetics
Communication
Legal

Structure: contains or limits it's contents; Crates, nets cocoons, displays etc. It's the shape of the package. It may be dictated by availability of containers and needs of the product, the maximum size along with stability, space limitations on the shelf and at home.

Aesthetics & style: This represents the part appearance plays in the effectiveness of the package. One large area of study on the Psychology of colors, copy, communication etc. is part of this discipline.

Communication: The least amount of copy is usually most effective.

Enough information is required to answer the buyers questions.

Legal: Product Liability is considered when a poor package can cause damage or injury to people resulting in costly litigation and unfavorable publicity. Designing hand holes in heavy boxes, including warning labels where necessary, Must follow GMPs and industry standards. Current liberal laws allow suit throughout entire distribution chain.

Technology Introduction

Processes & Materials

Materials:

Paper and paperboard are still generally the most economical and continue to make up the majority of packaging.

Metals high strength, rigidity, and comparatively, in flexible packaging only foil or foil laminates provide equal barrier protection. Glass bottles and jars are chosen over plastic for being inert and are used for precious commodities

Most exciting area is the work going on in plastics.

Processes:

Must know the possibilities and limitations of machinery.

Cost considerations important element.

Testing of materials: ASTM handbook

Specification development.

Materials Presentation Details

Adhesives

Total adhesive production in the US is over one billion lbs. annually.

Packaging uses about 25% at a cost of about 900MM

Greatest single use of adhesives is in the manufacture of plywood.

First adhesives:

Pitch from trees, egg whites and human saliva

Animal glue used over 3000 years ago by Egyptians.
Animal glue is made from bones at meat packing plants.
The bones are dried, ground and refined into a crystalline structure, reconstituted with water to make them into glue. Hence; the term glue factory

Casein made from cows milk. use dates back to prehistoric times.

Glue has been made since the 9th century from fish, stag horns, and cheese.

The "natural" adhesives are made of starch based products such as vegetable proteins.

They can be made from any starch based material. In the US mostly made from corn. In other countries, wheat or potatoes are used.

They are readily available and they are cheap. least expensive adhesive available.
They have good heat resistance.

Properties are consistent and work exceptionally well on paper.
They are used in corrugated board manufacturing, tube lining, paper laminating, labels, case sealing, carton sealing bag making and others.

The viscosity of starch based adhesives range from fluid to gummy.

Color varies from white to amber.
Work at temps around 140F.

Some of the disadvantages of natural adhesives are that they have low water resistance, slow setting times,

The "synthetic" adhesives are resin emulsion, latex, hot melt or solvent borne.

<u>The most used synthetic is resin emulsion</u>

They cost 2 to 3 times more than natural adhesives.

It is preferred by many packagers for sealing purposes.

It tends to be non-crystalline and of high molecular weight.

It is usually a derivative of PE or PVA

It often appears as a liquid white glue.

Has little odor, toxicity, color variation, and imparts no taste characteristics.

Latex adhesives are used and are five times more expensive than starch based adhesives. It is use for self sealing bags, envelopes, and wrappers and foil/paper laminations.

Hot melts are the most expensive adhesive costing 6 to 8 times the cost of starch based adhesives. It is an all solid adhesive and is a blend of plasticizer, polymer resins, and waxes.

Requires temps between 250 and 400 F to melt Usually purchased in the form of pellets, granules, chips, or bricks.

Colors vary from white to brown, but can be customized to any color.

They are fast setting and work very well on high speed applications.

Solvent borne adhesives are a broad based adhesives made up of polymers and modifiers dissolved in organic solvents.

Fast drying with colors ranging from white to brown. Most are flammable.

Commonly used in graphic arts and film to film laminations, paper/foil laminations, and other flexible packaging structures. They are also used for pressure sensitive labels and tapes. Application must be in vented areas because of toxicity to workers.

There is a 50/50 use split in Packaging between natural and synthetic adhesives.

Materials Presentation Details
Plastics in Packaging

Notes:
Two kinds of Plastic:

Thermosets- once heated they are permanately set. Cannot be reformed.
Thermoplastics- can be repeatedly reheated and reformed.

Sources of Plastic:

All carbon based elements. crude oil, natural gas, & organic chemicals.
Monomers are chemical compounds that can be combined in chains to form polymers, which are what is necessary to make plastic.
Ethylene is a combination of Hydrogen & Carbon

First plastics:

1843-Gutta Percha found in Malaysia. A rubber-loke sap from trees.
1845-Cellulose Nitrate=cellophane paper based plastic-like.
1933-Polyethelene

Advantages of plastics over other packaging media:

***lightweight**
***high strength to weight ratio.**
***most have excellent resistance to products**
***ability to be tailored to the needs of the product.**
***shape very well and are easily modified.**
***can be soft or rigid**
***thin or thick**
***containers can be made right in line along with product**

Sheets vs. Films

Big difference is flexibility
Films less then 10 mils in thickness
Sheets are over 10 mils

Kinds of Plastic

Over 7000 different combinations of plastic films available. Most used plastic in Packaging is Polyethylene (PE) and most PE used in Packaging is low density PE (LDPE)

LDPE characteristics include:

*translucent, milky look
*very limp
*good flexibility
*good moisture barrier
*high puncture and tear resistance
*poor machinability, but low melting temperature 180F"
*high gas permeability (not a good barrier for CO2 or oxygen)*LOWEST COST FILM sometimes used in stretch wrapping

Linear low density PE (LLDPE)

*stiffer, stronger, more expensive than LDPE

High Density Polyethelene (HDPE) characteristics include:

*less clarity then LDPE
*packaging applications are primarily blow molding
*more expensive than LDPE

Polypropylene:

PP is extensively used in Packaging.
*excellent clarity
*stiff film with excellent machinability
*higher sealing temperatures 280F"
*good gas barrier properties
*moisture barrier good, not as good as LDPE
*high resistance to tear initiation-but low tear resistance.
*usually needs coating, lamination, or coextruded skins to aid in sealing

Polyester: (PET)

Growing share of packaging markets
*high temperature resistance: used in ovenable trays
*high tensile strength
*Used frequently in carbonated beverage bottles.
*fair oxygen barrier
*Stiff with good machinability characteristics
*high sealing temperatures required
*MOST EXPENSIVE SINGLE LAYER STRUCTURE IN THE FILM FAMILY

Polyvinylchloride (PVC)

Popular packaging film

***more expensive than PE but less expensive than PP**

***great clarity**

***very tough, high puncture and tear resistance**

***very limp, similar to LDPE**

***clings and is difficult to machine; often laminated to other films to enhance machinability.**

***can be blow molded into bottles**

***used to package oils and alcohol solvents.**

***used for shampoos, cooking oils, & household chemicals.**

***USED IN STRETCH WRAPPING**

Expanded Polystyrene (EPS)

foamed polystyrene used for cushioning materials

***uses include egg cartons, cups packing peanuts, EPS is formed in molds to the shape of the product.**

Polystyrene (PS)

blow molded <u>very clear</u> bottles, vitamins, spices, & medicine.

Plastic Packaging Forming Processes:

***injection molding-hot resin forced in die and cooled.(caps)**

***blow molding-hot resin blown into mold**

***Thermoforming-films heated until soft and and drawn into mold by a vacuum. sometimes referred to as vacuum molding**

***Blister packs-similar to thermoforming but form is sealed to plastic coated paperboard.**

Making Plastic Films

***Bubble process- film blown into a large bubble, stretched,slit up both sides and wound on rollers.**

***Cast film processes - film is cast in a mold**

***Extrusion/tenter frame process. Film is extruded stretched in the machine direction (MD)by progressively speeding up rollers and then stretched in horizontal or transverse direction. (TD) by tenter frame clips.**

Film variations:

***Coated films: coatings are "painted" on the film to enhance properties often including sealing characteristics or barrier properties. Example of coatings: Acrylic, Latex, Saran(PVDC),**

***Laminated films: two or more films are "glued" together to created composite**

structures necessary for given product protection requirements.

*Co-extruded Films: usually three resins are extruded simultaneously in layers with a base film and two "skins", one on each side. Current technology allows for up to nine layers to be simultaneously extruded. Composite structures allow for creating customized structures with any combination of properties.

Converting film:

Converters as defined here are those businesses that buy raw film and add value before selling to an end user who may in turn use it on form fill and seal machines, or simply on overwrappers.

Converting includes:Printing, slitting, coating, laminating but not co-extruding.It might include bag and pouch making.

Problems with film:

Blocking-films sticks to itself on roll, caused by winding too tight or exposure to too much heat in warehouse;
Static: causes clinging to machine, use static eliminators
Sweating: film must be brought to room temperature before running on equipment.
Odor: cause from improper curing or drying of inks & laquers
Gauge bands: caused by thickness variations across web or improper winding.
COF variability: too sticky....too slippery process control problem by vendor.
Color variation: print problem, foreign matl, old film.

Terms to Know:

Yield, COF, Tensile strength, Lap seal, Fin Seal, MD, TD, Modulus of elasticity, Hot Tack, Seal strength, gloss film memory,

Examples of Packaging machinery using film:

Doboy, Sitma, Hart, Scandia, Hayssen, GD, FA, FMC and more

General info:

Seals require time ,temperature and pressure control.
Plastic packaging reduces solid waste by using less volume than paper, steel or glass. It is all recyclable but rarely is because cost to recycle is more than virgin resin. Less product wast because it extends shelf-life of products(foods)

Can be burned-recapture energy, or buried safely (almost inert)

Glass

What is glass?

It has the molecular structure of a liquid and the physical characteristics of a structure.

It is an inorganic, noncrystalline solid, formed by cooling from the liquid state, which shows no discontinuous change at any temperature. It simply becomes more rigid through a progressive change in it's viscosity.

History of Glass

Glass is one of the oldest substances known.

Materials very much like it are found near areas of volcanic action.

It was sometimes used as arrow heads during the bronze age.

Glass beads found as early as 12000 bc.

7000 BC Egyptians used glass beads (amulets) to ward off evil spirits.

Story of sailors on shore with camp fire.
Used some blocks of soda from cargo to make a fireplace on the sandy beach. Soda fused with sand to make glass.

3000 BC glass bottles were being made sparingly in Egypt on display in the London Museum.

Molten strands of glass spirally wound to form containers. Fragile, small, and expensive and used only by the very wealthy to contain perfumes and oils.

1550 glass was an important industry in Egypt.

300 BC first glass blow pipe was used. Big breakthrough because large containers could be made with quality and precision.

"Finish" implies opening.

By 300 AD Romans were casting window glass on flat rocks.

Glass remained extremely expensive until around 1800 when the first machines were produced that convert molten glass into useable containers fairly fast. Glass became available to the average person.

1903 the first automatic bottle-making machine was invented by M.J. Owens in the libby glass factory. Hence the name Libby-Owens so well known in glass manufacturing today.

Cheap bottles modernized milk distribution. Heretofore milk was delivered by a milkman with a large laddle who would poor it into your container.

Today 40 billion glass containers are produced in this country each year.

Today food packaging alone uses 12 billion containers. Beer 11 billion containers. Soft drinks about 9 billion containers. Health Care 2.5 billion. Cosmetics 1.3 billion.

Future is dependent on growth of plastics container industry and recycling efforts in glass.

Composition

Various oxides. Silica-Sand can make glass al by itself but does not have the most desirable container characteristics. It is hard to melt and hard to form, but it is strong. Soda can be added to lower the melting temperature and to lower the viscosity. But soda is expensive. Calcium can be added to make the container durable and lower the expansion rate. Lastly alumina can be added. devitrification

Sand-silica, Soda Ash-soda, limestone-calcium, Feldspar-aluminum trioxide or alumina

Manufacturing of glass bottles.

Raw materials are combined in a BATCH HOUSE above the furnace. Water is added.

The furnace consists of three principle parts: The melter, the refiner, the regenerator or checker. The melter section of the furnace is separated by a bridge wall. The wall has openings on the bottom (throat) and separates the melter atmosphere to the refiner atmosphere. Glass passes through the throat in a water cooled tunnel through the bridge wall. The refiner acts as a holding basin where the glass is allowed to cool to former temps before allowing the glass to enter the forming section. All the impurities float to the top so the bridge wall acts an impurity separator. They are periodically skimmed off.

Temperature ranges = 2700F for melting.
2100F-2400F for refining consistency of honey.
2000F for the forming phase

As glass exits the furnace going into the forming shapes they are called "GOBS". A GOB is a measured quantity of molten glass which will be formed into a glass container. Sizes may vary from 1/2 oz to 48 oz. 7 oz. is typical for a 12 oz. beer bottle. Speed of gob discharge through a single neck can vary from 30 gobs per minute to 150 Gobs per minute. The shape of the gob is critical in that it will affect the precision of the gob entry into the forming tube which has to accurate to maintain consistent quality. These shapes are controlled by plunger, height, stroke, size, shape, machine speed, temperature, orifice size, sheer cam, and tube height. Once the gob leaves the furnace it drops by gravity into the scoop. It is then routed to a section of the glass forming machine ready to receive it.

Once in the container forming section which can be between four to ten molds per machine, the temperature is about 2000F. It takes about 10 seconds to form and cool the average beer or soda pop bottle. As it is being formed the gob is called the "PARISON". The parison is the premature shape of the glass container which will be blown up to make the bottle. The finish, opening and threads at this point are shaped into it's final form. The body is hollow and the temperature is reduced to about 1700F. It is immediately transferred to its final mold and highly compressed air is forced into the opening pushing the parison into the final shape of the bottle (mold). Within seconds the mold is separated and the container is removed with tongs. When cooled the containers will go through annealing and a coating will be applied.

Note: The following test questions were used in the program taught at WITC. I used selected items as an outline during my presentation in UGANDA to trigger discussion and to be sure that all items I wanted in my presentation would be covered. They are included for reference only.

19. List the five most common films used in Packaging and discussed in class. (10pt)

Assume all the above films are 1 gauge in thickness.

20. Which of the above films as discussed in class has the highest clarity? Which has the least clarity? (4pt)

21. Which of the above films as discussed in class has the lowest MVTR values? Which has the lowest WVTR values? (4pt)

22. Which of the above plastics has the highest seal initiation temperature? Which has the lowest? (4pt)

23. Which has the least tear resistance? (Do Not Confuse withTear Initiation) (2pt)

24. What are the differences between Thermosets and thermoplastics? (4pt)

25. What % of all plastics produced in the US are used in Packaging? (2pt)

26. Describe briefly the differences between a blown film, a cast film and a tenter-frame film. (9pt)

27. Describe in some detail the differences between a coextruded film, a coated film and a lamination. Examples are required. (9pt)

28. Using an illustration and labels describe both the retort pouch and the aseptic package as discussed in class. (6pt)

29. Illustrate both a fin seal and a lap seal. (4pt)

30. What is the major difference between films and sheets? (4pt)

PLASTICS (other)

12. What are the three variables to be controlled while sealing film or otherwise converting plastic into packaging?

13. What is the primary difference between thermosets and thermoplastics?

14. About 25% of all plastics manufactured are used in Packaging according to the text. Approximately how much of that 25% is used in films?

15. What is the most commonly used film in Packaging?

A. Cellophane B. Polyethylene
C. Polypropylene D. Polyester
E. Polystyrene

16. Which of the following films has the <u>least</u> clarity?
A. Cellophane B. Polyethylene
C. Polypropylene D. Polyester
E. Polystyrene

17. Plastic sheets are distinguished from plastic films in that they are thicker than films. Which thickness below are the minimum thickness required to be considered a plastic sheet? (Circle each correct answer)
A. .0010 B. .0100 C. .1000 D. .0001 E. 100 Mil
F. 10 Mil G. 1 Mil H. 1000 Mil

18. List typical applications of LDPE. (at least three)

19. List typical applications of HDPE. (at least three)

20. List some the characteristics of LDPE film. (at least three)

21. What is the sealing range of both PP and LDPE as discussed in class?

22. What is the primary plastic used in the two liter bottle industry?

23. When discussing styrofoam in the future what is the actual plastic material that styrofoam, is made from? (Be Specific)

24. Briefly describe an injection molding process.

25. Briefly describe a thermoforming process.

26. Briefly describe a "Blister Pack".

27. Briefly describe a "Vacuum Pack".

28. Describe in some detail the difference between shrink wrap and stretch wraps. (List the actual materials for extra credit.)

29. What is the difference between a film manufacturer, a film converter, and a film end user. (Be Specific)

30. What are the differences between a laminated film, a coated film, and a co-extruded film? (Be specific)

31. We discussed the processes of blown film, cast film, and tenter frame film in class. Select one to describe in detail for question #31 and discuss the other two for up to five points extra credit each, depending on the detail and accuracy of your description.

32. List three disadvantages of plastic.

Food & Beverage Packaging

1. **What percentage of disposable income do Americans spend on Food & Beverage PACKAGING if we assume that 25% of the cost of food and beverages are for Packaging? (Be Careful)**

2. **How many different firms are there in the United States producing both food and beverage products for which you might apply for employment upon graduation?**

3. **According to the text, is the Package alone important to the ongoing success of a given product? Explain your answer.**

4-7. **When the Packaging professional selects the proper materials and/or package design, what four sets of facts are required to successfully package a products?**

8. **List three ways in which Packaging processes help to control food spoilage through the control of bacteria.**

9. **According to the text what are some of the predicted trends regarding the future of food & beverage packaging?**

Pharmaceutical Packaging

1. **What branch of the government is most heavily involved in pharmaceutical packaging?**

2. **Approximately how many drug manufacturers are there in the United States today of which you might apply for employment upon graduation?**

3. **What is the primary difference between over the counter drugs and prescription drugs regarding Packaging?**

4. **How are pharmaceutical operations, different from food and beverage operations with regard to processing and packaging?**

5-10. **According to the text, the pharmaceutical packaging emphasis is on six very specific areas. Name each of them.**

11. **Discuss the difference between tamper-evident and tamper-proof packaging.**

Cosmetic Packaging

1. What are cosmetics?

2-3. Comparing the cosmetic industry with the food & drug industry, what are some of the major differences?

4. Describe the Marketing considerations for cosmetics including the relative cost of the Package vs. the Product.

CLOSURES

1. If you were a student under Socrates approximately 600BC and you were given the task of finding a suitable closure to protect the wines in the crude bottles of the day for at least one year, how would you go about solving the problem. (Hint..... a strange new material just arrived on the spice ships from west Africa and south Spain) Be specific.

2. Who invented the closures for the Mason jars and in what approximate time in history?

3-7 List five modern closures.

8. What is a secondary closure. Give examples.

9-13 Most modern closures have liners to provide 10 basic functions discussed in the text. List five of those functions.

14-15 The book discussed a particular interest that consumers have in closures. In fact research indicates people would be willing to pay more for certain products with a particular feature associated with the closure. In five words or less, what is that feature?

Paper

3. Who were the Fourdrinier brothers and what was their contribution to Packaging?

4. The per capita consumption of paper products per year in the USA is approximately:

A. 800 lbs. B. 600 lbs. C. 300 lbs. D. 50 lbs.

5. **Paper is primarily made from softwood fibers with controlled quantities of hardwood fibers added primarily to impart what measurable characteristic to paper.**

6. **Two processes were discussed in the making of Paper. What are they? (Do not confuse with question number 7)**

7. **Two main types of Paper making machines were discussed. What are they?**

10. **What is "C" flute in reference to corrugated? (Be specific)**

11. **True or False_____ Corrugated cases manufacturing is the largest single packaging industry in the United States with about 1400 converting factories.**

WOOD

33. **What is the biggest use of wood in Packaging?**

34. **What are the three containers by their specific names that make up the largest majority of containers in Wood Packaging?**

FLEXIBLE PACKAGING

35. **Sales of Flexible Packaging approaches:**

A.	**$180 million/annually**	**B.**	**$800 million/annually**
C.	**$2900 million/annually**	**D.**	**$10 billion/annually**

36. **If I wanted to create the best barrier package in a flexible composite structure that money could buy, what one flexible material must be a part of the structure?**

37. **What are the three basic materials that go into the retort pouch?**

38. **Draw a sketch describing the structure of Aseptic Packaging listing the material used in each layer.**

39. **How does effective Packaging design curtail theft?**

40. **What is meant by "orienting" a film during the manufacturing process?**

METALS

11. What were some of the first metals used in Packaging and in what form.

12. What percent of all Packaging is done in metal containers?

13. What product accounts for the largest use of cans?

14. Why have steel cans been very unsuccessful at recycling attempts while aluminum cans have been exceedingly successful?

15. What is "necking down" on a can?

15. How fast are cans manufactured in a modern can making facility?

16. How did concentric rings and can coatings make a significant contribution to the canning industry?

17. Describe the difference between a two-piece can and a three piece can.

18. In a high speed Automated Packaging Line designed for maximum efficiency in filling, sealing and casing cans, how many containers per minute can be produced?

19. Approximately how many different kinds of products are being packaged in cans in the USA at present?

20. What is the difference between a metalized film and a foil laminated film? Be Specific.

TUBES

11. Approximately what time frame in history was the first metal tube invented and what was its first application?

12. What is the chief advantage of the metal tube?

13. Approximately when in history were plastics tubes developed? When were laminated tubes developed?

14. How are plastic tubes manufactured? List the components.

15. How would you describe the future of the plastic/laminated tube market?

General

1. What are the four primary functions of Packaging?

2. With the industrial revolution came a number of significant advances in Packaging. List at least three.

3. T F Packaging as an industry is the largest employer in the USA.

4. T F Packaging involves about 200 industries, 300,000 manufacturing companies and countless service fields in the United States today.

5. The four categories of Packaging include form, materials, machinery, and _____.

6. Which number below represents the most accurate annual per capita consumption of Packaging materials in the USA.

   A. 249 lbs. B. 468 lbs. C. 594 lbs. D. 718 lbs.

7. What product accounts for the largest use of glass containers?

8. What benefits do Cullet add to the glass making process?

9. There are nine key bottle parts. List at least seven.

10. What does the annealing process in the manufacture of glass containers do?

11. What packaging material (form) is the single largest use in the food & beverage industry?

12. What product accounts for the largest use of the answer from #11 above?

13. During what century was the paper making process introduced in the USA?

14. Paper is primarily produced with softwood, adding only controlled quantities of hard wood fibers. What characteristics do hardwood fibers impart to paper?

15. Two main types of paper making machines were discussed. List them.

16. What is "C" Flute in reference to corrugated?

17. What are the three variables to be controlled when sealing film or otherwise converting plastic films into a Packaging form?

18. What is the primary difference between thermosets and thermoplastics?

19. Which of the following plastic films has the least clarity?

A. Cellophane B. Polyethylene C. Polypropylene
D. Polyester E. Polystyrene (not EPS)

20. What is the difference between a film manufacturer, a film converter and a film end user?

21. How is a coextruded film different from a laminated film and a coated film.

22. Draw a sketch representing the structure of a typical aseptic package.

23. Draw a sketch representing the structure of a typical retort pouch.

24. What is the difference between a metalized film and a foil laminated film?

25. What is meant by orienting a film during the manufacturing process?

26. Aerosols consist of five components. List at least three.

27. What one packaging application are aerosols said to offer a real advantage over other packaging forms? Explain your answer.

28. What is the chief advantage of a collapsible tube?

29. How would you describe the future of the tube market?

30. List five modern closures.

31. What is a secondary closure. Give examples.

32. What is the greatest single use of Adhesive?

33. (HINT TO 32) What is the single largest use of wood in Packaging?

34. What adhesive is used most in Packaging?

35. At what temperature range is hotmelt applied to Packaging?

36. How many different firms are there in the United States producing both food and beverage products for which you might apply for employment upon graduation?

37. According to the text, is the Package alone important to the ongoing success of a given product? Explain your answer.

38. When the Packaging professional selects the proper materials and/or package design, what four sets of facts are required to successfully package a product?

39. According to the text what are some of the predicted trends regarding the future of food & beverage packaging?

40. What branch of the government is most heavily involved in pharmaceutical packaging?

41. Approximately how many drug manufacturers are there in the United States today of which you might apply for employment upon graduation?

42. What is the primary difference between over the counter drugs and prescription drugs regarding Packaging?

43. How are pharmaceutical operations, different from food and beverage operations with regard to processing and packaging?

44. Discuss the difference between tamper-evident and tamper-proof packaging.

45. Describe the Marketing considerations for cosmetics including the relative cost of the Package vs. the Product.

46. Describe the identifying characteristics of Industrial Packaging as opposed to consumer packaging.

47. Parts for Jeeps (bushings, carburetors, drive-shafts etc.) will be handled differently by American Motors for their Industrial users such as their nation-wide distributorship and their largest single contractor, the US government. Describe by example how these parts might be packaged and shipped differently.

48. List four US regulatory agencies that Packaging professionals work with regularly.

49. If you wanted to pursue a career in Packaging graphics what kind of background education should you pursue?

50. Do consumers typically notice the Package? How? When? Why

Attachment #1

Jewel of the Nile Business Plan

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JEWEL OF THE NILE

P.O.BOX 6709
KAMPALA.
TEL. 235510

Ref.4430 Date:

Sir,

RE: APPLICATION FOR FINANCIAL ASSISTANCE WORTH U.SHS.25,000,000 (US$20,834)

I am submitting application for development financing for the women project worth UShs.25,000,000 to be established in Kampala-Mpigi area.

We are an enterprising Cooperative Society composed of women and heavily engaged in income generating project but have been unable to propel this project to the desired success. Well motivated by the success so far achieved and aware of your contribution to our nation, we have found it necessary to register our need for financial assistance on short term loan basis for a period of 5 years.

A comprehensive project of the society is here enclosed and the level of current performance is also contained in our two year Accounts and Balance Sheet. Find also appended list.

Our legal status and chain of administration is encompassed by the attached certificate and Bye-laws. We are supervised by the line Ministry of Trade and Industry and other technical supportive staff. We shall be grateful for your favourable consideration.

Yours faithfully,

Miriam Okiror
CHAIRPERSON

Mirembe

Faith Mirembe
SECRETARY

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54

Jewel of the Nile
Cooperative Society
P.O.BOX 6709
Kampala.

Tel..... Fax.....

30th August 1993

Our urgent requirements are as follows;

1. Food Grade Pectin (High Set Grade 250 or 200 grade). We use 2 kg a month at the moment. We intend to increase production as there is a lot of demand.

2. Plastic Jars that can be sterilized by boiling at 80 degrees Centigrade. We are using 1000 jars a month now. The jars we need are 500 g and 250 g.

3. A hot foaming filling machine - which can seal that can make 25 g container special for hotel and airline market.

4. Commercial Blender of 240 volts.

5. Refractometer

6. Locally Made Boiler - Uganda Shillings 1,500,000=

1000 Shillings = a bottle

80¢

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PROPOSAL FOR FUNDING THE ESTABLISHMENT OF A FRUIT PROCESSING FIRM

BY

M/S JEWEL OF THE NILE COOPERATIVE SOCIETY LTD.

REG. NO. 4430

Appraised by:-
U.T.J./A.C.O.
Ministry of Trade & Industry
Department of Coop. Dev.
P.O. Box 1340
KAMPALA.

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CHAPTER 1.0 INTRODUCTION

M/s Jewel of Nile Cooperative Society Limited was formed in order to create income generating activity for the members. The society was registered with Multipurpose objectives so as to take up the exploitation of various resources to the benefit of the members and the community it serves. Currently the society pursues assorted Grocery marketing and Agro-processing. The society is processing varied fruits in production of Marmalade and Jam. It has incited a wide market for production and now relieved fruit farmers of the lack of market for their produce. The society is therefore seeking financial assistance to establish a small-scale fruit processing firm.

1.1 BACKGROUND TO THE SOCIETY

The society was founded in 1983 by a group of women and has membership of 43 people. It started as a cooperative group and its major activity included farming, consumer goods distribution to members and Agro-processing. The society finally got its recommendations to be registered as a fully fledged cooperative society after satisfying all conditions laid down by the Cooperative Societies Act 1970. It was firstly legally registered on the 13th March, 1983. Up to date, the Society is still engaged in active business.

1.2 THE LEGAL STATUS

M/s Jewel of the Nile Cooperative Society Limited is legally registered under the provisions of Section 5 of the Cooperative Societies Act 1970 on the 13th March, 1983 by the Registrar of Cooperative Societies. It holds Certificate Number 4430.

1.3 THE PROPOSAL (PROJECT)

This proposal was commissioned by M/s Jewel of the Nile Cooperative Society Limited, to examine the technical financial and economic requirements of the venture and evaluate the economic, financial, technical and commercial viability of fruit processing and canning in Kampala-Mpigi area.

1.4 THE PROJECT OBJECTIVES

a) To uplift the standards of women in emancipation of economic endeavour towards an independent self sustaining economy.

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b) To effectively involve needy women into economic and social engagements that uplifts the disadvantaged, vulnerable children of Uganda.

c) To improve on the quantity and quality of fruit produced by members and farmers to economic value earnings for improved welfare.

d) To identify and select better market for fruit products to the benefit of individual producers and the women folk.

e) To increase community incomes and standard of living through appropriate resource utilisation and provide education for fellow women.

f) To develop an institution capable of upholding resources utilisation by members and their upliftment in the area.

g) Any other related issues pertaining to development of the community i.e. Environment, safe motherhood and other related issues.

1.5 THE PROJECT REQUIREMENTS

The proposed project involves the establishment of fruit processing firm. It is proposed that the Society solicits funds to procure the following:

i) Juice/Jam Production plant and components

- Hot foaming filling machine	Ug.Shs.12,000,000=
- Stainless Steel Boiler	" 1,300,000=
- Blenders	" 600,000=
- Refractomer	" 500,000=
- Packing Tank	" 500,000=
- Mixers (Wooden)	" 20,000=
Total capital costs	Ug.Shs.14,920,000=
ii) Working Capital	Ug.Shs.12,080,000=
	Ug.Shs.27,000,000=

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2.0 THE INDUSTRY

Fruit processing and canning in Uganda is still least exploited despite the large fruit production. Most fruits are consumed without processing and there is low preservation ability limiting consumption to harvesting seasons only. Few firms have opened but with low capacity to cater for both urban and rural areas. The greatest proportion of canned fruits products is imported and much expensive and draws much forex in importation. The imported products has alienated consumption to only few and this project is expected to put up alternatives that would avail products to the entire populace.

3.0 THE MARKET

The market challenges are still great. The most eminent markets are the urban and rural areas on local level and the export potential are still unexploited. The city groceries form immense retail outlets currently being utilised by the society and these have still imposed greater demands uncaptured by current society production level. With this financial assistance in place, the society intends to produce sufficient quantities of good quality products for both local and export markets.

3.1 THE PRODUCTS

The main products of the project will be Jam, Marmalade and in the later stages tomato sauce and juice and squashes.

3.2 COMPETITION

There is little competition expected in the near future as the market potential is still big. Otherwise the society will accept positive competition as they are prepared to deliver products of impressive qualities within convenient times of needs (strategized marketing).

3.3 DISTRIBUTION

The society will deliver the products to the markets and purchase products from members and outgrowers to be transported to the processing plant through the projected transport votes.

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4.0 TECHNICAL ASPECTS

This relates to accessibility, operations, production and of the products.

4.1 LOCATIONS

The society's Head office and processing plant is located at Plot No.C459 Rubaga area in Kampala. This plant's site is intended to facilitate easy processing and market links for fruit products.

4.2 PROJECTED OPERATIONS

The project is expected to purchase assorted fruits and other required raw materials i.e Pineapples, Oranges, Tomatoes, Lemons, preservatives and others in production of Jam, Marmalade and Squashes. It is estimated that raw materials worth Ugshs. 65,800,000 will be utilised over the projected 5 years. The capacity utilisation of the plant will steadily rise in line with fruit production and the market potential utilisation. The first year displays a lower turnover in production due to machine installation operational product requirement table:-

HEAD PROJECTION

Item/Year	Year1	Year2	Year3	Year4	Year5
Jam in 500gm bottles	4320	5640	7320	9600	12600
Marmalade in 500gm bottles	2880	3760	4880	6400	8400
	7200	9400	12200	16000	21000
TOTAL COST	7,200,000	9,400,00	12,200,00	16,000,000	21,000,000

See Appendix Attached

4.3 PROJECTED PRODUCTION AND SALES

It is estimated that, the monthly production will be sold to retail agents who will in turn dispose of to the consumer market. The firm product is projected to be Ug.shs. 2600 per bottles of 500 gms an average of both Jam and Marmalade. It is therefore estimated that, the firm will market a total of 65,800 bottles over the projected 5 years.

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Item/Year	Year1	Year2	Year3	Year4	Year5
Total Income from Jam	10,800,000	14,382,000	19,062,000	25,440,000	34,024,000
Total Income from Marmalade	7,200,000	9,588,000	12,688,000	16,960,000	22,680,000
Total Revenue	18,000,000	23,970,000	31,720,000	42,400,000	56,700,000

See appendix 1 attached.

5.0 ORGANISATION AND MANAGEMENT

Fruit processing and canning requires expertise. The Organisation is in constant touch with Food technology Department of Makerere University. The society intends to employ qualified personnel for proper management and good results. The society is also privileged to have most of its founder members properly exposed to fruit processing and this will assist a great deal in the Management of the firm.

5.1 MANPOWER REQUIREMENTS

The proposed manpower below is regarded adequate for the project.

Category	No.	Monthly Payment Ug.shs.	Annual Payment Ug.shs.
Secretary Manager	(1)	50,000=	600,000=
Production Manager	(1)	40,000=	480,000=
Bookkeeper	(1)	40,000=	480,000=
Salesman	(1)	40,000=	480,000=
Factory Hands	(3)	60,000=	720,000=
	(7)	230,000=	2,760,000=

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5.2 ORGANISATION CHART

MEMBERS (SUPREME AUTHORITY)
COMMITTEE OFFICIALS (POLICY MAKERS)
SECRETARY MANAGER (POLICY IMPLEMENTORS)

PRODUCTION MANAGER BOOKKEEPER SALESMAN

FACTORY HANDS (PORTERS)

6.0 FINANCIAL ANALYSIS

Appendix I - Projected Cashflow Statements

Appendix II - Projected Annual Trading, Profit and Loss Accounts.

Appendix III - Projected Loan Repayments Schedule

Appendix IV - Projected Fixed Assets and Depreciation Schedule

6.1 ASSUMPTIONS

a) The exchange rate : 1 United States Dollar is equivalent to Uganda Shillings 1,200=

b) Loan Amount : Ug. Shs.25,000,000=

c) Loan Facility : Interest free.

d) Loan period : 5 years inclusive of one year of grace period

e) Selling price Ug. Shs. 2,500 per 500 gms Bottles with an increase of Ug. Shs.50 over the years.

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6.2 INVESTMENT AND FINANCING

Item	Existing	Additional	Total
Land and Developments	650,000	-	650,000
Office Equipments	325,000	-	325,000
Processing Plants & Capitalised Costs	413,100	14,920,000	15,333,100
TOTAL CAPITAL COSTS	1,388,100	14,920,000	16,308,100
WORKING CAPITAL	200,000	10,080,000	12,080,000
TOTAL PROJECT COST	3,388,100	25,000,000	28,388,100

The estimated total project cost is Ug. Shs.28,388,100 of which the Sponsors have already invested Ug. Shs.3,388,100. The required additional machinery, equipments and working capital will be acquired as loan from the financiers.

The table above summarises the proposed investment and financing plan.

6.3 WORKING CAPITAL

The Net Working Capital has been estimated and projected on the following assumptions:-

Item	Cover	Cost per Unit
Fuel and other petroleum products	312 days	Shs.1000 per litre
Packaging/Bottling		Shs.300 per empty bottle
Transport		Shs.1500 per km.
Handling charges		Shs.150 per dozen

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Item	Cover	Cost per Unit
Maintenance		Projected on experience
Storage		Shs.120 per dozen
Administrative expenses		Based on current experience
Insurance		2.5% of Fixed Asset cover

7.0 PROFITABILITY

The project expects to achieve a Sales revenue of Ug.Shs.172,790,000 in five years as against a cost of Sales of Ug.Shs.99,364,985 yielding a Gross profit in trade of Ug.Shs.73,425,000.

When an office expenditure composed of Administrative and financial expenses worth Ug.Shs.28,795,900= is deducted, a net profit before adjustment of Ug.Shs.44,629,115 is expected. The net business result less loan repayments of Ug.Shs.25,000,000= a net profit before tax of Ug.Shs.19,629,115= is achievable. It is statutory that all business contribute 30% of their net profits to government in corporate tax. This is estimated at Ug.Shs.5,888,735. The project is expected to achieve a net retained earnings of Ug.Shs.13,740,380 (See Appendix II attached)

7.1 PROJECT FIXED ASSETS AND DEPRECIATION

The project fixed asset in use is being spread over cost through depreciation by straight line method at a rate of 5% per annum. It is projected that after the analyzed 5 years the asset book value will be Ug.Shs.11,190,000 coupled with retained earnings estimated at Ug.Shs.13,740,380 means that that business continuity without further borrowings is achievable (see Appendix IV attached).

8.0 LIQUIDITY

The project cashflow on Appendix I attached reflects fairly favourable liquidity position meaning that the customer's produce will be bought on cash. The overall liquidity even after debt servicing and loan repayment is favourable and stands at Ug.Shs.37,037,450 after the analyzed 5 years.

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9.0 LOAN REPAYMENTS

The project estimates a four year repayment period at a uniform instalment of Ug.Shs.6,250,000= per year. The estimated one year of grace is estimated to enable the effective consolidation of business for better resources utilisation (See Appendix III attached).

10.0 ECONOMIC ANALYSIS

The project is to purchase a basis product which would help in improving the diet of the population by providing more canned vitamins and sugars. The project also leads to more effective land use. Besides, seven people will be directly employed and this leads to higher incomes and improved welfare for the people. The most needed forex outflow for importation of canned fruits is henceforth minimised for the state.

11.0 CONCLUSION

After the analysis carried out, it has been established that the proposal is technically feasible, financially viable, economically desirable and commercially profitable. It is therefore, our desired opinion, that M/s Jewel of the Nile Cooperative Society Limited be assisted to enable the establishment of the Fruit Processing Firm.

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Attachment #2

Liberty Dairy Business Plan

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TABLE OF CONTENTS

ITEM			PAGE
1.0		INTRODUCTION	
	1.1	The Proposal	1
	1.2	Legal Status	1
	1.3	The Sponsors	2
	1.4	The Industry	4
	1.5	Government Policy on Livestock Development	5
2.0		MARKET ASPECTS	
	2.1	Products	7
	2.2	National Demand	7
	2.3	Supply for Drinking Milk	8
	2.4	Prices and Pricing	8
	2.5	Sales Volume	9
3.0		TECHNICAL ASPECTS	
	3.1	Location	10
	3.2	Building and Civil Works	10
	3.3	Machinery and Equipment	12
	3.4	Vehicles, tractors and transport equipment	14
	3.5	Installed Capacity and Projected Volume of Production	15
	3.6	Production Processes	16
	3.7	Raw Materials	18
	3.8	Packaging Materials	23

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LIBERTY DAIRY BUSINESS SERVICE CENTRE LTD.
P.O. Box 4795 Tel 247005 Fax 254433
KAMPALA UGANDA

M/S LIBERTY DAIRY BUSINESS SERVICES LIMITED

FEASIBILITY STUDY FOR EXPANSION OF THE MILK PROCESSING FACTORY AND MILK PRODUCTION

LIBERTY DAIRY BUSINESS SERVICE CENTRE LTD.

BEST AVAILABLE DOCUMENT

Prepared by:
E.Group
P.O. BOX 4795
KAMPALA

Date: June, 1993

681

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1.0 INTRODUCTION

1.1 The Proposal

M/s. Liberty Dairy Business Services Limited (LDBSL) is currently running a dairy farm at Bugiri. The company processes its milk into cheese. The company's proposal is to:

i) Increase the milk production to 3000 litres per day.

ii) Increase the cheese production to 148.2 kg/day

iii) Introduce production of Yogurt, 500 lts/day

iv) Introduce butter production 18 kg/day

v) Introduce packaging of drinking milk, 1000 lts/day

With regard to increasing the milk production, the company is proposing to purchase more daily cattle and under a well planned loan scheme to selected outfarmers. The outfarmers will be assisted to put up simple cattle houses and trained in keeping the cattle. They will pay-back by supplying milk from their cattle to LDBSL farm until the loan is fully paid-up. The LDBSL will then start buying milk from the outfarmers when the loan(s) are fully repaid.

The above scheme is intended to help the people in the area around the farm and throughout the whole district of Mpigi by introducing them and training them to keep dairy cattle on a small commercial scale from which they can earn good living and at the same time LDBSL achieves its expansion objectives.

1.2 Legal Status

M/s. Liberty Dairy Business Services Limited is a private limited liability company incorporated on 1 March, 1991.

BEST AVAILABLE DOCUMENT

3.9	Manpower Requirement	24
3.10	Utilities	25
4.0	MANAGEMENT AND ORGANISATION	
4.1	Management	27
4.2	Organisation	27
5.0	FINANCIAL ASPECTS	
5.1	Consideration	29
5.2	Investment and Financing	29
5.3	Working Capital Provisions	30
5.4	Profitability	30
5.5	Liquidity	31
5.6	Break-Even Analysis	31
5.7	Capital Structure	31
5.8	Loan Repayment Schedule	32
6.0	ECONOMIC ASPECTS	
6.1	Employment	33
6.2	Value Added	33
6.3	Government Revenue	33
7.0	CONCLUSION	35

Appendices

1 Projected Fixed Costs

2. Projected Variable Costs

3. Income Statements

4. Projected Cashflows

5. Projected Balance Sheet Positions

6 Discounted Cashflow Analysis

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The company has an authorised share capital of Shs. 2,000,000 divided into 2000 ordinary shares of Shs. 1,000 each.

The shares are held as follows:

Name	Shares
Mr. Richard S.M. Bakojja	250
Mrs Beatrice N. Bakojja	200
M/s. Liberty Trading Company Ltd.	800
Miss Sarah Lakeri Naluwu	150
Unallocated	600
Total	2000

Miss Sarah Lakeri Naluwu is a minor.

1.3 **The Sponsors**

The sponsors of LDBSL and the proposed project are the shareholders named in Section 1.2 above. The C.Vs are summarised hereunder:ts

i) **Mr. Richard S.M. Bakojja**

Married with six children

1954-64	-	Bwala Primary School - Masaka
1965-1966	-	Agakhan Junior Secondary School - Masaka
1967-1970	-	Kololo Secondary School - O Level
1971-1972	-	Kololo Secondary School - A Level
1973-1975	-	Charleston College - West Varginia, U.S.A. B.A. Economics Diploma in Business Administration
1976-78	-	Sales Manager, Spear Motors Ltd
1979-81	-	General Operations Manager, Spear Motors Ltd

70

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1983-85	-	Development of Ards Beach interrupted by war and 60% destroyed
1986-93	-	Started and erected Liberty Trading Company Limited manufacturing quality animal feeds at Kabalagala, Gaba Rd
1986	-	Attended an International Standard course for 3 months at the Bernavald College, Holland in Animal Nutrition
1991-1993	-	Established Liberty Dairy Business Service Centre Limited - started the production of Gouda Cheese as the first ever private investment in Dairy processing at Bugiri - Kisubi near Entebbe.

He has attended several International agricultural seminars, conferences and shows in W. Germany, France, Israel, the Netherlands and Zimbabwe.

1992-93	-	RC III for Finance Gombolola Sabaddu Katabi and Councillor RC V, Mpigi District Council.
1986-1993	-	Member of PTA Executive Nakasero Primary School and a member of Finance Development for the same school
1987-1990	-	Chairman Kampala Kindergarten PTA

ii) <u>Beatrice N. Bakojja</u>

Marital Status - Married with 6 children

<u>Education</u>

1959-1961	-	Agakhan Nursery School, Kampala
1962-1968	-	Agakhan Primary School, Kampala
1967-1973	-	Greyland's College -U.K. O Level
1974-1976	-	Greyland's College, U.K. - A Level
1977-1982	-	Lady Margaret Hall Oxford BA (Hons) Law

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1982 - Switzerland - Diploma in Social Antiquities

- East Born College, U.K. Certificate in Cordon Blue Cookery

Working Experience

1982-1984 - Israel Joslen Advocates, Holborn, U.K

1985-1987 - Managing Director of Mamba Trading Holding, London

1988-Todate - Farmer

- Director of Liberty Trading Dairy Business Services Limited

- RC V Secretary for Women, Mpigi District

- Chairman of Uganda National Farmers Association, Mpigi Branch.

iii) Liberty Trading Company Limited

Liberty Trading Company Limited is a private limited liability company incorporated on 1 September, 1979. However, the company did not become operational until 1986 due to civil strifes in the country.

The company has an authorised share capital of Shs. 2,000,000 divided into 1,000 ordinary shares of Shs. 2,000 each.

The shares are held by the following people:

Name

Mr. Richard S.M. Bakojja

Mrs. Beatrice N. Bakojja

Master Haward Mutesasira

Miss Helen Luyiga

iv) Messrs Mutesasira & Luyiga

These are minors and children of Mr. and Mrs. Bakojja.

1.4 The Industry

The project falls within the dairy industry, specialising in milk production and milk processing into various products.

The project area i.e. around Kampala was once a prosperous farming area, and used to be a milkshed for Kampala.

However, during the years of war, thousands of people fled the area and crops and livestock were destroyed. This led to an unbalanced supply and demand situations for livestock and dairy products. As a result, up to now, consumers in Kampala pay high prices for milk and dairy products.

In areas far from Kampala, like Mbarara, the diary farmers produce a lot of milk beyond what their neighbouring areas can consume and have difficulty in selling their surplus milk. At the same time, the Dairy Corporation is incurring high costs by transporting some of the surplus milk from Mbarara to Kampala.

The proposed project will also involve purchasing dairy cows and under a scheme loan them to other farmers between Entebbe and Kampala. This will be mainly to increase milk production and supply to the project and the project area.

The project also aims at an increase of income and productivity through gradual technological advancement, in particular of zero grazing techniques, upgrading of cattle by means of cross-breeding and improve the production and supply of dairy products.

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1.5 Government Policy on Livestock Development

Government objectives in the livestock sector include:

i) Improving the income of livestock farmers

ii) Diversification of agricultural production and exports, by improving animal health, animal nutrition, tsetse control, milk processing and marketing, and Government related services.

Milk production is carried out by the traditional sector, specialized dairy farms and departmental dairy farms. Productivity is low in the traditional sector which has more than 95% of the country's cattle population and contributes 90% of the national milk output.

Well managed specialised farms exists with exotics and crossbreeds along with indigenous cattle, while departmental dairy farms are stocked with exotic breeds for multiplication.

In fact, milk production is left to the traditional sector and the major constraints they face include:

- lack of disease control
- water shortage in some areas
- overgrazing on many communal lands
- the deteriorated market infrastructure

Specifically for dairy development, the objectives of Government are:

i) increase production from the traditional sector

ii) up-grade the national herd

iii) improve the processing and marketing of milk

iv) substitute imported combined milk for fresh milk

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To arrive at the above objectives, the Government strategies include:

i) removing bottle-necks in diary production as experienced by 90% of the cattle farmers, especially animal diseases;

ii) developing a production oriented price policy, improving physical infrastructure in particular feeder roads and water supply;

iii) subsidizing breed programmes and pasture improvement.

The Rehabilitation and Development Plan 1987/88-1990/91 allocated US$ 20 million to the project ADB for rehabilitation of the dairy industry.

Source: Government of Uganda Livestock and Fisheries Development Policy paper, revised June 1988, October 1987.

In 1990 the cattle population (dairy and beef) was estimated at 4,913,200 by the then Ministry of Animal Industry and Fisheries.

Source: Background to the Budget 1991/92.

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2.0 MARKET ASPECTS

2.1 Production

The products of the project will include:

i) Drinking milk

ii) Cheese

iii) Yogurt

iv) Butter/cream

2.2 National Demand

The National demand for drinking milk is easy to estimate based on the available historical data, while that for cheese, yogurt, and butter may not be easy to estimate. This is mainly because cheese and yogurt are relatively new products in the market and being expensive, they are consumed by mainly the high income class and foreign visitors including tourist and expatriates.

The demand for butter would also be easy to estimate if data was available on the quantity of imports of butter and other types of creams. Unfortunately the available data with Customs cover a class of foods and beverages which covers a wide range including creams. As such the quantity of imported creams cannot be singled out.

However, it is expected that if the production of cheese, yogurt and butter can be economically increased and at cheaper prices, a good market for them/demand can be created at high levels.

2.2.1 Demand for Drinking Milk

In the 1970s the supply of milk for the whole country was 40 litres per capita p.a. (400 m litres).

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By 1980, the domestic supply per capital had dropped to 30 litres p.a. due to the poor economic conditions as a result of the civil wars.

Todate, the annual supply per capita is estimated at 26 litres, this 430m litres of milk.

Therefore based on the 1970s per capita supply of milk at 40 litres p.a., the country can be assumed to have a current potential demand for drinking milk of 660m litres.

2.3 Supply for Drinking Milk

The Government planning parameters targeted the supply of drinking milk to 29 litres per capita p.a. by 1990 and 37 litres by year 2000, which is still below the 1970s milk consumption level.

Therefore the milk supply in 1990 and the projected supply in year 2000 compared to the supply of the 1970s is given here below:

Year(s)	Milk Supply (m litres)
1970s	400
1990S	480
2000	820

Source: Government of Uganda Livestock and Fisheries Development Policy paper, October 1987, revised June 1988.

2.4 Prices and Pricing

The current wholesale and retail prices for the project products and similar ones on he market around Kampala are indicated below:

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Product	Wholesale/Project Ex-Factory Price(US$)	Retail Price (US$)
Drinking milk*	0.24/litre	0.36/litre
Cheese	6.00/kg	6.80/kg
Butter	3.50/kg	4.00/kg
Yogurt	2.15/litre	3.20/ltre

* Government price ex-factory Dairy Corporation is US$ 0.18 per litre

The project's current ex-factory prices for cheese is US$ 6.80 per kg mainly because they sell to retailers like super markets and hotels.

When it starts production of drinking milk, butter and Yogurt, its ex-factory prices will be US$ 0.24 per litre, US$ 3.50 per kg and US$ 2.15 per litre respectively. The prices are based on the current wholesale market prices of similar products on the market, both imported and locally produced.

2.5 Sales Volume

Year	1993	1994	1995	1996	1997	1998 onwards
Capacity Utilisation	N.A	45%	63%	81%	89%	88%
Volume:						
Drinking milk ('000'lts)	-	156	218	280	308	304
Cheese (Tonnes)	28	23	33	42	46	46
Butter (Tonnes)	-	2.8	3.9	5.0	5.5	5.4
Yogurt ('000"lts)	-	78	109	140	154	152
Sales Revenue (US$'000')						
Drinking milk	-	37	52	67	74	73
Cheese	168	138	198	252	276	276
Butter	-	10	14	18	19	19
Yogurt	-	168	234	301	331	327
TOTAL SALES	168	353	498	638	700	695

79

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3.0 TECHNICAL ASPECTS

3.1 Location

The company's farm and cheese production machinery is located at Bugiri, Plot No. 12 Block No. 24 Busiro. Bugiri is 13 miles along Kampala-Entebbe main Road, and 5 Km along Kisubi bay.

The size of land is 100 acres.

The land title is in the names of Richard Seruwu Bakojja who is the company's main shareholder.

The land is valued at US$ 300,000.

The premises are connected to the electric power supply mains. Water is directly pumped from Lake Victoria.

3.2 Buildings and Civil Works

The company's buildings are summarised hereunder:

Description	Plinth area (M2)	Estimated Value (US$
i) MD's residence comprised of a four bedroom house and guest wing	1,542.76	*
ii) 15-two bedroom housing units for staff @ 42.25m² plinth area	633.75	*
iii) 2 Herdsmen houses	32.09	*
iv) Cattle stable/kraal for 50 animals calf pens, and kraal store	336.10	10,000

80

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v) Electric meter house	2.88	*
vi) Pump house at Bugiri	2.60	*
vii) Standby generator house	14.52	*
viii) Dairy plant building	1,510.50	50,000
ix) Gate house	4.00	*
x) Other civil works including power line and cables, water reticulation, etc.		90,000
	TOTAL VALUE	223,800

N.B.* The total value of these buildings is US$ 73,800.

The new cheese production, yogurt production and cream production machinery will also be housed in the existing dairy plant building. However, the building will be extended with another 100 sq. metres, which extension is estimated to cost US$ 20,000. This will be funded by the company.

The project will also finance construction of several cattle houses/kraals for its outfarmers scheme estimated to cost US$ 1000 per kraal, adequate for two animals.

For purposes of training the outfarmers the company has leased from Government 7 sq. miles at Lusenke Young Stock farm at Lusenke, about 92 km from Kampala for 49 years. The farm is already facilitated with a cattle dip, a manager's house, office, guest house, and fifteen staff housing units.

The annual lease fee for the stock farm will be based on the Government Valuation of the farm which valuation will take sometime to complete. However, the lease fee is estimated to be about US$ 10,000 p.a. The farm will also be used by the company as a feed lot for male calfs. The male calfs will be fed for one year and then sold for production of tender meat.

A kraal will be constructed at Bugiri farm to accommodate the new flock of 30 animals estimated to cost US$ 12,000.

81

3.3 Machinery and Equipment

3.3.1 Existing

At present the company has a cheese factory composed of an ice machine, milk cooler carpentry capacity 1,000 litres, cheese vat capacity 1,000 litres, a set of laboratory/quality control equipment, three water pumps, a 100 KVA standby electricity generator, coldroom equipment for two rooms, a culture machine, three deep freezers and a milking machine. Scholf. Cutters

The existing machinery and equipment are valued at US$ 51,000, and are all in good working conditions. The machinery was installed and commenced commercial production in May, 1992.

3.3.2 Required Additional Machinery and Equipment

The company requires new additional machinery and equipment to enable it to:

i) increase cheese production

ii) introduce packaging of drinking milk

iii) introduce production of yogurt

iv) introduce production of cream

v) introduce veterinary extension services to its dairy farmers under the proposed milk [illegible] to the project scheme.

The required machinery and equipment [illegible]ted by M/s. PLADOT EIN HAROD MUEHAD of Israel are as follows:

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Item(s)		Cost CIF EBB (US$)
1.	1 Pasteuriser + balance tank	
2.	1 Cream separator	
3.	1 Butter churn wooden 36L	
4.	1 Milk bags filling and sealing machine	
5.	1 Cheese and yogurt filling machine	
6.	2 Insulated tanks @ 1200 L	
7.	1 Cooling tank 1200 L	
8.	1 Cooling room 12 sq.m.	
9.	1 Cooling tank 300 L	
10.	1 Cheese bags trolley	
11.	1 Cheese and yogurt pump JABSCO	
12.	1 Cheese vat 300L	
13.	15 Cheese plastic trays	
14.	15 Cheese weights	
15.	120 cheese bags	
16.	1 Lot milk test laboratory	
17.	1 Air compressor 200L/M	
18.	1 Set spare parts and piping materials COST FOR ITEMS 1-18	110,000
19.	1 Butter churn machine	12,000
20.	1 Milk palour	42,000
21.	4 Sets veterinary extension services equipment including insemination kits, Nitrogen cylinders and semen tanks	50,000
	TOTAL COST	214,000
	Provision for price escalation 10%	21,400
	Installation and commissioning	10,700

83

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Local Costs

The company has an Investment licence with incentive including tax exemptions for 6 years with effect fro June, 1992.

Therefore the local costs that will be associated wit importing the above additional machinery and equipmen will be:

-	Bank charges - 2%	US$ 4,922
-	Import Commission 1%	US$ 2,461
-	S.G.S. Commission 1%	US$ 2,461
-	Clearing and handling charges 2%	US$ 4,922
-	Installation expenses 3%	US$ 7,383
	TOTAL LOCAL COSTS	US$22,149

The suppliers will undertake the installation an commissioning of the new machinery and equipment and als train the local personnel how to operate and maintain th same.

3.4 Vehicles, Tractors and Transport Equipment

3.4.1 Existing Vehicles and Tractors

The company has one 1.5 tons DONA pick-up, which the have been using since November, 1992 with a curren market value of US$ 12,000. Their annual running an maintenance expenses amount to US$ 5,000. The vehicle in good running condition.

The existing tractor is one of Ford 5619 type with plough, a disc hallow, a slasher, a trailer stone, o planter valued at US$ 23,800. The tractor was purchase in June, 1991 and is still in good operating conditio It's running and maintenance expenses are estimated US$ 9,000 p.a.

54

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3.4.2 Required Additional Vehicles and Transport Equipment

The expanded farm and dairy process factory will require two additional pick-ups one ton each and three motor bikes. One of the pick-ups will be used to collect milk from outfarmers and the second pick-up and the motor bikes will be used for veterinary extension services to the outfarmers. Two small farm transporter with trailers @ 0.5 tons for carrying cattle grass with charf cutters will also be required.

The costs of the above addition vehicles are estimated as follows:

2 pick-ups	US$ 24,000
3 motor bikes	US$ 9,000
2 farm transporters with trailers and charf/cattle grass cutters	US$ 25,000
TOTAL COST CIF SITE	US$ 58,000

The local costs that will be associated with importing and registering the above vehicles are estimated as follows:

1% S.G.S. commission	US$ 580
1% Import licence	US$ 580
2% Bank charges	US$ 1,160
2% Clearing and handling charges	US$ 1,160
5% Registration fees	US$ 2,900
TOTAL LOCAL COSTS	US$ 6,380

The running and maintenance expenses of the new vehicles above is estimated at US$ 12,876 p.a.

3.5 Installed Capacity and Projected Volume of Production

The project at present is a small scale farm with a cheese factory. The scale that it will attain after expansion is considered medium. Therefore its capacity utilisation now and even after expansion is expected to be relatively high at least 80%.

The present and the expanded installed capacities are shown below:

Section	Installed Capacity Present	Installed Capacity Expanded
1. Milk intake	1,000 lts/day	3,000 lts/day
2. Cheese production	100 kg/day	148 kg/day
3. Drinking milk	-	1,000 lts/day
4. Butter	-	18 kg/day
5. Yogurt	-	500 lts/day

The projected volume of production p.a. (280 days of lactation) will be as follows:

Year	1993	1994	1995	1996	1997	1998 onwards
Capacity Utilisation	N.A	45%	63%	81%	89%	88%
Cheese (Tonnes)	28	23	33	42	46	46
Drinking milk ('000'lts)	-	156	218	280	308	304
Butter (Tonnes)	-	2.8	3.9	5.0	5.5	5.4
Yogurt ('000"lts)	-	78	109	140	154	152

3.6 Production Process

3.6.1 Pasteurised Milk

Pasteurising is heating fresh milk . The aim of heatin the milk is killing the bacteria in the milk, so that th milk is tinable for about one week.

The milk is heated for 60 minutes at 60 degrees celsiu or for 15 seconds at 72 degrees celsius. Out of 1C litres of fresh milk, 100 litres of pasteurised milk ca be produced. The milk can then be cooled and stored c distributed.

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3.6.2 Cheese

Cheese is a milk product that contains the valuable fat and protein content of milk. Most of the water is removed and a compact mass of milk (cheese) is created. Out of 100 litres of milk 10 kg of cheese is produced. The principle of cheese making is as follows:

- milk will be pasteurized to kill bacteria

- milk must be soured with cheese ferment for the taste and tinability

- Saltpetre to counteract bacteria growth. Culciumchloride for a successful coagulation and rennet can be added at the same time. Rennet originates from the stomach of young calves (chymosine) or eventually a vegetable extract (papaine from papaya) can be used.

- The renneting time is about 30 minutes. The created curd is cut and the whey separated.

- The curd is done in cheese moulds and for the last separation of whey it is pressed. In the moulds, cheese is turned once a day.

- For the taste and to counteract the bacteria growth the cheese is placed in a salt basin (Brine tub).

- The last handling is treating with plastic to protect the cheese from drying out.

- Cheese is then left to ripen in a storeroom for about one month at 12-16 degrees celsius and a humiditing of 8-%.

Cheese produced under bad hygienic conditions will crack during the ripening process because of the bacteria growth.

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3.6.3 Butter

To produce butter from milk, the fat is separated from other milk constuants. The resultant skimmed milk is then separated from the butter. Out of 100 litres of milk, 6 kilograms of butter can be produced.

Butter processing is as follows:

- The milk is pasteurized to kill bacteria.
- The pasteurized milk is then soured with butter ferment and salted for the taste.
- The soured milk is then churned for 15 to 60 minutes during which the fat granula breaks and the milk fat coagulated.
- The coagulated butter is then separated from the rest of the product.
- The butter produced is then washed to separate it from the last rests of liquid.
- The last rests of liquid can be separated by kneading the butter.
- Storage and distribution of butter must be done in an H.D. Polyethelene foil in a cool storage.

3.6.4 Yogurt

Whole milk can be used or often skimmed milk. This skimmed milk is subjected to the processes of pasteurization at a temperature of 4°C for 30 minutes The milk is then rapidly cooled down to about 41-45°C for 3 hours at a ph. of 4.6-4.8, and then cooled at 20°C.

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Any desired food e.g. fruits such as straw berry, etc can then be added. The yogurt is then cooled to about 4°C to arrest the properties at a final ph of 3.8-4.4. The yogurt is then ready for packaging in an appropriate manner, e.g. plastic cups with cover.

Out of 100 litres of milk, 100 litres of yogurt can be obtained.

3.7 **Raw Materials**

The basic raw material is fresh milk. At present and for the rest of 1993, milk will be obtained from the company's dairy cattle numbers 50. The milk yield during 1993 is estimated at 95,073 all of which will be used to produce cheese.

The target is to have a daily fresh milk intake of 3000 litres, of which 1,000 litres will be used to produce drinking milk, 1500 litres will be used to produce butter and cheese and 500 litres will be used to produce yogurt.

The present stock of 49 dairy cattle is projected to yield a total of 139,995, 239,862, 278498, 301160 and 371474 litres of fresh milk in 1994, 1995, 1996, 1997, 1998 and 1990 respectively (see attachment I).

At a daily fresh milk intake rate of 3,000 litres, 840,000 litres of milk will be required p.a. at full capacity. 672,000 litres will be required at a projected machinery capacity utilisation of 80% in 1996.

To achieve this milk supply by January 1995, the project will require to import 60 additional dairy animals ready to go in the first stage of lactation by January, 1994. The excess milk production in the subsequent years after 1996 will be left to the out dairy farmers for sale/their own consumption.

Out of the required additional cattle, 30 will be kept at the project farm at Bugiri, and the remaining 30 will be under Bakojja Heifer In-Trust Scheme to be loaned to 15 outfarmers in the area around the project, who will undertake to look after the animals and repay the loan through supplying fresh milk to the project. The

89

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- two animals	:	US$ 5,000
- Cost of constructing a staple	:	1,000
- provision of initial veterinary services for one year		500
TOTAL		US$ 6,500

In order to pay back the loan of US$ 6,500 at 9% interest rate p.a., each outfarmer will be required to supply to the project 90% of the milk at US$ 0.16 per litre ex-outfarmers' gate.

Given the rate of milk yield as shown below, it is projected that it will take each outfarmer five years to repay the loan.

Supply of milk from each outfarmer

Year	1994	1995	1996	1997	1998
Lactation stage	1	2	3	4	5
Milk supply to the project at (90% of yield)lts	7560	9072	12600	14112	9731
Debt service (US$)	1210	1452	2016	2258	1557

The effective loan repayment will be as follows:

Year	Outstanding	Repayment	Interest	Total Debt Service
1994	5,875	625	585	1,210
1995	4,952	923	529	1,452
1996	3,382	1,570	446	2,016
1997	1,428	1,954	304	2,258
1998	-	1,428	129	1,557

In addition the outfarmers will forfeit the first calves to Bakojja Heifer In-Trust Scheme.

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The purpose of the Scheme is to utilise the non-working group of people (65% women, and 35% retired men and youth) to produce the required milk by the project, and at the same time help them to earn an income.

The total milk supply to the project from the 15 outfarmers is summarised below:

Year	1994	1995	1996	1997	1998
Milk supply(lts)	113,400	136,080	189,000	211,680	145,965

In 1999 onwards the project will be buying the milk from the outfarmers amounting to 300,526 litres p.a.

The milk yield from the 30 additional cattle that will be kept at the project farm is projected below:

Year	1994	1995	1996	1997	1998	1999
Lactation Stage	1	2	3	4	5	6
Milk yield	126000	151200	210000	235200	258720	284592

The total milk supply to the project is indicated below:

Year	1994	1995	1996	1997	1998	1999
Milk supply(lts)						
- Outfarmers	113400	136080	189000	211680	145965	79779*
- Within project	265995	391062	488498	536351	589880	656066
TOTAL	379395	527142	677498	748031	735845	735845

NB: * To be purchased by cash

The annual raw materials requirement is as follows:

91

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a) Fresh milk - 3000 litres per day at full capacity

b) For cheese production:-

- Rennet - 4 tablets per 300 litres of milk
  @ DFL 760 per 300 tablets CFI Kampala
  (US$ 390)

- Cheese coating, 100gm per kg of cheese

  @ DFL 540 per 90 kg CIF Kampala
  (US$ 277)

- Calcium chloride, 1 1/2 tablets per 300 litres of milk @ DFL 670 per 300 litres CIF Kampala
  (US$ 344)

- Sodium Nitrate, 180 gms per 300 litres of milk
  @ DFL 346 per 5kg CIF Kampala
  (US$ 178)

- Cheese culture, 10 kg p.a.
  @ DFL 878 CIF Kampala
  (US$ 451)

c) For yogurt production:

- Yogurt culture 10 kg p.a.
  @ DFL 878 CIF Kampala
  (US$ 451)

d) For butter production

- Butter ferment, 10 kg p.a.
  @ DFL 878 CIF Kampala
  (US$ 451)
- Salt, 3 kg per 300 litres of milk
  @ US$ 0.8 per kg

The annual requirement and cost of raw materials is projected here below:

92

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Year	1993	1994	1995	1996	1997	1998	1999
Requirement							
a) Milk (000 lts)							
From: Project farm	95	266	391	488	536	589	656
Outfarmers' Scheme	-	113	136	189	212	146	80
b) Rennet (tablets)	1268	2457	3440	4423	4850	4805	4805
c) Cheese coating(tons)	2.8	1.8	2.6	3.3	3.6	3.6	3.6
d) Calcium Chloride(tbs)	476	922	1290	1659	1823	1802	1802
e) Sodium Nitrate (kg)	57	113	158	203	223	221	221
f) Cheese Culture (kg)	10	10	10	10	10	10	10
g) Yogurt Culture (kg)	-	10	10	10	10	10	10
h) Butter Culture	-	10	10	10	10	10	10
i) Salt (kg)	-	945	1323	1701	1869	1848	1848
Cost US$ '000'							
a) Milk	-	-	-	-	-	-	12.8
b) Rennet		1.7	3.2	4.5	5.7	6.3	6.2
6.2							
C) Cheese coating	8.9	7.3	10.5	13.4	14.6	14.6	16.4
d) Calcium Chloride	0.6	1.1	1.5	2.0	2.2	2.1	2.1
e) Sodium Nitrate	2.1	4.1	5.8	7.4	8.2	8.1	8.1
f) Cheese Culture (kg)	0.5	0.5	0.5	0.5	0.5	0.5	0.5
g) Yogurt Culture (kg)	-	0.5	0.5	0.5	0.5	0.5	0.5
h) Butter Culture	-	0.5	0.5	0.5	0.5	0.5	0.5
i) Salt (kg)	-	0.8	1.1	1.4	1.5	1.5	1.5
TOTAL COST	13.8	18.0	24.9	31.4	34.3	34.0	46.8

The cost includes 3% local costs including import licence and clearing charges.

3.8 Packaging Materials

Fresh milk will be packed in one litre wax coated paper.

Cheese and butter will be wrapped in LD and HD polythene sheets in quantities of 1 kg and 0.5 kg respectively.

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Yogurt will be packed in cups made using wax paper and plastic cover in quantities of 250 mls. All packing materials will be printed/lebelled with the company's logo indicating the product brand name and date of packaging.

The unit costs of the packaging materials are as follows:

Wax papers, one litre	US$ 0.05
LD polythene sheet, one kg 14"x14"	US$ 0.04
HD polythene sheet half kg 9"x9"	US$ 0.05
LD plastic cups 250	US$ 0.08

The annual requirement and cost of packaging materials is summarised below:

Year	1993	1994	1995	1996	1997	1998 onwards
Capacity Utilisation	N.A	45%	63%	81%	89%	88%
Requirements '000'						
Wax paper (lts)	-	156	218	280	308	304
HD Polythene sheets9"x9"	-	5.6	7.8	10.0	11.0	10.8
LD Polythene sheets14"x14"	28	23	33	42	46	46
LD Plastic cups 250gm	-	312	436	560	616	608
Cost of US$'000'						
Wax paper	-	7.8	10.9	14.0	15.4	15.[illegible]
HD Polythene sheets	-	0.3	0.4	0.5	0.6	0.[illegible]
LD Polythene sheet.	1.1	0.9	1.3	1.7	1.8	1.8
LD plastic cups 250gm	-	25.0	34.9	44.8	49.3	48.6
TOTAL COST	1.1	34.0	47.5	61.0	67.1	66.[illegible]

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3.9 Manpower Requirement

The company at present employs 23 people. Upon expansion of its operations, it will recount 47 additional people.

The total manpower requirement (existing plus additional) is indicated below:

Category	Existing	Required	Monthly Salary (US$)
Administration			
Managing Director	1	0	480
General Manager	0	1	320
Accountant	0	1	200
Farm Manager	1	0	200
Diary Process Manager	0	1	200
Marketing Manager	0	1	200
Extension Services Manager	0	1	200
Assistant Accountant	1	0	170
Bookkeepers	1	2	210
Clerks	1	3	280
Cashier	1	0	70
Secretaries	0	2	140
Messengers	0	2	50
Watchmen	4	2	180
Drivers	2	4	180
Storekeeper	0	1	30
Assistant Storekeeper	0	1	25
Salesmen	0	2	240
SUB-TOTAL	12	24	3,405
Production			
Supervisor	0	1	170
Cheese Producers	2	0	200
Cream churner	0	1	100
Packers	0	4	200
Portion Cheese and Butter handmen	0	2	100
Inserminator	0	1	170
Extension Assistants	0	3	510
Herdsmen	1	2	90
Milkers	2	0	80

95

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The project requires technical assistance in dairy processing for the first six months during 1994. Advertisement for a suitable candidate will be done and the cost of such technical assistance is estimated at US$ 25,000 including air ticket and subsistence in the country.

3.10 Utilities

3.10.1 Water

The farm water is pumped directly from Lake Victoria It's cost is embédded within the cost of electricity.

3.10.2 Electricity

The farm is already supplied with three phase powe supply and a 100 KVA transformer. A standby power generator of 100 KVA is also available.

The present power utilisation is about 30% of the transformer rating. It is expected that the transforme rating will be almost fully utilised when the far operations are expanded in 1994.

The projected consumption and cost of electric power is worked out below:

Year	1993	At Full Capacity
Power Demand	100 KVA	100 KVA
Utilisation	Approx.30%	100%
Power Consumption 280 days @ 8 hrs (KWH)	67,200	179,200
Demand charge @ Shs 4170/ KVA/(Shsm)/month	5.00	5.00
Unit charge @ Shs52/KWH for Jan-June '93 and Shs. 94/KWH onwards	4.96	16.84
Standing Service fee @ Shs. 2700/month	0.03	0.03
TOTAL COST	9.94	21.87
EQUIVALENT US$ '000'	8.0	17.5

Because it is more expensive to use the standby generator power supply, it has been assumed that the cost of electrical power per annum will go up by 10% to reflect the cost of running the standby generator during power failure, thus US$ 8,800 in 1993 and US$ 19,250 in 1994 onwards.

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4.0 MANAGEMENT AND ORGANISATION

4.1 Management

The company is headed by a Board of Directors composed of the two shareholders. Mr. Richard S.M. Bakojja is the Managing Director responsible with implementation of the policies made by the Board.

He is assisted in the day to day operations of the farm by the Farm Manager and Accountant. When the farm operations are expanded in 1994, a General Manager, a Dairy Process Manager, a Marketing Manager, and an Extension Services Manager will be recruited to further assist the Managing Director.

4.2 Organisation

The company's Organisation Chart after expansion will be shown in the Organisation Chart below:

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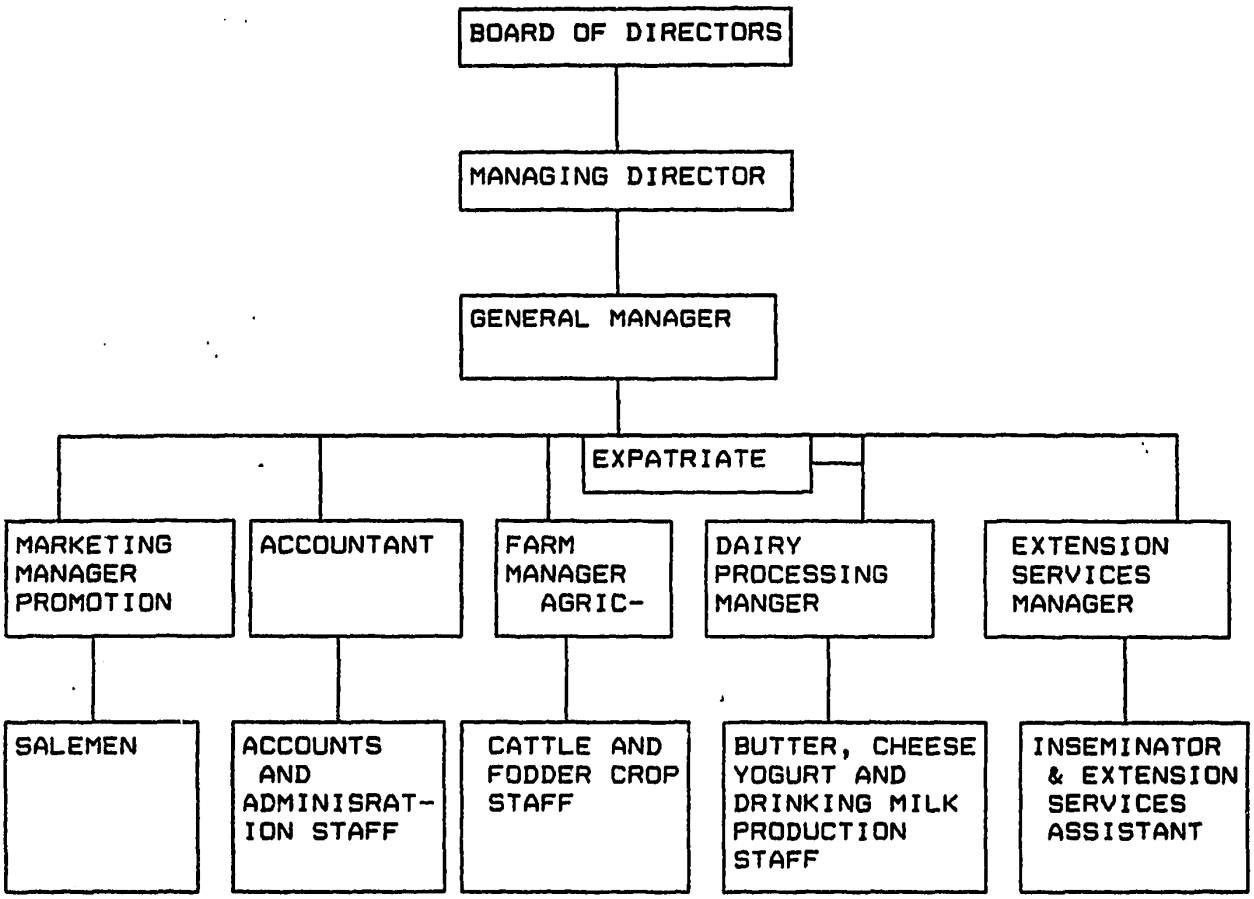

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5.0 FINANCIAL ASPECTS

5.1 Considerations

Loan Required	:	US$ 479,100
Interest Rate	:	Assumed at 9% p.a.
Loan Period	:	Taken at five (5) years inclusive of one year of grace.
Sales Ex-Factory Prices	:	
Drinking milk	:	US$ 0.24/litre
Cheese	:	US$ 6.00/kg
Yogurt	:	US$ 2.15/litre
Butter	:	US$ 3.50/kg

5.2 Investment and Financing US$ '000'

Item	Existing	Required Local	Additional Foreign	Total
1. Land	30.0	-	-	30.0
2. Buildings and civil works & infrastructure	223.8	32.0	-	255.8
3. Machinery, tools and equipment	51.0	22.1	246.1	319.2
4. Vehicles	18.8	6.4	58.0	83.2
5. Office equipment, fittings and furniture	1.5	-	-	1.5
6. Technical assistance (6 months)	-	-	25.0	25
7. Livestock	60.0	7.5	150.0	217.5
TOTAL CAPITAL COSTS	385.1	68.0	479.1	932.2
8. Working Capital Provision	39.9	(2.1)	-	37.8
TOTAL PROJECT COST	425.0	65.9	479.1	970.0

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FINANCING

Loan	-	-	479.1	479.1
Equity	425.0	65.9	-	490.9
TOTAL FINANCING	425.0	65.9	479.1	970.0

DEBT/EQUITY 0.98

5.3 Working Capital Provision Estimates US$ '000'

Item	Cover	1993	1994	1995	1996	1997onwards
Salaries	2 months		7.4	7.4	7.4	7.4
Animal drugs	1 month		1.5	1.5	1.5	1.5
Creditors	1/2 month		14.7	20.6	26.5	29.1
Spares	6 months		3.9	3.9	3.9	3.9
Work-in-Progress(Cheese)	1 month		8.1	11.3	14.6	16.0
Vehicle Running & maintenance	1 month		2.2	2.2	2.2	2.2
TOTAL WORKING CAPITAL		39.9*	37.8	46.9	56.1	60.1
CHANGE IN WORKING CAPITAL		39.9	(2.1)	9.1	9.2	4.0

N.B.* Existing for 1993 as per company's balance sheet.

5.4 Profitability

At the present level of production (cheese only) the annual sales revenue is estimated at US$ 168,000 in 1993 rising to US$ 353,000 in 1994, when production of drinking milk, butter and yogurt is expected to begin.

Net profit is expected to rise from US$ 2,000 in 1993 to a retained income level of US$ 412,000 in 1999.

The project is expected to attain a Financial Rate of Return of 9.9% and a Net Present Value of US$ 33,000 at 9% discount rate.

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For details see appendices 3 and 6.

5.5 Liquidity

The project is indicated to have a satisfactory liquidity position over the period analysed. At the present operations, the project is expected to realise a cash balance of US$ 34,000 in 1993, increasing to US$ 3[illegible],000 in 1998 when all the debt obligations will be cleared.

The cumulative cash balances increases from US$ 34,000 to US$ 534,000 in 1999.

For details refer to Appendix 4.

5.6 Break-Even Analysis

The break-even calculated based on 1997 is 56%.

Sales revenue	:	US$ 700,000
Variable costs	:	US$ 234,300
Contribution margin	:	US$ 465,700
Fixed costs	:	US$ 261,400

$$\text{Break-even capacity} = \frac{\text{Fixed Cost}}{\text{Contribution margin}} \times 100\%$$

$$= \frac{261{,}400}{465{,}700} \times 100\%$$

$$= 56.1\%$$

5.7 Capital Structure

The project is indicated to have a strong capital structure with a Debt to Equity Ratio of 0.97 in 1993, improving to 0.18 in 1997 when the debt last appears in the company's balance sheet.

Appendix 5 refers.

5.8 Loan Repayment Schedule US$'000'

Year	Principal Outstanding	Loan Repayment	Interest
1993	479	-	-
1994	479	-	43
1995	359	120	43
1996	239	120	32
1997	119	120	22
1998	-	119	11

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6.0 ECONOMIC ASPECTS

6.1 Employment

The project is expected to create 47 additional jobs to the 23 existing ones which is a direct benefit to the country. All together the project will employ 70 people of which 40 will be professional and skilled personnel and 30 unskilled.

6.2 Value Added

Value Added as percentage of sales is 51.5% as calculated below based on 1997.

Item	Value (US$)
Salaries	44,400
Interest on loan	22,000
Profit before tax	182,000
Depreciation	112,000
TOTAL VALUE ADDED	360,400
SALES REVENUE	700,000
VALUE ADDED/SALES	0.515

6.3 GOVERNMENT REVENUE

The project was granted an Investment licence by Ugand Investment Authority in May, 1992 with the followin incentives:

- Exemption from corporation tax, withhold tax and tax on dividends for 6 years ending May, 1998.

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- Exemption from import duty, sales tax on imported plant, machinery and construction equipment.

- First arrival privileges for the expatriate workers.

- Facilitation of work permits for two expatriates.

The above tax exemption have been taken into account.

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7.0 CONCLUSION

From the foregoing analysis, the project is indicated to be technically feasible, financially viable and economically beneficial to the country.

Appendix 1

PROJECTED FIXED COSTS US$'000'

Year	1993	1994	1995 Onwards
Directors Expenses	9.6	9.6	9.6
Salaries and Benefits	14.9	26.0	26.0
Office Expenses	33.6	67.2	67.2
Postages	0.2	0.2	0.2
Insurance	2.4	7.8	7.8
Audit Fees	0.8	0.8	0.8
Depreciation			
- Buildings and Civil Works (4%)	17.0	17.5	17.5
- Machinery (10%)	1.8	38.8	38.8
- Vehicles and other transport/	5.0	24.3	24.3
farm equipment	0.2	0.2	0.2
- Office furniture & fittings (10%)	0.0	2.5	2.5
- Technical assistance	10.0	28.8	28.8
- Livestock	0.0	10.0	10.0
Machinery & equipment maintenance	2.4	7.8	7.8
Dairy soap and disinfectants	1.3	1.9	1.9
Animal drugs	8.2	18.0	18.0
Lease of Lusenke stock farm	0.0	10.0	10.0
TOTAL FIXED COSTS	107.4	261.4	261.4

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Appendix 2

PROJECTED VARIABLE COSTS US$ '000'

YEAR	1993	1994	1995	1996	1997	1998	1999
Capacity Utilisation	N.A	45%	63%	81%	89%	88%	88%
Salaries and benefits	5.5	18.4	18.4	18.4	18.4	18.4	18.4
Animal feeds	20.6	54.1	54.1	54.1	54.1	54.1	54.1
Raw materials	13.8	18.0	24.9	31.4	34.3	34.0	46.8
Packaging materials	1.1	34.0	47.5	61.0	67.1	66.1	66.1
Electricity	8.0	12.6	15.6	18.6	20.0	19.8	19.8
Distribution costs (2% of sales)	3.4	7.1	10.0	12.8	14.0	13.9	13.9
Vehicles running and maintenance	6.0	26.4	26.4	26.4	26.4	26.4	26.4
TOTAL VARIABLE COSTS	58.4	170.6	196.9	222.7	234.3	232.7	232.7
TOTAL FIXED COSTS	107.4	261.4	261.4	261.4	261.4	261.4	261.4
TOTAL PRODUCTION COSTS	165.8	432.0	458.3	484.1	495.7	494.1	491.1

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Appendix 3

INCOME STATEMENTS US$'000'

YEAR	1993	1994	1995	1996	1997	1998	1999
SALES REVENUE							
- Cheese	168	136	196	252	276	276	276
- Drinking milk	-	37	52	67	74	73	73
- Butter	-	10	14	18	19	19	19
- Yogurt	-	168	234	301	331	327	327
TOTAL SALES REVENUE	168	353	498	638	700	695	695
Production Costs	166	432	458	484	496	494	494
Gross Profit	2	(79)	40	154	204	201	201
Interest on loan	-	43	43	32	22	11	-
Profit before tax	2	(122)	(3)	122	182	190	201
Corporate tax (35%)	-	-	-	-	-	33	70
Net profit	2	(122)	(3)	122	182	157	131
Dividends (20%)	-	-	-	-	-	31	26
RETAINED INCOME	2	(120)	(123)	(1)	181	307	412

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Appendix 4

PROJECTED CASH FLOWS US'000'

YEAR	1993	1994	1995	1996	1997	1998	1999
SOURCES:							
Gross Profit	2	(79)	40	154	204	201	201
Depreciation	34	112	112	112	112	112	112
Loan	479	-	-	-	-	-	-
Equity	491	-	-	-	-	-	-
TOTAL SOURCES	1,006	33	152	266	316	313	313
USES:							
Capital Costs	932	-	-	-	-	83	-
Working Capital	40	(2)	9	9	4	-	-
Interest on Loan	-	43	43	32	22	11	-
Loan Repayment	-	-	120	120	120	119	-
Corporate Tax	-	-	-	-	-	33	70
Dividends	-	-	-	-	-	31	26
TOTAL USES	972	41	172	161	146	277	96
CASH BALANCE	34	(8)	(20)	105	170	36	217
CUMMULATIVE CASH	34	26	6	111	281	317	534

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Appendix 5

PROJECTED BALANCE SHEET POSITION US$'000'

YEAR	1993	1994	1995	1996	1997	1998	1999
ASSETS:							
Net Fixed Assets	898	786	674	562	450	421	309
Working Capital	40	38	47	56	60	60	60
Cash	34	26	6	111	281	317	534
TOTAL ASSETS	972	850	727	490	791	798	903
LIABILITIES:							
Loan	479	479	359	239	119	-	-
Equity	491	491	491	491	491	491	491
Retained Income	2	(120)	(123)	(1)	181	307	412
TOTAL LIABILITIES	972	850	727	490	791	798	903
DEBT/EQUITY	0.97	1.29	0.98	0.49	0.18	-	-

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Appendix 6

DISCOUNTED CASH FLOW ANALYSIS US$'000'

YEAR	1993	1994	1995	1996	1997	1998	1999
INFLOWS:							
Profit before tax	2	(122)	(3)	122	182	190	201
Depreciation	34	112	112	112	112	112	112
Realisable assets	-	-	-	-	-	-	309
TOTAL INFLOWS	36	(10)	109	234	294	302	622
OUTFLOWS:							
Capital Costs	932	-	-	-	-	83	-
Working Capital	40	(2)	9	9	4	-	-
TOTAL OUTFLOWS	972	(2)	9	9	4	83	-
NET FLOW	(936)	(8)	100	225	290	219	622

DISCOUNTING:

AT 9% NPV = 33
AT 11% NPV = (44)

$$IRR = 9\% + \frac{33 \times 7}{33 + 44}\ \%$$

$$= 9.9\%$$

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ATTACHMENT 1

M/S LIBERTY DAIRY BUSINESS SERVISES LIMITED.

PROJECTIONS OF MILK YIELD FROM THE EXISTING CATTLE.

EAR TAG	NAME OF ANIMAL	STAGE OF LACTATION	PRESENT MILK YIELD (LTS)	PROJECTED MILK YIELD IN LITERS. 1993	1994	1995	1996	1997	1998	1999
1	77 MANDGENYI	3	28	8,540	9,150	9,760	9,760	9,760	9,760	0
2	102 ANN-MARRIE	3	25	7,625	8,235	8,845	8,845	8,845	8,845	0
3	281 KAKUNGU	2	18	5,490	6,100	6,710	7,381	7,381	7,381	8,999
4	214 KYASHA	2	18	5,490	6,100	6,710	7,381	7,381	7,381	8,999
5	222 KARASEKE	3	23	7,015	7,625	8,235	8,235	8,235	8,235	0
6	131 KYOSIMBA	2	16	4,880	5,490	6,100	6,710	7,381	7,381	8,999
7	7934 MAKAZZI	1	14	4,270	4,880	5,490	6,100	6,710	7,381	8,999
8	7070 KAKUZI	2	14	4,270	4,880	5,490	6,100	6,710	7,381	8,999
9	7937 BUSHENYI	1	13	3,965	4,575	5,185	5,704	6,274	6,901	8,414
10	7782 ZANUWETA	2	14	4,270	4,880	5,490	6,100	6,710	7,381	8,999
	714 TUSURTRA	1	12	3,660	4,270	4,880	5,490	6,100	6,710	8,999
12	713 KARALAST	1	12	3,660	4,270	4,880	5,490	6,100	6,710	8,999
13	7174 NANASINGA	1	12	3,660	4,270	4,880	5,490	6,100	6,710	8,999
14	219 ZINU	2	11	3,355	3,965	4,575	5,185	5,704	6,274	8,414
15	211 KAROGO	1	11	3,355	3,965	4,575	5,185	5,704	6,275	8,414
16	746 KIRIRA	2	10	3,050	3,660	4,270	4,880	5,490	6,100	8,181
17	210 KALEMBA	2	10	3,050	3,660	4,270	4,880	5,490	6,100	8,181
18	888 KYTREKERA	2	18	5,490	6,100	6,710	7,381	7,381	7,381	0
19	705 KIRIMUTU	DRY	0	4,793	5,490	6,100	6,710	7,381	7,381	8,999
20	772 NGARO	DRY	0	5,185	5,795	6,710	7,381	7,381	7,381	0
21	212 KARAGO	HEIFER	0	0	3,355	4,793	5,273	5,800	6,490	8,556
22	7926 ASURTRA	HEIFER	0	0	3,660	4,793	5,273	5,800	6,490	8,556
23	7927 TRIFANANA	HEIFER	0	0	3,660	4,793	5,273	5,800	6,490	8,556
24	793 TSORKLSARRI	HEIFER	0	0	3,660	4,793	5,273	5,800	6,490	8,556
25	7935 NALWADDA I	HEIFER	0	0	3,660	4,793	5,273	5,800	6,490	8,556
26	7931 NALWADDA II	HEIFER	0	0	3,660	4,793	5,273	5,800	6,490	8,556
27	7930 NAKALYANGO	HEIFER	0	0	3,660	4,793	5,273	5,800	6,490	8,556
28	7933 CHERSR	HEIFER	0	0	3,660	4,793	5,273	5,800	6,490	8,556
29	7936 MAGIRINYA	HEIFER	0	0	3,660	4,793	5,273	5,800	6,490	8,556
30	7929 NANONO	HEIFER	0	0	0	3,660	4,793	5,273	6,081	7,778
31 NONE	ZANUWETA'S	HEIFER	0	0	0	3,660	4,793	5,273	6,081	7,778
32 NONE	GINNAH	HEIFER	0	0	0	3,660	4,793	5,273	6,081	7,778
33 NONE	DONNAR	HEIFER	0	0	0	3,660	4,793	5,273	6,081	7,778
34 NONE	RIRABWA	HEIFER	0	0	0	3,660	4,793	5,273	6,081	7,778
35 NONE	RORINA	HEIFER	0	0	0	3,660	4,793	5,273	6,081	7,778
36 NONE	KYATR'S	HEIFER	0	0	0	3,660	4,793	5,273	6,081	7,778
NONE	NGARO'S	HEIFER	0	0	0	3,660	4,793	5,273	6,081	7,778
38 NONE	KARALASIZI	HEIFER	0	0	0	3,660	4,793	5,273	6,081	7,778
39 NONE	TUSURTRA'S	HEIFER	0	0	0	3,660	4,793	5,273	6,081	7,778
40 NONE	KALEMBA'S	HEIFER	0	0	0	3,660	4,793	5,273	6,081	7,778
41 NONE	KARASEKE'S	HEIFER	0	0	0	3,660	4,793	5,273	6,081	7,778
42 NONE	KYASHA'S	HEIFER	0	0	0	3,660	4,793	5,273	6,081	7,778
43 NONE	MAKAZZI'S	HEIFER	0	0	0	3,660	4,793	5,273	6,081	7,778

44	MONK	ASURTZA'S	HRTPRE	0	0	0	3,660	4,793	5,273	6,081	7,778
45	MONK	KAZONGU'S	HRTPRE	0	0	0	3,660	4,793	5,273	6,081	7,778
46	MONK	ZANUGRNYI'S	HRTPRE	0	0	0	3,660	4,793	5,273	6,081	7,778
47	MONK	KYOSTNRA'S	HRTPRE	0	0	0	3,660	4,793	5,273	6,081	7,778
48	MONK	ZTNUS'	HRTPRE	0	0	0	3,660	4,793	5,273	6,081	7,778
49	MONK	KARUGO'S	HRTPRE	0	0	0	3,660	4,793	5,273	6,081	7,778
50	MONK	KTRTNUYUS	HRTPRE	0	0	0	3,660	4,793	5,273	6,081	7,778
		TOTAL MTLK YIELD			95,073	133,995	239,882	278,498	301,151	331,160	371,934

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Attachment #3

Nice Toothbrush & House of Plastics Brochure

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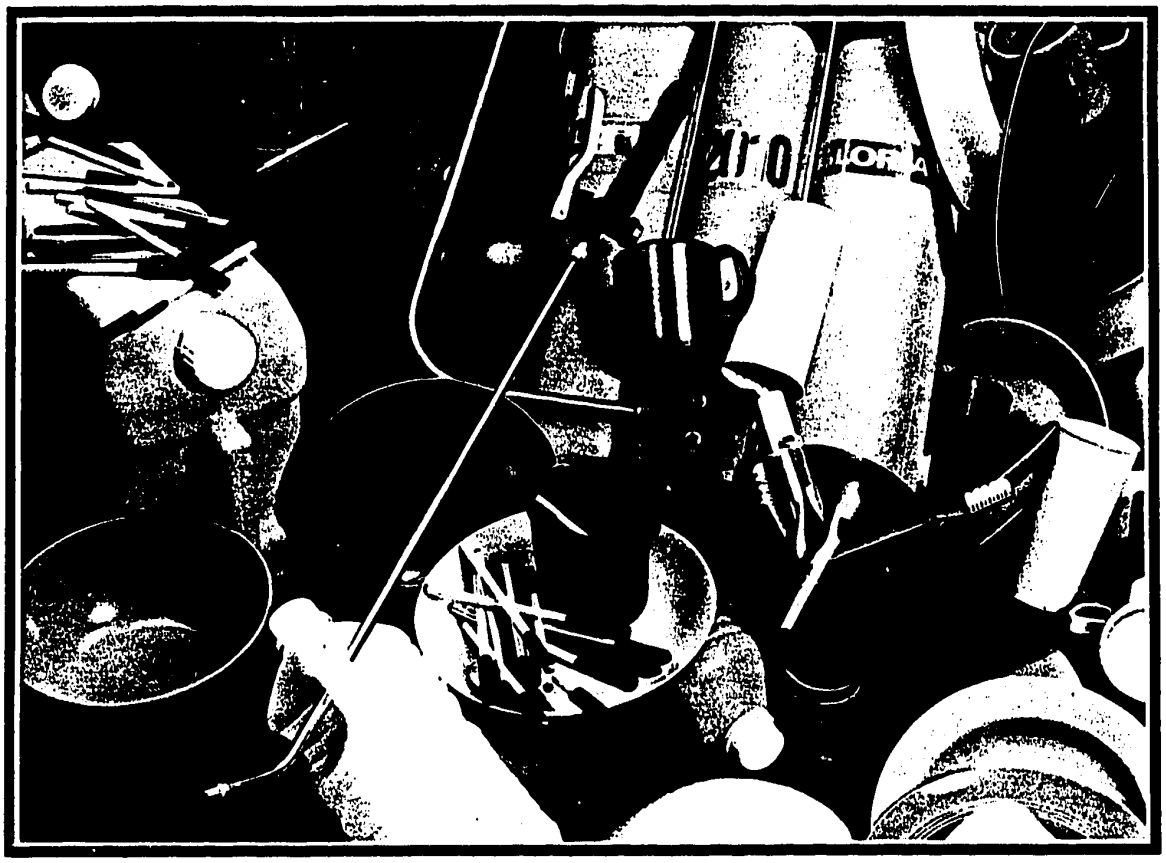
NICE®

HOUSE OF PLASTICS



WHERE THE DIFFERENCE IS QUALITY.

116

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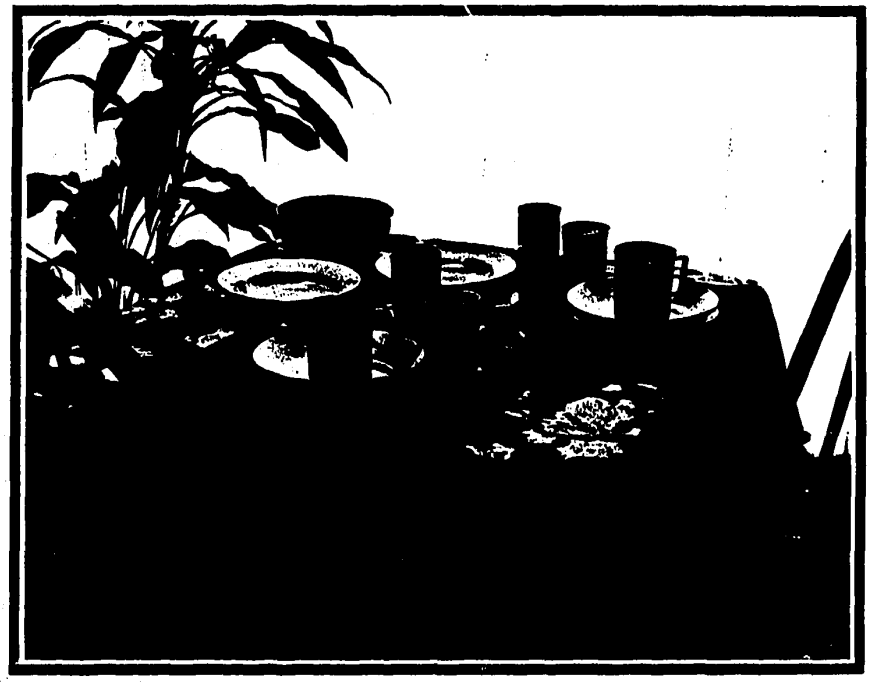
Have a NICE® Party

NICE® Bottles

- 2 Litre Bottles available in red, green, yellow and white.
- 1 Litre Bottles smooth sides, and without handles (not pictured). Available in list colours.



Have a NICE® Dinner

NICE® Tableware

Bowls, mugs, tumblers and plates of different types, available in a variety of colours like: red, blue, green, pink and yellow. Bowls also available in chocolate brown.

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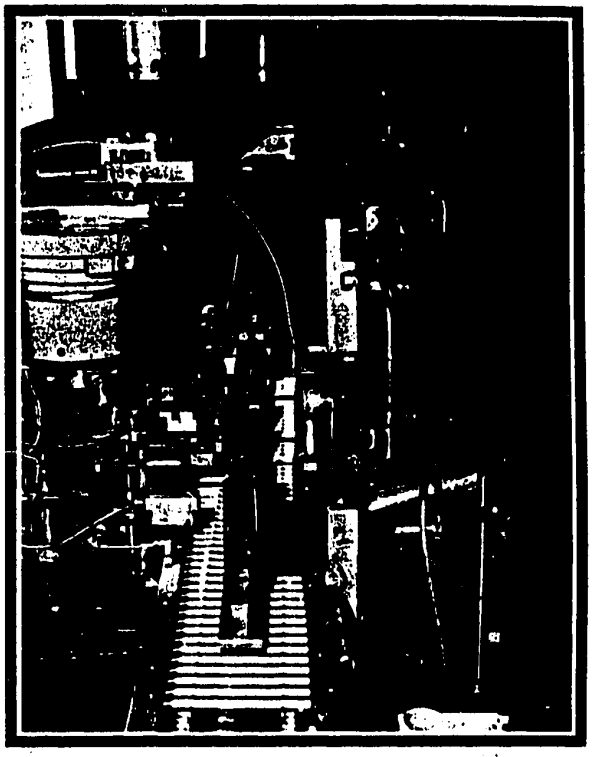
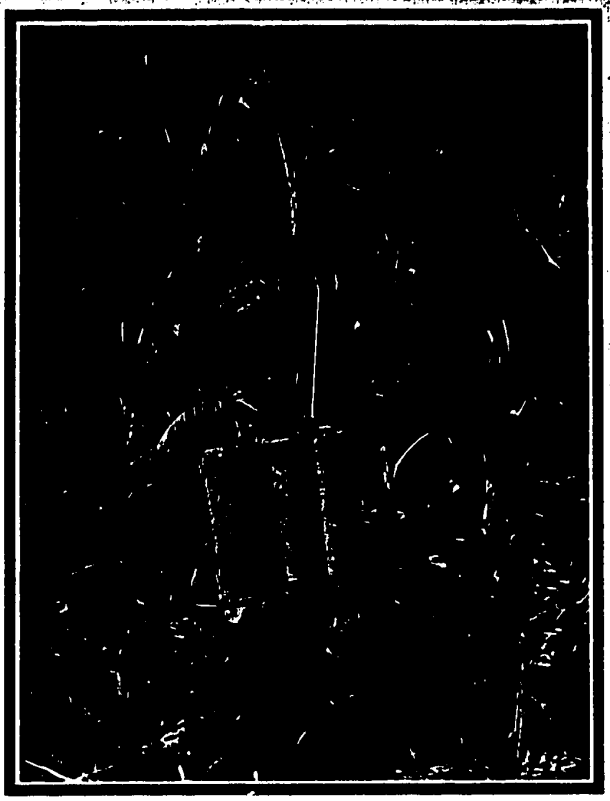
HOUSE OF PLASTICS

Ship Toothbrush Limited, was established in 1970. The company's name can be attributed to its first product: the NICE® toothbrush. However today, we are more than just a toothbrush factory. Our objective is to provide *high quality plasticware* such as tableware, writing instruments and packaging items in addition to toothbrushes. Over the past twenty years, we have introduced several new products for use not only in the home, office and school but also in the agricultural and industrial sectors. We have now truly earned the designation: *House of Plastics.*



We continue to employ the latest manufacturing technology and production techniques in order to provide our customers with the quality they have come to expect from us at a very reasonable price. We invite you to try our products and experience the NICE® quality. All our products are available in a variety of colours.

NICE® Products



Better Farming with House of Plastics

GLORIA®

Knapsack Sprayer

Features

- Easy to use
- Comfortable
- Lightweight
- Durable
- Longlasting
- Total capacity - 18 Litres

Packaging Materials with NICE®

- Jerrycans - 20 Litre
- Soda/Beer Crates
- Medicine Containers
- 5 Litre Buckets
- 1 & 2 Litre Bottles

Features

- Durable
- Lightweight
- 5 Litre Bucket has tight fitting lid.

Possible Uses

Storage for:

- Home
- Farming
- Industry

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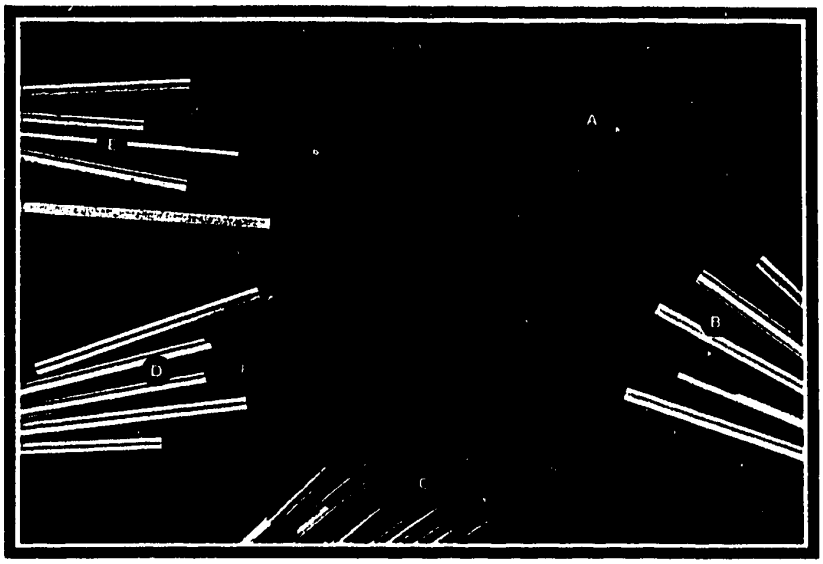
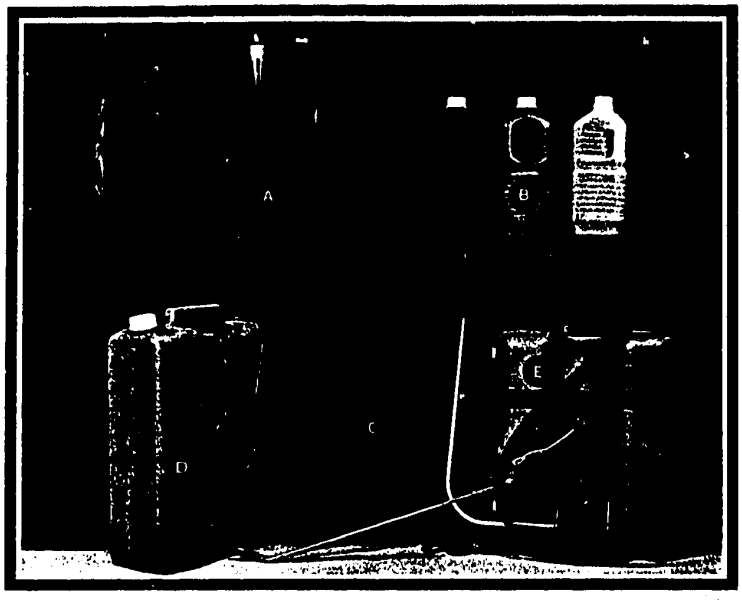
HOUSE OF PLASTICS



Business and School

A - NICE® '76
B - NICE® '80 Black
C - NICE® '90
D - NICE® '80 Blue
E - NICE® '80 Red



Agriculture and Packaging

A - Bucket
B - 2 Litre Bottles
C - Soda Crate
D - Jerrycan
E - Knapsack Sprayer

Domestic Products

A - Tumbler '78
B - 2 Litre Bottles
C - Soup Plates
D - Dinner Plates
E - Deep Plates
F - Flat Plates
G - Mug '86
H - Mug '80
I - Bowls
J - Tumbler '77

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Schoolwork with NICE®

NICE® Pens

- Three different style pens:
  NICE® '76
  All blue body.

  NICE® '80
  White with coloured striped body.

  NICE® '90
  Clear body.
- All pens available with either blue, red or black ink.

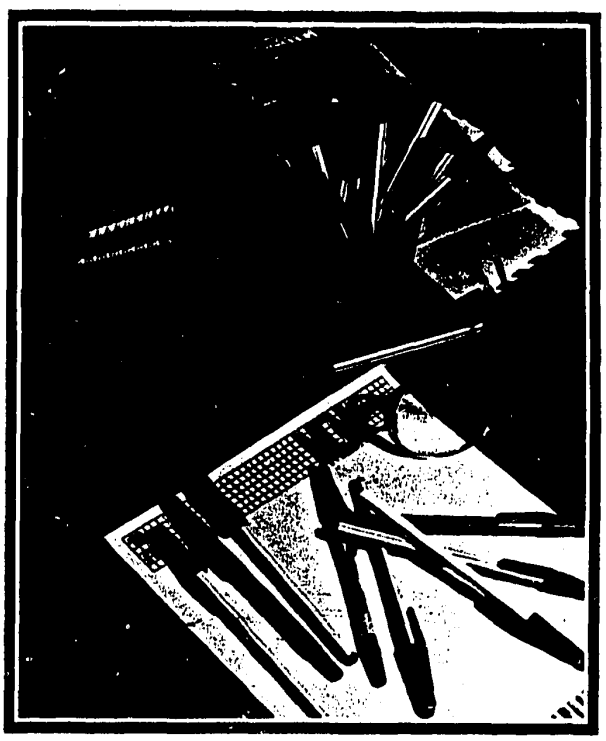
Better Business with NICE®

NICE® Pens

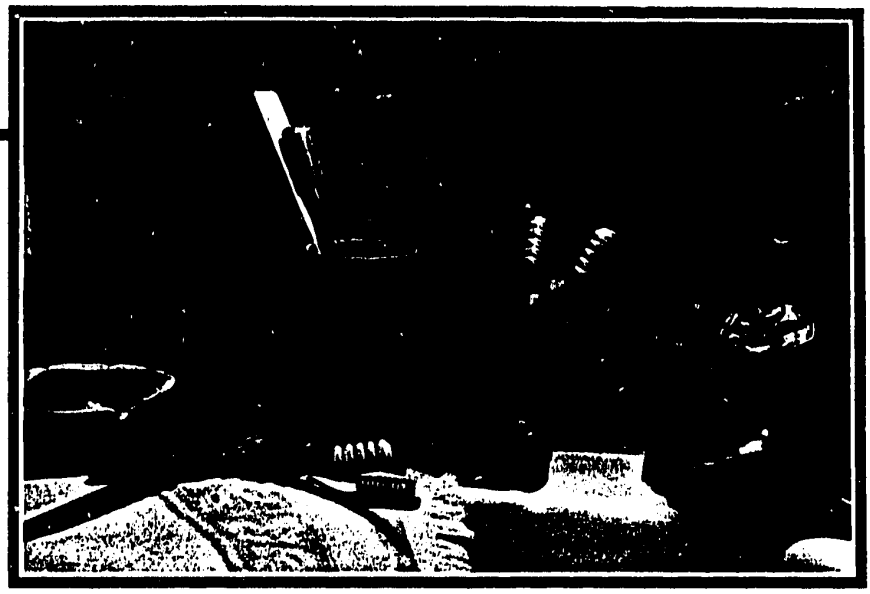
- Three different style pens:
  NICE® '76
  All blue body.

  NICE® '80
  White with coloured striped body.

  NICE® '90
  Clear body.
- All pens available with either blue, red or black ink.



Cleaner Teeth with NICE®

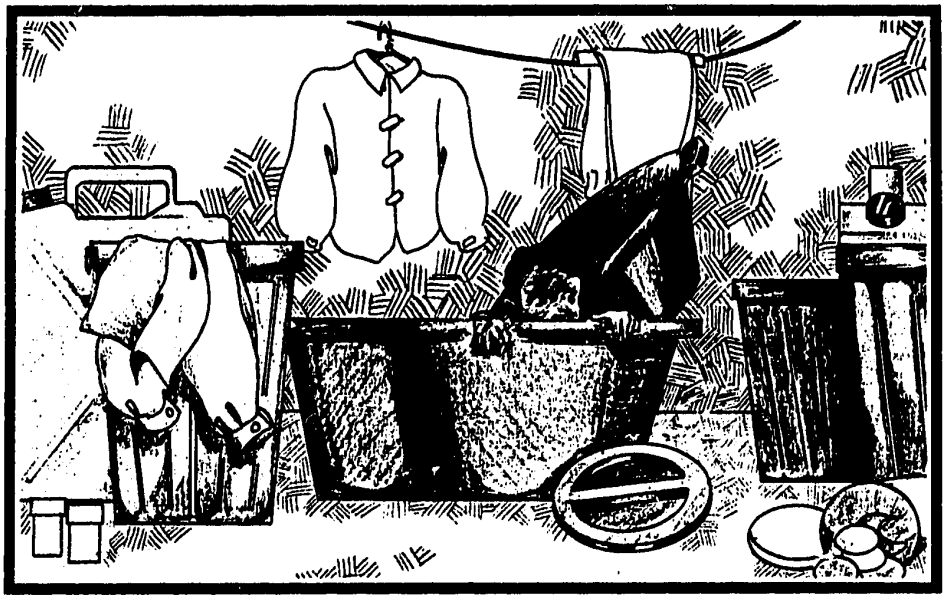


NICE® Toothbrushes

- Adult toothbrushes: long or short head
- Children toothbrushes

All toothbrushes available with either soft, medium or hard bristles; and in many attractive colours.

Washtime with NICE®



NICE® Bucket

Features:

- Durable
- Tight fitting lid
- Total capacity - 23 Litres
- Available in many colours.

Possible uses

- Washing clothes and dishes
- Fetching water
- Dustbin

NICE® Basin

Features

- Durable
- Basin has strong handles for easy handling.
- Total capacity - 20 Litres
- Available in many colours.

Possible uses

- Washing children, clothes and cars.
- And much more

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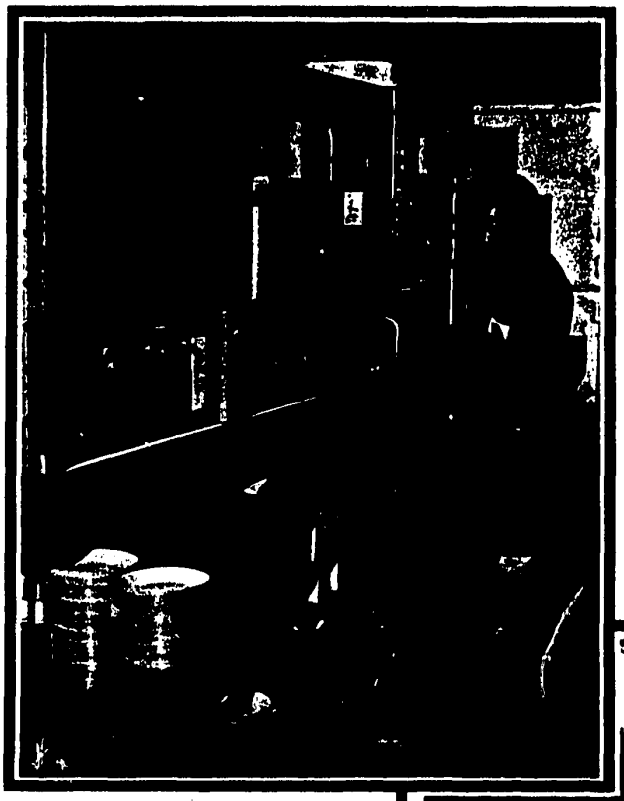
OVER 20 YEARS OF QUALITY

Ship Toothbrush Factory Limited, Kampala

Administration and Factory:

75 B Kibira Road
P.O. Box 5961
Kampala Uganda
Telephone 259358/232176
Cables Afroagent
Telex 61281
Fax 221289



Product Offerings

Packaging Items

- 1&2 Litre Bottles
- Soda/Beer Crates
- Medicine Containers
- 5 Litre Buckets

Domestic Use Products

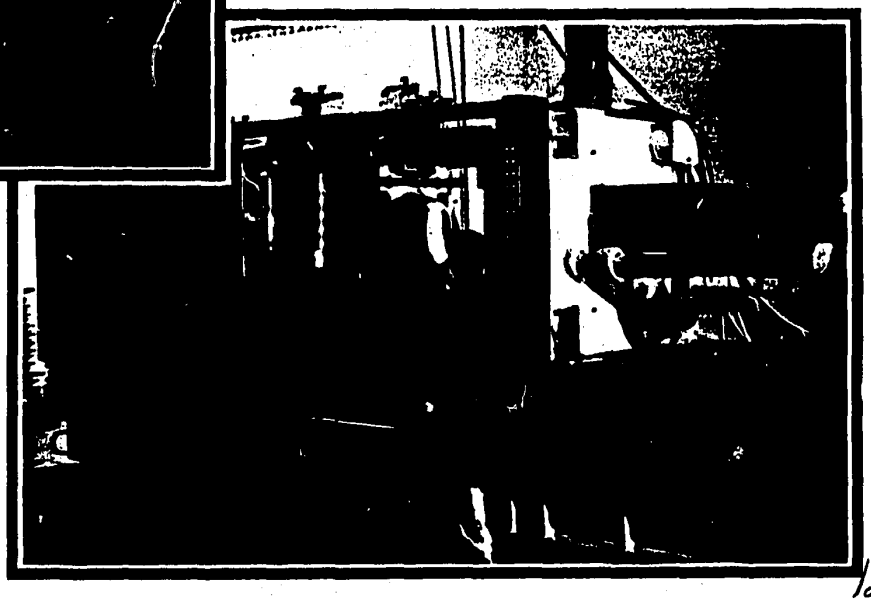
- Toothbrushes
- Mugs
- Plates
- Tumblers
- Bowls
- 23 Litre Buckets
- 20 Litre Jerrycans
- Basins

School/Office Use Products

- Ball point pens

Agricultural Use Products

- Knapsack sprayer



Attachment #4

Dairy Corporation Information

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items
Business Calendar
w/ sayings

DAIRY CORPORATION

DESIGN OF NEW PACKAGING FOR DAIRY PRODUCTS

TENDER SCHEDULE

1. Background

Dairy Corporation is a parastatal organization which was established by the Uganda Government in 1967. Its main activities include milk collection, processing and marketing of packed pasteurized milk and dairy products.

From the early 1970s upto the mid 1980s the Corporation like other organisations, has faced many operational difficulties. However, since 1987, the Corporation has embarked on serious and substantial rehabilitation of its facilities. As a result collection of fresh milk from farmers has increased dramatically and milk quality has improved significantly. The range of dairy products produced by Dairy Corporation has also expanded. Hence, the Corporation is now set to market first class quality milk and dairy products in a market place which is becoming increasingly competitive and sensitive to quality issues.

Accordingly, the Corporation has decided to introduce new packaging for all its products in order to underline the enhanced quality of its products and to portray a new, better and appropriate image. DANIDA funding has been secured for this purpose as part of a larger current commitment to rehabilitate various Dairy Corporation facilities.

2. <u>Product Range</u> (Samples of existing packages given).

The following products of Dairy Corporation will require new packaging:

i. Standardized pasteurized homogenized milk - 1 litre, 0.5 litre, 0.25 litre.

ii. Premium pasteurized homogenized milk - 1 litre, 0.5 litre, 0.25 litre.

iii. Flavoured milk - several flavours (0.5 litre, 0.25 litre).

iv. Butter - salted/unsalted

v. Cheese - type/size

vi. Yoghurt - several flavours

vii. Ice-cream - several flavours

viii. Ghee

ix. Cream - (Sweet Cream) 1 kg., 0.5 kg.

3. <u>Brand Name Strategy</u>

The Corporation has adopted a family brand name to apply to all products - FRESH DAIRY. The family brand name will be followed by the name of a particular product, for example:

Fresh Dairy
Standardized Pasteurized Homogenized Milk

Fresh Dairy
Premium Pasteurized Homogenized Milk

Fresh Dairy
Butter - Salted/Unsalted

Fresh Dairy
Cream - (Sweet Cream)

The only product which will not use the family name Fresh Dairy is yoghurt.

However, the Corporation logo and Corporation name will also be shown on the packages <u>without prominence.</u>

4. <u>Colours</u>

The colours of the Corporation are white and blue. Yellow and red are also used. For standardized milk, premium milk and flavoured milk packages will be distinguished by different colour combinations that must be clearly identifiable. It is the duty of the designer to choose the most attractive colour combinations compatible with packaging for dairy products.

5. <u>Products Profile</u>

(i) <u>Standardized Pasteurized Milk and Premium Pasteurized Milk</u>

- Presently packaged simply as pasteurized milk in co-laminate polythene film sachets 1 litre, 0.5 litre and 0.25 litre. The sachets have inner black with outer white base overprinted with multiple colours (present sample provided). Basic packaging materials will be maintained.

- Polythene film packaging and inner black colour to be maintained. Overprinting of colours to change as well as the writing on the package.

- Colour combinations for the two products to be distinct and attractive preferably with one dominating colour base in each case.

- A small strip to be left at the bottom for date printing.

- Instructions on usage on the back cover of the sachets to remain the same.

- Brand name, product name, logo and Dairy Corporation general address to be included.

(ii) Flavoured Milk

As with (i) above, except the small strip left will be used for date printing and identification of different flavours.

(iii) Dairy Products

Qualitative changes to be made to improve the existing designs. The present packaging materials to be maintained along with the sizes.

6. Samples

Tenderer should provide a profile of capability to undertake the job. This must be accompanied by samples of similar work executed in recent years.

Attachmnet #5

Correspondence

BEST AVAILABLE COPY

UGANDA NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY

TELEPHONES: ~~530002 & 530004~~ 250431
EXECUTIVE SECRETARY'S DIRECT LINE: 530003
TELEX NO..... TELEFAX NO.....

76 BUGANDA ROAD,
P.O. BOX 6884,
KAMPALA, UGANDA.

Your Ref: .....

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DATE 27th Aug. 1993

Our Ref: .....

Dear Sir,

We met at the conducted workshop for Food Products Packaging. I would like to take this opportunity in thanking you for the information you availed to this country. We shall put it to good use and perhaps this letter is the beginning in this direction.

I talked to you about packing water from some areas in Uganda. I have been thinking about the whole project and some ideas have started crystallising

1. You informed me that packing machinery may cost ≈ $ 1,500. There will be need for boiling and filtering equipment. ~~We~~ Shall also need some kind of chilling equipment - say a freezer.

2. There should be a delivery kind of system - and one can purchase a reasonable pick-up here at around $ 3000.

3. One thing perhaps which is most attractive is fresh orange & passion fruit juice. A 300 ml juice does not take more than 130/= to produce and yet a bottle of soda (300ml) costs 500/=. The reason why people here do not take this juice is because they are not sure wether water is sterlised. So long as the public is aware that water is purified, they will take it in preference to soda.

4. If the container is like the one you gave to the lady who manufactures jam, then it will be an added advantage as many customers will keep this

130

to sell such containers for domestic use here in Uganda
So I have extensive contacts here and I am sure marketing would not be a problem.

It is possible, after the initial stage of marketing in Kampala to go to export. This is the time one would bottle the water from the mountains.

I am therefore kindly requesting to be avail the contact for the packing machine supplier and manufacturer of those clear kind of glass containers (I think they are of polystrew material). Packing would be in 300ml and 500

Lastly, I am looking for a buisiness partne from that side of the world, I will be able to raise some modest capital, and with our banks. I see this as a viable proje

Hope to hear from you,
yours faithfull,

MOZ NDIQUE

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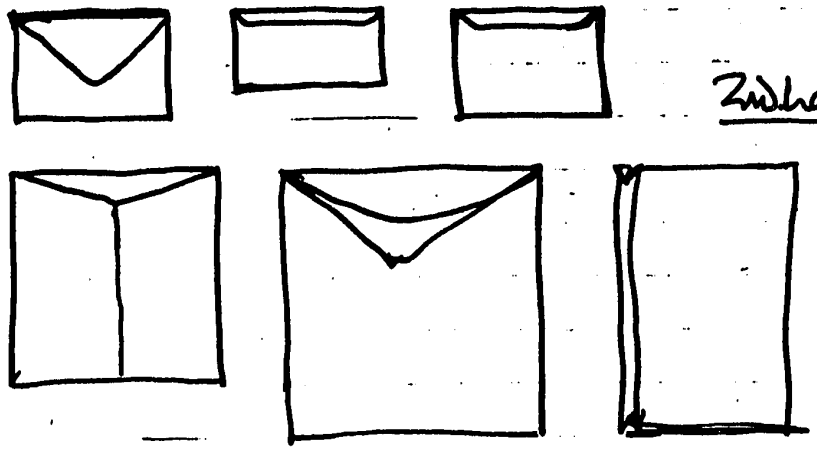
1. Envelope machine



2nd hand Machine

Envelopes
traditional/
Standard sizes

2. Labels – traditional labels e.g. beer bottle labels
– pressure sensitive labels

3. Bags – paper bags (block bottom & flat bottom

to make bags out of kraft paper.
Varying from sizes 250gm – 10 kg content.

Complete details – drawings or catalogues
Manufacturer, year of mfr.
Capacity
Power requirements
Prices
Price landed in Uganda
Any inspection certificates, guarantees?
etc etc.

CONSTANTINE MUKE OYO

~~DAN~~

MARKETING MANAGER

DAIRY CORPORATION

P.O. BOX 7078

KAMPALA

UGANDA

EST AVAILABLE COPY

[redacted]

Dear Mr. Lindemann,

I am writing to requ
to give me information of which persons/
organizations I should write to in order
to get a guideline to my investment
plan.

I was one of the participants to a
packaging workshop organized by the
Uganda Manufacturing Association. During
one of your talks you mentioned that
the investment plan is very important
and then funds obtained could be
put to good use or could be obtained
subsequently. You also mentioned that
in your country there is an organization
that gives guidelines in planning by
answering their questions set.
If you could please link me to such
people I would be able to write my
investment plan in order to get funds
for a packaging project I intend to
initiate in my country and also to
obtain an investment licence.

Please advise my also on a packaging
Machinery Company from which I should
buy such machinery

Yours faithfully

Dennis Mniro

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KAMPALA JELLITONE SUPPLIERS LTD.
(Coffee Roasters & Packers)
Plot No.259 SIR ALBERT COOK RD-NATETE
P.O. BOX 30430 - KAMPALA - UGANDA
TEL.OFFICE 241475 FACTORY 270887

16th September, 1993.

LAND O' LAKES, INC.
FAX 612 -481- 2002
MINNEAPOLIS
U.S.A.

DEAR MR. DON LINDEMANN,

LET ME TAKE THIS OPPORTUNITY FIRST OF ALL TO EXTEND MY OWN AND MY OWN AND MY COMPANY'S GRATITUDES FOR YOUR VALUABLE TIME YOU SPARED WHEN YOU VISITED OUR FACTORY ON SUCH A SHORT NOTICE INVITATION. IT WAS REALLY SO A NICE TIME FOR US TO RECEIVE SUCH AN IMPORTANT VISITOR LIKE YOU AT THAT HOUR. THE INTEREST YOU SHOWED AND THE ADMIRATION YOU PAID TO OUR LOCALLY FABRICATED MACHINES CREATED YET ANOTHER PRIDE IN OUR WORK. WE COULD NOT BELIEVE YOU WOULD ACCEPT OUR COFFEE AND WE NOW LOOK FORWARD TO HAVE ALL THE COMMENTS ABOUT IT. I HAVE TO COMMENT THAT MOST OF US WHO ARE ENGAGED IN PACKAGING INDUSTRY BENEFITED A LOT FROM YOUR WORKSHOP AS FAR AS MODERN PACKAGING IS CONCERNED AND MAY BE THAT IS WHY I HAD TO LOOK FOR PROPER PACKAGING MATERIALS FOR OUR COFFEE POWDER, THE LAMINATES. NOW THE TASK REMAINS WITH THE PRODUCT ITSELF, THE COFFEE. WE HOPE THAT TO HAVE MATCHING WITH YOUR RECOMMENDED PACKAGING MATERIALS WE IN FACT NEED A GOOD AND EFFICIENT COFFEE ROASTER. BUT AS OF NOW WE ASSURE YOU THAT WE CAN ONLY GO IN FOR A SECOND HAND OR USED ROASTER. AGAIN WE WOULD REQUEST YOU TO GET US CONTACTS FOR FELLOW COFFEE ROASTERS IN THE UNITED STATES.

HOPING TO HEAR FROM YOU SOON.

I REMAIN ONE OF YOUR UGANDAN FRIENDS.

A.K. MUSISI

BEST AVAILABLE COPY

Bankers:- Standard Chartered Bank Uganda Ltd

KAMPALA JELLITONE SUPPLIERS LTD.
(Coffee Roasters & Packers)
Plot No.259 SIR ALBERT COOK RD-NATETE
P.O. BOX 30430 - KAMPALA - UGANDA
TEL.OFFICE 241475 FACTORY 270887
FAX 00256-41-251475

11TH NOV. 1993.

Dear Mr Lindemann,

I am glad once again to have to write to you again since you left Uganda. I hope you arrived safely home and I think you must have received my fax soon after my return from India when we met at Adis-Ababa Airport-Ethiopia.

Well I am glad to report to you and to express my sincere gratitudes for that wonderful workshop you organised for us concerning Packaging. In fact we have just completed an International Trade Fair in Kampala where we exibited our Coffee product properly packed in laminates as per your friendly advice to us when you visited our Factory. This new packaging attracted a lot of customers for us and we now expect many more customers. But as I had earlier on indicated to you and as you saw our locally fabricated Coffee Roasters we still have fear our ground Coffee may not be as good as reflected by the new packaging. So this is again to request you to do anything possible get me in contact with anybody, any Company which may be willing get me a SECOND HAND COFFEE ROASTER at reasonable price as compared the size of our Company. It should be with a capacity of from 30-60Kgs, of any kind of heating but preferbly electric heating. I would also like to get in contact with my fellow Coffee Roasters in the U.S.A. But most important of all I need more training in this Coffee Roasting Industry. So assistance in this regard is most welcome.

Best regards.

BEST AVAILABLE COPY

ASI KAZIBWE MUSISI

Bankers:- Standard Chartered Bank Uganda Ltd

MAKERERE UNIVERSITY
P.O. Box 7062 Kampala Uganda
Phone: 42471/56861
DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY

Your Ref: .....

Our Ref: .....

8th September, 1993.

Dear Donald,

It was a pleasure having interacted with you and sharing your experience and knowledge on packaging. Let me hope you had a good journey back home.

Before you left I tried to get in contact with you at Fair Way Hotel all the time you were out. The issue I wanted to discuss with you is the School of Packaging you expressed interest in setting up. We in the Department are trying to grow into an Institute so that we can offer not only Degrees but also Diplomas and certificates. This means that we are going to have affliated institutions to offer the Diploma and Certificate Courses of Makerere University.

In such an arrangement, we could work out the possibility of including the Packaging School in the Institute. This could enhance our policy of working with and reaching out to industries and producing qualified personnel more suitable for the industries.

If the idea is good, you can give me a go ahead so that I can discuss it with higher authorities and get you in contact with the Dean and the President of the University.

Starting with this month I will be Ag. Head of the Department and I will be able to push it through personally.

Lastly the photos are enclosed.

Yours sincerely,

Kyamuhangire

William Kyamuhangire.

1993-08-27.

Hallo Don,

I had called to see you about the plastic containers I told you about. I will call again tomorrow between 8.30 and 9am. However, if you won't be around do not worry I will come again next week.

Eve Kasinye Mlemu,
Bureau of Standards

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Attachment #6

High Technology Training Module

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High-Technology Training Module

Module Title: ELECTROMECHANICAL COMPONENTRY

Unit: UNITS I - X

Course: PACKAGING SYSTEM EQUIPMENT CONTROL

Grade Level (s): 2 YEAR VOCATIONAL PROGRAM (2nd Semester)

Developed by: DON LINDEMANN

Date: NOVEMBER 20, 1990

School: WISCONSIN INDIANHEAD TECHNICAL COLLEGE (WITC)

NEW RICHMOND, WI 54017

Developed as a part of the High-Technology Training Model for Rural Based Business and Industry, Technical Colleges and Local and State Educational Agencies under Grant No. V199A90151.

Title: Electro-Mechanical Componentry

School: Wisconsin Indianhead Technical College (WITC)
New Richmond, WI.

Grade Levels:

This module represents the content of a three credit course or 16 weeks of instruction in a regular semester. It is presented in the second semester of a 2 Year Vocational program offering an Automated Packaging Systems Diploma.

Developed by: Don Lindemann

Description:

This module is intended to make simple, the relatively complex functions of numerous electro-mechanical devices that are essential as a pre-requisite for understanding input/output devices for PLC applications. Students learn the function of each component through classroom lecture and laboratory settings. The module is part 1 of 3 intended to prepare the student for a thorough understanding of motion control/circuit control via PLC applications in Automated Machinery Systems.

This module is intended for use in any electro-mechanical componentry course. It is presently used as part of the electro-mechanical componentry course in an Automated Packaging Systems vocational diploma program at WITC.

The program is fortunate to have industry support in the form of over 5 million dollars in full scale packaging machinery including case packers, liquid fillers, powder fillers, cartoning lines, conveyors, shrink tunnels, wrappers, bundlers, coupon placers, check weighers, hot melt glue applicators, and many more too numerous to mention. Equipment is housed in an 8000 square foot shop set-up as a simulated production environment. Although it may not be necessary to have such equipment to teach an electro-mechanical course, it serves to bridge the theoretical training to the practical (hands-on) training for most students.

Students prepare for positions in maintenance, installation and building of Automated Packaging Machinery. Some students become technical representatives for their companies, traveling to the customers job site to solve technical problems with machinery.

Pre-requisite:

A basic understanding of the principles of electricity is essential. Completion of a 3 Credit Introduction to an AC/DC Circuits course or equivalent in a typical vocational school setting would be adequate.

Module Layout:

This module consists of several units of instruction outlined herein. The total module objectives, module outline, module teaching methodology, and evaluation methodology are discussed in the "Module Overview" Section. Each unit listed in the module outline is detailed with a resource requirement section, unit objective section, content summary section, and a tools of evaluation section.

MODULE OVERVIEW

Objectives

Upon successful completion of this module the student in accordance with the grading procedure will be able to:

1. Identify all the basic components outlined.

2. Explain the function of each component.

3. Identify each component in a schematic circuit utilizing ladder logic principles and in wiring diagrams.

4. Identify each component in an actual circuit as it relates to a ladder logic diagram.

5. Define the component relationships to each other in a system.

6. Create a working model of a circuit by physically hard wiring components identified and demonstrating a desired outcome for a given circuit drawing.

7. Articulate the relationship of a variety of electro-mechanical components as they might be used with a PLC application or how their functions might be replaced with a PLC application.

Module Methodology and Activities

1. This semester long module is made up of 10 sequential units.

2. Students participate in a balance of lecture and lab activities.

3. As each component is introduced during a lecture, the appropriate symbol is shown in a circuit diagram using the chalkboard, overheads, examples in books, or handouts, whichever is most appropriate for a given situation. The circuit diagrams continuously evolve to become more complex as each component is added, like building blocks, throughout the module.

4. With the introduction of each component,

   a. actual examples are examined by each of the students, and its purpose and applications discussed.

   b. students observe the actual component operation on numerous fully operational automated packaging lines in simulated production environments.

   c. students observe each component in existent circuits discussed, noting the components position, the wiring, and the ordering of components in relationship to other components in the circuit.

   d. students analyze actual circuit based on the circuit being described in ladder logic diagrams, electrical schematics and in wiring diagrams. Students are required to follow the wiring through on actual circuits to gain an understanding of the relationship between logic diagrams and physical circuits.

5. When enough components have been introduced and the student has developed and demonstrated the requisite knowledge base

   a. they are teamed up in groups of two or three to develop operational circuits on a training board based on the schematic(s) provided.

   b. students select components, hard wire them, and achieving the desired outcome according to a given circuit diagram.

6. Students are given reading and homework assignments from each class period associated with the material discussed.

7. Classroom discussions are distinguished from lectures in that it is a time for dynamic interaction between the student and with the teacher.

Content Outline:

Unit

I. A review of the principles of electricity and an introduction to electro-mechanical componentry.

II. Fuses and circuit breakers.

III. Control Transformers

IV. Switches

- A. Overview Discussions
- B. Oil Tight Units
- C. Limit Switches
- D. Proximity Switches
- E. Vane Switches
- F. Pressure Switches & Transducers
- G. Temperature Switches (thermostats) & Heaters
- H. Mercury Switches
- I. Transistor Switches

V. Circuit Application of switches utilizing actuators. (LAB EVALUATION)

VI. Relays and Solenoids

VII. Timers

VIII. PMMI Controls

IX. Photo-electric sensing units

X. Motors

8. It is essential to have all the electro-mechanical components to be discussed, on hand in quantities of no less than six each for each student.

9. It should be expected that students will occasionally burn up or smoke, a transformer or other components, inadvertently through improper or faulty wiring on the part of the students, as they learn how to wire them correctly.

10. The use of operational machinery demonstrating the wiring position and function of each component is recommended for maximum learning.

11. When solid state components are introduced a digital logic lab with a variety of CMOS chips with all the basic gates, switches, bread-boards, DC power supply and wiring is required.

Resources

Several books were researched for the High-Tech Project. It is the opinion of this author that the following book is among the best available and is used for the Electro-Mechanical course at WITC.

Rexford, Kenneth B. Electrical Control for Machines 3rd Edition, Delmar Publishing ISBN 0-8273-2792-7

For basic supplementary material:

Davis, C. Glenn, Packaging/Converting Machinery Components Vol. 1 PMMI 2000 K. Street N.W., Washington, DC 20006

Davis, C. Glenn, Basic Electrical Components Vol. 3 PMMI 2000K. Street N.W., Washington, DC 20006

Evaluation

1. Students ultimately are evaluated on the basis of the success at which they are able to create a circuit according to a given schematic.

2. Students are orally examined upon completion of their actual circuits and circuit diagrams to determine their level of understanding. They are required to explain the operation and application of each component in the system as it becomes activated and explain what the expected results would be when the system is reconfigured.

3. A variety of quizzes and tests are used in conjunction with each instructional unit as well as at the end of each unit. Oral, written, and operational evaluations are designed to determine the students overall level of understanding of the application and function of each component and the various circuit designs.

Unit 1

Introduction to Electrical Control of Circuits

Content Summary

A. Basic steps in the development of circuits.

1. Know what work or function is to be performed.

   Examples: Lighting a lamp. Students are given a demonstration of a simple circuit in operation.

2. Know the operating conditions under which the starting, stopping and controlling of the process is to take place.

   Example: Position, Time, Temperature, Pressure

3. Begin the process of selecting dividing and/or isolating the circuit as required.

   Example: A circuit may be required to operate a machine under manual, semi-automatic, (single cycle) or fully- automatic (continuous cycle) operation.

B. Problems to overcome to understand electrical control circuit diagrams.

   1. Starting with a circuit too large or too complicated.

   2. Failing to carry a mental picture through into the electrical circuit.

   3. Failure to relate physical action to the job required into electrical signals through the components which in turn do the job.

   4. Failure to understand that an electrical circuit must perform those actions which must perform the correct functions while not performing those actions which are dangerous to the operator,, or that will result in damaged components or faulty product.

Evaluation Students take quiz.

1. What are the three basic steps necessary to understand electrical control circuits?

2. List some of the problems students have which hinder their progress in understanding electrical control circuits.

Unit II

Fuses and Circuit Breakers.

Content Summary

A. Objectives: The student will be able to:

1. Describe basic fuse construction.
2. List different fuse types and applications.
3. Identify four types of circuit breakers and their uses.
4. Explain the use of time delay fuses in certain circuits.
5. List voltage and current ratings for given fuses and circuit breakers.
6. Draw the symbols for protective devices.

B. Methodology

1. Discussion on how circuits are protected by fuses and circuit breakers.
2. Discussion on the construction and operation of fuses.
3. Discussion on the various fuse types and applications including:

a. One time fuses
b. Current limiting fuses
c. Time delay fuses
d. Considerations of voltage ratings, current ratings, and interruption capacities

4. Discussion on circuit breaker types and appropriate selection.

a. Non-automatic
b. Thermal and Thermal Magnetic
c. Magnetic

Evaluation of Unit Two

See Attached Test

Electro-Mechanical Componentry
Unit II Test
Fuses and Circuit Breakers

Name_____

1. Draw the symbol for each of the following:

   a) Single fuse element

   b) Three-pole fused disconnect switch, ganged w/handle

   c) Three-pole circuit interrupter, ganged w/handle

   d) Three-pole thermal magnetic circuit breaker, ganged w/handle.

2. Explain the inverse time-current relationship function in a delay fuse.

3. In the time-current data chart below a curve has been drawn for a 100 ampere delay fuse. How long will it take for the fused to blow when:

   a) 1000 amperes of current are being drawn?

   b) 300 amperes of current are being drawn?

   c) 100 amperes of current are being drawn?

4. If you have to create a circuit requiring a circuit breaker and you are particularly concerned about <u>overload protection</u> will you select a

   a) thermal circuit breaker,
   b) a magnetic circuit breaker,
   c) a non automatic (circuit interrupter type) circuit breaker.

5. List at least five important factors to consider when selecting a protective device.

6. Draw a complete circuit showing a 480 3-phase 60 hz power source fused to protect the transformer wired in series with followed by another overload protector between the transformer and a selector switch wired in parallel with a maintained contact push button switch to a green pilot light. At what power will the main leads L1 & L2 be.

Unit III

Control Transformers

Content Summary

A. Objectives: The student will be able to:

1. Explain why industry practice has been to control machine systems with 120 volts.

2. Explain how transformers are able to obtain 120 volts from a higher line voltage.

3. Clarify the term turns ratio and regulation in a transformer.

4. Draw the symbols for a variety of transformer configurations including : A dual primary, single secondary control transformer in line with a higher voltage input and a 120 volt control circuit.

5. Explain the causes of temperature rises in transformers.

6. Calculate the size of a transformer for a given load.

B. Methodology

1. Discussion on what transformers are, how they work, the various types, and how they are selected for a given requirement.

2. Students observe actual transformers in circuits and see the correct wiring for parallel and series applications.

3. Students are shown the symbol for transformers on schematics and learn to trace the wiring on live circuits measuring the voltage changes in the circuit across the transformer.

C. Homework Assignment (Example) taken from Rexford's book Electrical Control for Machines is included below. Students use their books and any other resources to find answers to the problems.

1. What type of electrical energy is normally used to supply industry?
2. What are two important reasons for using 120V in machine control systems?

3. There is 480V AC available in a given plant. To obtain 120V what turns ratio is required between the primary and the secondary of the control transformer?

4. You find that under unusually heavy loads, the voltage in your plant drops to 456 V. What will the resulting secondary voltage be if a transformer with a 4:1 primary to secondary turns ratio is used.

5. Draw the symbol for a dual-primary, single secondary control transformer. Show all lead designations.

6. What parts in a transformer generally contribute to temperature rise?

7. What may happen to components that are energized in a control system if, due to poor transformer regulation, the voltage drops to an unusually low level?

8. Draw a complete circuit showing the primary of a dual primary control connected to a three phase, 480V power line, and the single secondary connected to a 120V control system.

9. In a given transformer the voltage is reduced from the primary to the secondary. This transformer is called a
   a. current transformer b. step-up transformer
   c. step-down transformer

D. Critical Thinking Option

1. On a given job, you have calculated the total inrush current of all coils energized at any one time is 42 amperes. The calculated continuous or sealed current of all coils at the same time is 8 amperes. Using the first method discussed in class and explained in the text, determine the size of transformer you should use. The control voltage is 120. Commercially available transformers are 750, 1000, 1500, and 2000 VA.

Electro-Mechanical Componentry
Unit III Test
Control Transformers

Name:_____

1. What are transformers used for?

2. You have been asked to wire a wrapper requiring a 220 volt, 3 phase power supply. The wrapper also has a number of relays and control circuits requiring a 110 volt single phase power supply.

   Draw a schematic showing a transformer application for the above scenario. Be as specific as possible.

3. List two applications for a variable transformer.

4. What test procedure might be applied to determine whether or not a transformer is defective?

5. How will a transformer perform with DC voltage applied?

6. In a theoretical situation whereby the primary winding in a step down transformer has 500 turns and the secondary has 100 turns, what is the turns ratio?

7. If voltage is increased or decreased in a transformer, what happens to the current? Be specific.

8. What is an isolation transformer and in what application are they used?

9. How is a transformers efficiency determined?

10. When replacing a transformer what are the foremost rules to keep in mind?

Unit IV

Switches

Content Summary

A. Overview discussions

1. Oil Tight Units

a. Push-button switches

b. Selector switches

c. Multi-pole switches

d. Foot switches

e. Indicator lights

f. Drum switches

2. Limit switches

3. Proximity switches

4. Vane switches

5. Pressure switches and transducers

6. Temperature switches & heaters

7. Mercury switches

8. Solid state timer switches

9. Transistor switches

B. Objectives: The student will be able to:

1. Push-button switches

a. Describe methods of mounting push-button switches.

b. Identify operatorr nd explain different operators color codes.

c. Draw the various ·,mbols.

2. List several arrangements available for selectors.

3. Draw the symbols for foot switches, selector switches, limit switches including proximity switches in four different configurations, pressure switches, vane switches, time delay/relay switches, Timer reset-time-our configurations.

4. Discuss the purpose of push-to-test pilot lights.

5. Discuss the difference between selector switches and drum switches.

6. Draw simple basic circuits combining the knowledge of various components introduced to date.

7. Demonstrate a working knowledge regarding normally open and normally closed switches and combinations thereof on actual circuit development.

8. Describe the differences in the three basic limit switches and their functions.

9. Explain and identify circuits where the application of rotating cam limit switches is appropriate.

10. Define terms associated with various limit switches to include: operating force, release force, pre-travel or trip travel, over travel, differential travel.

11. Describe how proximity limit switches operate.

12. Describe applications for proximity switching and how it might be achieved.

13. Explain the operation of vane switches.

14. Identify applications where the use of mercury switches are warranted.

15. In a laboratory setting, apply the knowledge of transistors associated with the basic digital logic gates of OR, AND, NAND, NOR to create simple circuits with 5 volts to light diodes when the circuits are correctly wired.

C. Methodology

1. Lecture

a. Oil tight units. The concepts of normally open normally closed contact blocks are first introduced.

b. Review base mounting and panel mounting. Discuss the various operators to including recessed type buttons, mushroom heads, illuminated pull buttons and key lock types.

c. Color designations and safety.
Red - Stop or E-Stop
Yellow - Return
Black - Start motors etc.

d. Discuss the various positions available in selector switches are discussed along with the appropriate schematic representation. The concepts of multi-poled, double throw configurations are introduced.

e. Foot switches are discussed and shown in operation.

f. Indicator lights along with their color designations are reviewed.

Example:	Red	= Danger, Abnormal condition
	Amber	= Attention
	Green	= All Clear - Safe condition
	White or Clear	= Normal condition

g. Drum Switches also know as rotary pilot or transfer switches are introduced along with the appropriate schematic representation.

2. Students are given lab time to locate examples of each switch discussed to this point and allowed the opportunity to dismantle them, discuss their function on a machinery application. Watch them in action on virtually all packaging machinery and generally discuss any questions they might have about them.

3. Limit Switches are introduced with a discussion on their industrial applications. Mechanical type limit switches are reviewed noting the differences in linear motion and rotary motion switches.

4. Factors for selecting limit switches are discussed which include contact arrangement, current rating of the contacts, slow or snap action, isolated or common connections, spring returned or maintained, and the number of NO and NC contacts required.

5. An understanding of the various operators available and their applications are discussed including the definitions of the terms operating force, release force, pre-travel or trip-travel, over-travel, differential travel and total travel are required.

6. Students are given lab time to build on their limit switch understanding. They examine case packers, cartoners, bottle fillers all utilizing limit switches.

7. Proximity Switches are introduced with a lecture on magnetic fields, the hall effect and radio frequency fields capacitive fields, acoustic fields and light waves, all as methods to achieve proximity switching.

8. Students are given lab time to examine proximity switches.

9. Vane Switches are introduced and example of applications are reviewed.

10. Pressure switches and transducers are introduced with an opening lecture on the importance of pressure indication and control. The types of pressure switches which include the sealed piston, the bourdon tube, diaphragm, and the solid state variations are reviewed with example of each for examination. Electrical symbols for these shown along with circuits including each type in various applications.

11. Temperature switches (Thermostats) are introduced with a lecture on temperature control in film sealing applications on wrappers and baggers, heat shrink tunnel applications, and hotmelt glue applications.

12. Pyrometers, thermocouplers, bimetallic strips, potentiometric controllers, and liquid filled temperature controllers are reviewed. The concepts of ON/OFF and proportioning are introduced as a means of temperature control along with a discussion on the appropriate selection of heater elements necessary to achieve a desired outcome as a means of temperature control.

13. Heaters are covered at this time because they are so closely tied in with temperature controllers and there function needs to be understood to be clear on the thermostat function.

14. Mercury switches are introduced with a discussion on specific machinery applications where explosions are possible. Students observe mercury switches and the fact that they are enclosed within a glass casing containing sparks.

15. Solid State, Transistor or Microswitches are introduced with a primer on binary numbering systems, the basic gates including AND, NOR, OR & NAND with further discussion on exclusive ORs and exclusive Nors.

16. Applications are discussed including PLCs where timers, flip-flops, adders, counters and other functions are electronically performed to achieve a desired movement control on machinery.

17. A lab is conducted whereby the student builds a DC powered circuit implementing the basic gates to achieve a desired output. See lab attached.

D. <u>Evaluation</u>

See Attached Tests

Electro-Mechanical Componentry
Unit IV Test
Switches

Name_____

1. Describe how one might base mount a push-button switch.

2. Describe how a selector switch might be panel mounted.

3. The low voltage in a pilot light is preferred because it

   a. Requires less voltage
   b. Is much smaller in size than convention lights
   c. Will withstand operating vibration
   d. Will not consume as much electricity

4. Draw the symbol for an extended head push-button switch (one contact block-two contacts; one normally opened, one normally closed.

5. Draw the symbol for a selector switch (one contact block-two contacts; one normally opened, one normally closed.

6. Draw the symbol for a foot operated switch that is normally closed and opens with foot pressure.

7. List three operators for switches.

8. List three examples of color coded operators and what the color coding indicates.

9. What colors are lens for pilot lights available?

10. Draw the symbol for a green push-to-test pilot light.

11. What are the various arrangements that can be achieved with different types of drum switches? How are they different from selector switches?

12. Describe briefly the operation of a vane switch.

13. Draw the symbol for a three position, four contact selector switch. Contacts 1 and 3 are open in position 1, all are open in position 2 and contacts 2 and four are open in position 3.

14. Draw a circuit showing a three position selector switch and a green-to-push test pilot light. The pilot light is to be energized when the selector switch is operated to position number 1.

15. Describe an application where the use of a mercury switch is warranted.

16. Some of the methods used to achieve the operation of proximity limit switches are:

    a. capacitive fields
    b. light rays
    c. low current imput
    d. magnetic fields

17. The speed of response for the proximity limit switch using the oscillator method in the output circuit is:

    a. the switch location
    b. the speed at which the object is being sensed.
    c. dependent upon the frequency of the oscillator

18. Draw the normally open and normally closed pressure switch symbols.

19. List four distinct types of pressure switches.

20. Why do Bourdon - tube type pressure switches sometimes require a dampening device?

21. Describe how switching is accomplished in a solid state pressure switch.

22. The differential pressure in a pressure transducer measured by:

    a. Applying a constant voltage to the bridge
    b. Calculating it, using data provided by the manufacturer
    c. estimating the change on rising pressure
    d. pressure gauges in line measuring the differential

Electro-Mechanical Componentry
Unit IV Test
Temperature Controllers and Heaters

Name:_____

1. What are the three basic types of temperature sensing devices?

2. Electronic heater controllers include on-off and proportioning type.

   A. The on-off is the simplest and oldest method of temperature control. Describe in some detail how it works.

   B. Time proportioning is presently the most common temperature controlling device. Describe in detail how it works.

3. If the band width in a 800 degree F temperature controller is set for 2% what is the band width in degrees?

4. Draw the symbols for a normally open and normally closed temperature switch contact.

5. In electric heaters _____ current is applied to _____ wires made of special materials. What is the most popular material discussed in class?

6. PMMI discussed four types of heaters. List each with a brief description below.

7. What is the most common cause of failure in electric heaters?

8. To check a heater suspected of being defective list the steps to check it using proper instrumentation.

Electro-Mechanical Componentry
Unit IV
Lab 1 - 2
Arithmetic Circuits - Adders

Objectives: To demonstrate and understand the operation and characteristics of the half-adder and the full-adder.

Materials: Half-adder - 7408 IC
7486 IC
Full-adder - 7400 IC
7486 IC

Discussion: A half-adder is a circuit that accepts 2 binary bits as inputs and produces their sum and carry as outputs. A full-adder is a circuit that accepts 2 binary bits and a carry-in as inputs and produces their sum and carry as outputs.

PROCEDURE 1: Using the 7408 and the 7486 chips construct the circuit in Fig. 6-1. Inputs A and B will come rom data switches and the sum output and carry output can be connected to LEDs. Prove the truth Table I for the half-adder.

Using proper reference material, i.e. IC Master, find the proper pin configurations to use for all the following experiments.

TABLE I

Inputs		Outputs	
A	B	Sum	Carry
0	0		
0	1		
1	0		
1	1		

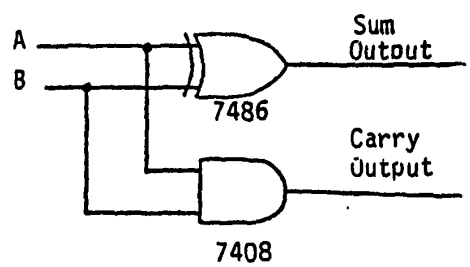


FIG. 6-1.

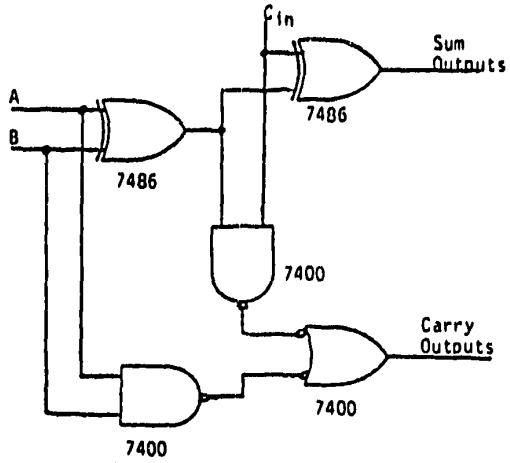
160

PROCEDURE 2: Using the chips 7400 and 7486 construct the circuit shown in Figure 6-2. Once again use data switches for the inputs Cin, A and B and LEDs for the outputs of Sum and Carry.

If for some strange reason these circuits shouldn't work properly, use your troubleshooting skills and find out why the circuit isn't functioning. You will <u>not</u> be allowed to say "This doesn't work!!!"

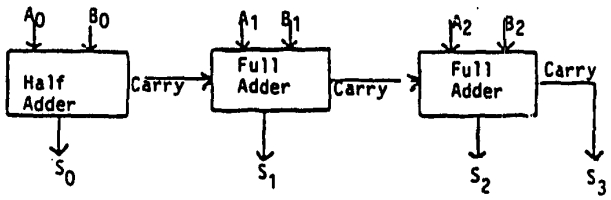
Table II

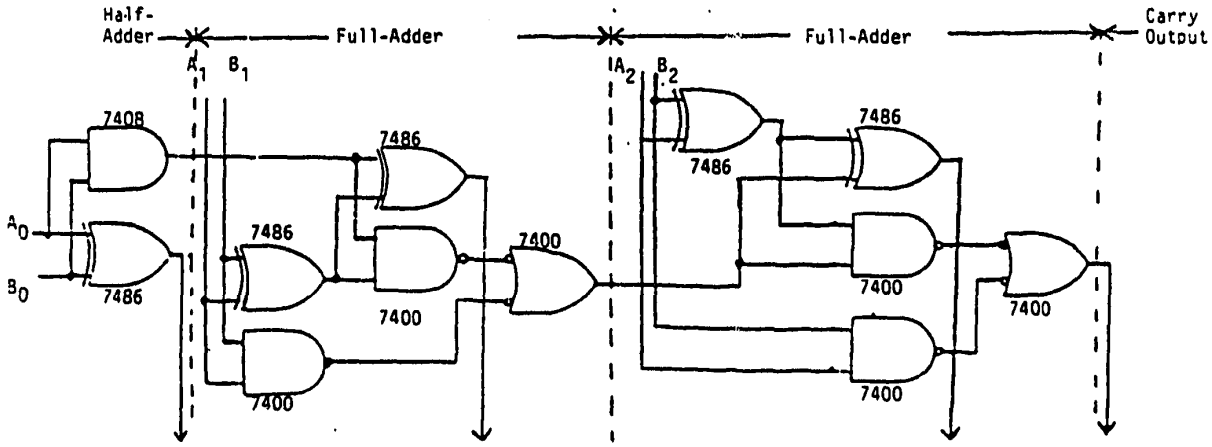
Inputs			Outputs	
Cin	A	B	Sum	Carry
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		



FULL-ADDER
FIG. 6-2

PROCEDURE 3: The following is an adder circuit for 3-bit numbers. It is composed of a half-adder and two full-adders. The MSB of the output is simply the carry of the second full-adder. You may want to experiment and attempt to hook up the following circuit. If you can't construct it, add 2 3-bit numbers using A0, A1, A2 and B0, B1, B2. Follow the logic through the circuit and see what the output will be. Adders for larger numbers can be built in this manner simply by adding another full-adder for each additional bit.





161

UNIT V

Circuit Application of Switches Utilizing Actuators

Content Summary

A. Objectives: The student will be able to:

1. Hard wire a control circuit according to a given schematic utilizing any or all the components detailed to date.

2. Troubleshoot a circuit using proper instrumentation to determine the cause of an unexpected output.

3. Reconfigure circuits to using different combinations of components to achieve the desired outputs.

B. Methodology

1. Students are teamed up into groups of two or three. Each group is given a different circuit problem with equal levels of complexity.

2. Students start with a 4 X 8 piece of 3/4 inch plywood paint it to a color of their choice.

3. A circuit is laid out on paper.

4. Each component is then mounted on the boards in any sensible configuration as long as the desired output is achieved.

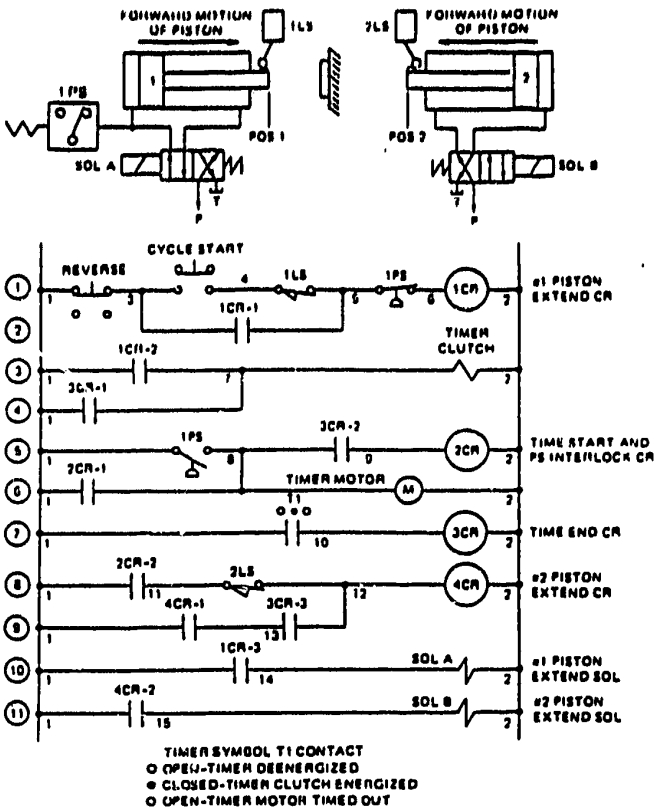
5. Students wire the components up learning the relationship between components, where the wires physically go, how to prepare them, the weight of wire to chose and all the many subtleties of wiring machinery that can only be learned by doing.

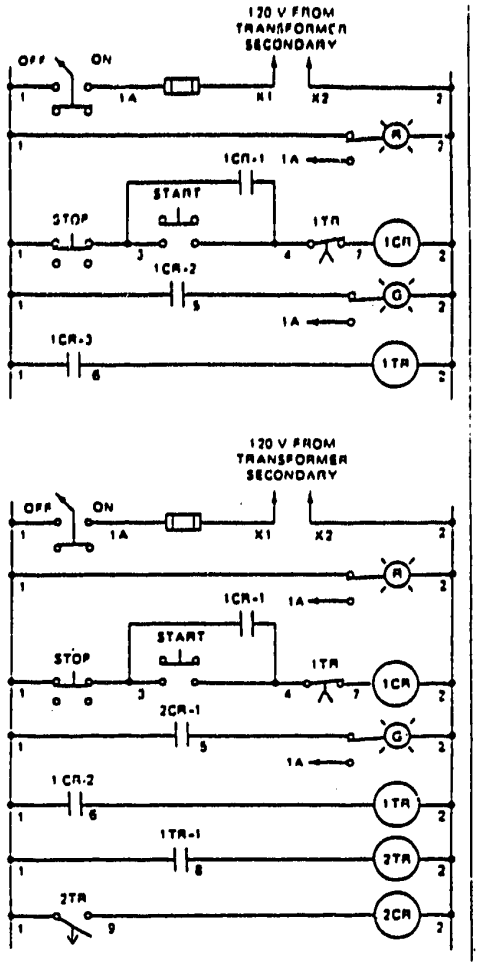
6. The students will work on their boards throughout the remainder of the semester, adding new relays solenoids and actuators as they progress through the remaining units receiving new circuitry instructions that expand the original design.

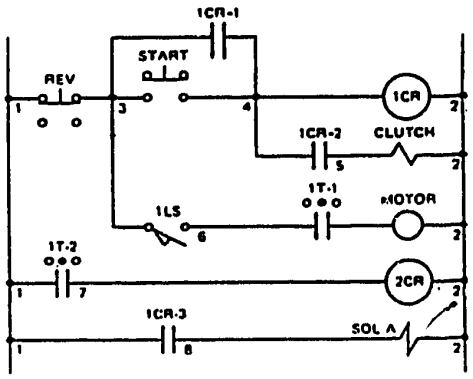
C. Evaluation

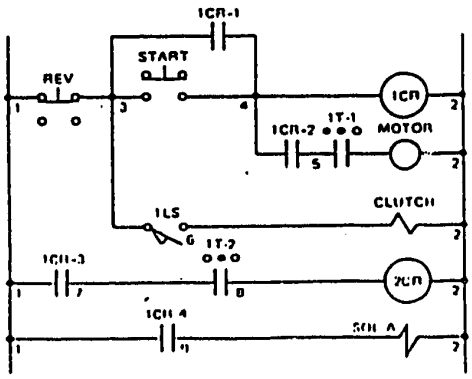
Students are evaluated by the success of achieving the desired output according to the schematics given to them. Students are also orally examined to determine the extent to which they understand the functions of each component in their systems. See attached photographs of completed boards.

Examples of Control Circuits used to build Boards









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UNIT VI

Relays and Solenoids

Content Summary

A. Objectives: The student will be able to:

1. Identify the main uses for control relays.
2. List three published ratings for relays.
3. Explain why silver is used in relays.
4. Discuss several phenomenon or factors associated with relay operation such as contact bounce, overlap contacts, contact wipe, and bifurcated contacts.
5. Draw and create an interlock circuit and explain why it is used.
6. Draw the symbols for relay coils, contacts, time delay and relay contacts.
7. Explain inrush current vs. holding current in a relay and sealed current vs. inrush current in a solenoid.
8. Describe a latching relay.
9. List uses for the contactor.
10. Explain the necessity for a plunger in a solenoid to complete its stroke.
11. Discuss the two most important problems to consider in the application of solenoids.
12. Apply the function of solenoids to operating valves.
13. Draw the symbol for a solenoid and a relay.
14. Draw a variety of circuits showing the energizing of solenoids by closing relay contacts using control relays, switches and a solenoid.

B. Methodology

1. Combination lecture and lab as outlined in the overview section.

2. Students handle, disassemble, observe the operation of and trouble shoot actual problems on full scale packaging lines. They also add relays and solenoid actuated valves to their circuit boards.

C. Evaluation

See Attached Quiz and Test

Electro-Mechanical Componentry
Unit VI Test
Relays and Solenoids

Name_____

1. What is the difference between inrush current and holding current in the coil of a control relay?

2. What are the three ratings generally published concerning control relay contacts?

3. Explain: How contact bounce can affect the operation of an electrical control circuit.

4. Show the use of a control relay contact in an interlock circuit. Use a control relay, two push button switches, and a red push-to-test pilot light.

5. What advantages can be obtained from the use of a time-delay relay as compared to a standard relay.

6. Identify the following time-delay relay contacts. Do they operate before or after the relay coil is energized? Indicate also whether each is normally open or normally closed.

A.

B.

C.

D.

7. Show the use of a time-delay relay contact in an interlock circuit. Use a control relay, two push button switches, and a green push-to-test pilot light. In this case, the green pilot light is to be energized two seconds after the relay coil is energized.

8. Describe how a latching relay operates. How is it different from a control relay? (applications, etc.)

9. Describe a contactor as fully as possible, including information on poles and the range of current carrying capacity and any additional information that distinguishes contactors from a regular control relay.

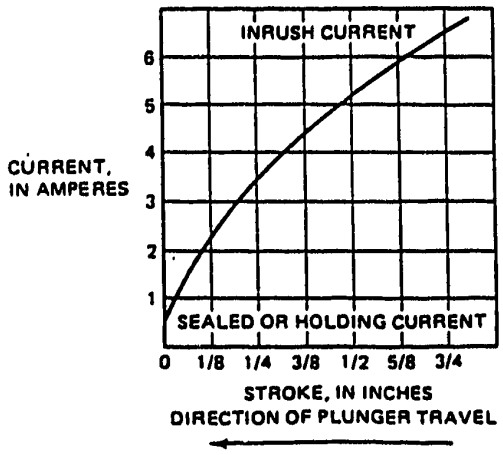
10. What is the major advantage of using plug-in relays?

11. What is the minimum standard determined by NEMA for relay manufacturers to maintain when designing a relay to not "drop out" when voltage falls to below what %?

12. If an electrically controlled, two way solenoid valve is leaking, what is the probable cause?

13. Why is silver used on some relay contacts?

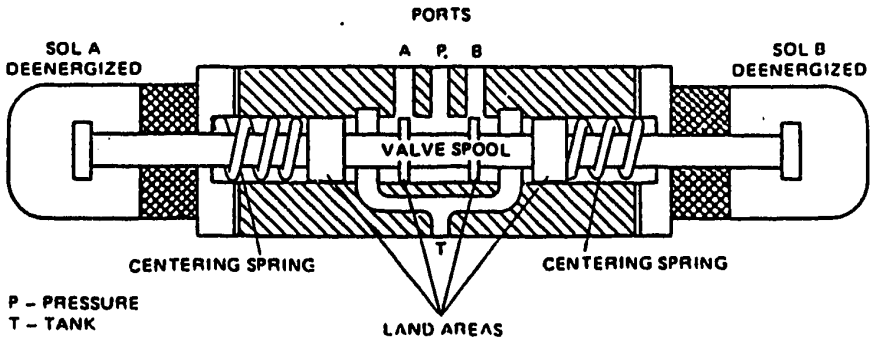
14. In the chart below a typical inrush to current ratio chart is shown. When the plunger is at the 1/4 inch position in its stroke, how much amperage will be required to maintain a sealed current?



15. Why must the pull of a solenoid exceed the load?

16. Draw a control circuit using two push button switches, a control relay, and a solenoid. The solenoid is to be energized when a normally open limit switch is operated. It will be de-energized when the moving part on a rotating cam completes its cycle.

17. The solenoid current in amperes with the plunger in the closed position is called_____.



167

18. In the double solenoid operating valve pictured below describe the direction of flow from point to point when the valve is in the :

a) neutral position as shown

b) when solenoid A is energized

c) when solenoid B is energized

Electro Mechanical Componentry
Unit VI Quiz
Relays

Name:_____

Match the relay type with the correct description. Some relays may have more than one right answer and will require all information to receive full credit.

1. Magnetic Overload Relay

2. Time Limit Overload Relays

3. Bimetallic Overload Relays

4. Instantaneous Trip Current Relays

5. Contactors

6. Thermostat Relays

7. Pneumatic Timers

8. Solid State Relays

9. Capacitor Time Limit Relay

10. Electronic Time Delay Relay

Describe as fully as possible using words and symbols the difference between Off-delay and On-delay relays.

UNIT VII

Timers

Content Summary

A. Objectives: The student will be able to:

1. Discuss the difference between a timer and a time delay relay.
2. Explain where and how timers are used.
3. List the different types of timers introduced in class.
4. Explain the concepts of reset, timing and timed out.
5. Draw simple control circuits showing various components being energized via the timer in a pre-set series or simultaneously.
6. Explain how multi-interval timers work.
7. Discuss the operation of the repeat-cycle timer.
8. Explain the operation of dash-pot and other pneumatic timers.

B. Methodology

1. Lecture on how and why timers are used to control the motion of packaging machinery with examples on the Doboy wrapper, Nordson Hot-melt equipment and Langen cartoner.
2. A discussion on the various types of timers is conducted with examples in hand.
3. The concept of timing with reset and timed out along with the electrical symbols for each is introduced.
4. Solid state timers are introduced along with pneumatic timers.
5. Circuits including timers are introduced and some students include timers in their control circuit boards.

C. Evaluation

See Attached Test

Electro-Mechanical Componentry
Unit VII Test
Timers

Name_____

1. List the three types of timers applied most frequently in the industrial field.

2. In the following symbol for a timer, what function does each position in the contact represent?

3. What controls the movement of the diaphragm in a pneumatic timer?

4. Of all the reset-type timers discussed in class, which is used most frequently with programmable controllers?

5. On a control circuit diagram(or board), what must occur in the circuit for the timer clutch to be energized. (Be specific)(Student must examine circuit diagram or circuit board and give oral or written explanation.)

   A. This delay type overload relay makes use of the oil dashpot principle whereby a plunger immersed in oil is slowed down when current energizes a coil and tries to pull the plunger in. Oil passes through bypass holes in the piston.

   B. This subject of the relay family is actually an electromagnetic switch operated by pilot devices such as limit switches or thermostat and is merely a safe and convenient way to connect or interrupt branch circuits.

   C. This relay does not have an inverse time characteristic built into it. It has a plunger in a coil that requires a certain level of current draw before it will trip. They are adjustable. It might be used on a conveyor to stop a motor when there is a jam or blockage to eliminate the possibility of breakage.

   D. This relay has a slowly moving element which makes a contact for both the closed and open positions of the relay and requires a thermostat control device.

   E. This overload relay operated by current intensity and not heat. It must also be connected in series directly with the motor except for very large motors when it is indirectly connected by transformers.

F. This relay has a potentiometer built into the relay to adjust the amount of resistance as a means to control the delay function. It is one of the relays that use the resistance-capacitance (RC) theory the current in this coil decay slowly depending on the rating of the relay.

G. This overload relay is activated by heat and may be one of the reset type in that they automatically reset when cooled down and contacts open.

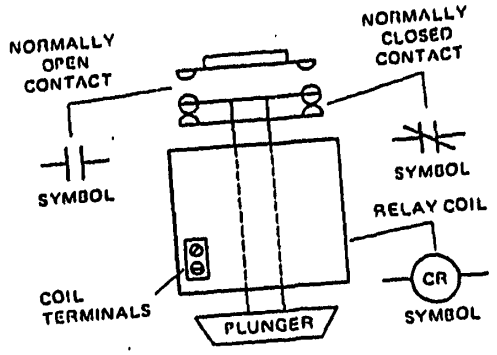
H. This relay typically has no moving parts and can be used to handle AC or DC current.

J. This relay has a feature known as zero switching which means that if it receives a signal in the middle of a cycle it will continue to act as a conductor until the voltage hits zero.

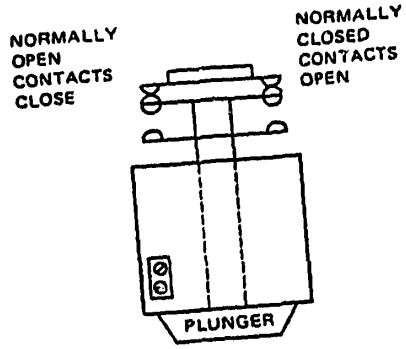
K. This relay operates by a rubber fellows or diaphragm and restricts the amount of fluid that passes through and orifice allowing the relay to function as a timer.

L. This relay uses a Quartz clock as the time base to function as a delay relay it uses a standard 8-pin socket. They are frequently used with programmable controllers.

A. Deenergized condition of relay; showing contact position



B. Energized condition of relay. With coil energized; magnetic force pulls the plunger up, operating the contacts



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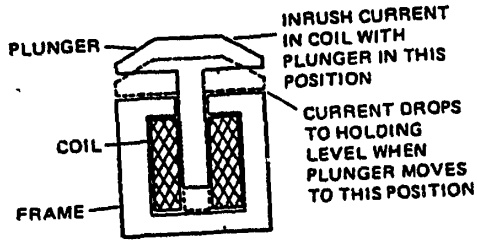


UNIT VIII

PMMI Controls

Content Summary

A. Objectives: The student will be able to:

1. Discuss the controls outlined by the PMMI (Packaging Machinery Manufacturer's Institute) and application to specific pieces of equipment.

B. Methodology

1. This unit is intended to tie the various components even more closely to specific applications on specific equipment according to the PMMI manuals recommended.

C. Evaluation

See Attached Test

UNIT VIII

PMMI Controls

Content Summary

A. Objectives: The student will be able to:

1. Discuss the controls outlined by the PMMI (Packaging Machinery Manufacturer's Institute) and application to specific pieces of equipment.

B. Methodology

1. This unit is intended to tie the various components even more closely to specific applications on specific equipment according to the PMMI manuals recommended.

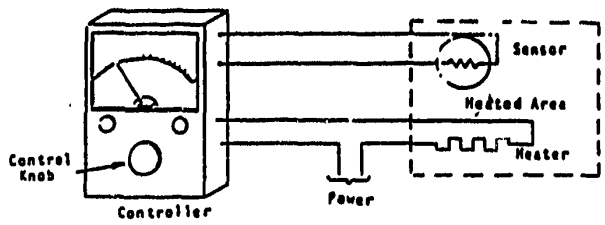
C. Evaluation

See Attached Test

Electro-Mechanical Componentry
Unit VIII Test
PMMI Control Systems

Name_____

1. In the diagram below showing a controller for a shrink tunnel, the actual temperature for the oven is shown on the meter which is scaled in degrees F. What is the meter actually measuring? (Be specific)



2. Describe the <u>construction</u>, the <u>operation</u> and <u>applications</u> of a bi-metallic temperature sensitive strips.

3. Briefly discuss the operation and application of pre-determined counters.

4. Describe a process using a weight controller in a filling line.

   A. How will it work?

   B. How might it control and intermittent motion of a conveyor?

   C. What other components are required to complete a control circuit?

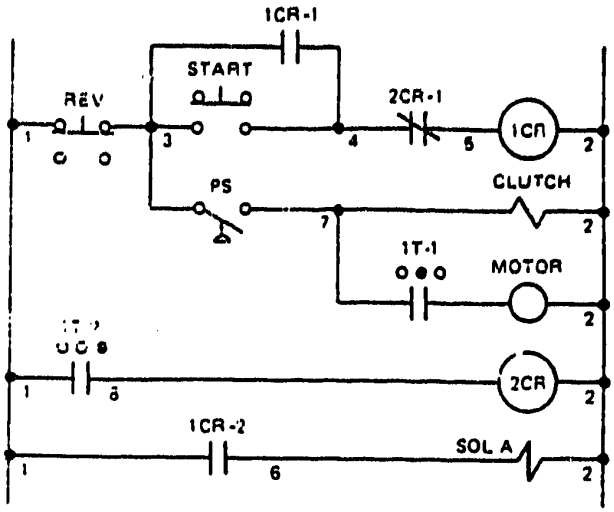
   D. How will it define and handle rejects?

5. Describe how <u>registration marks</u> can control motion on packaging machines.

6. What is the function of an alternator or sequence controller in a multiple line packaging operation?

7. Most control systems fail for two reasons as discussed in class. What are they?

8. In the control circuit shown below, what must occur in the circuit for the timer clutch to be energized. (Be specific)



177

UNIT IX

Photo-Electric Sensing Units

Content Summary

A. Objectives:

1. Discuss the principles by which photo-electric systems operate.

2. Identify several types of photo electric sensors.

3. Identify appropriate applications of photoelectric sensors as they might apply to a desired output.

4. Troubleshoot the malfunction of photoelectric sensors and/or the system in which it is set-up.

B. Methodology

1. A lecture on the operation of photocells, and the detection of lightwaves is followed by the component parts of the sensor and how it is used as an input signal which gets amplified to operate control devices such as solenoids on a given piece of machinery.

2. A discussion on the various types of photo-electric sensors is held in which on/off type, reflective type, time delay type, one shot and others are physically examined in the classroom followed by observing the sensors in operation detecting the registration marks on a web of film indicating that it is time to cut the web at the proper location.

3. Some students add photo-electric sensing units in their control circuit boards.

4. A discussion on troubleshooting a malfunctioning system is included whereby students measure the signal with an ohmmeter to determine the source of a given problem.

C. Evaluation

See Attached Test

Electro-Mechanical Componentry
Unit IX Test
Photo-Electric Sensors

Name:_____

1. List four types of photo-electric sensors.

2. What three characteristics of an object must be considered when selecting a scanning technique.

3. What is meant by:

   a. direct scan
   b. reflective scan
   c. retro-reflective scan

4. The signal produced by a photo-electric cell normally goes directly to the _____.

5. What is the purpose of an amplifier in a photo-electric sensor.

6. A time delay sensor set-up to detect jam-ups on a conveyor system:

   a. when the light beam is first broken
   b. when the angle of the deflection beam is first detected
   c. when the packages move faster than usual
   d. when the package moves slower than usual

7. Describe how the strength of a single in a photo-cell is usually measured.

8. Excess external light hitting a photo-cell will cause:

   a. the photo-cell to be more sensitive
   b. the photo-cell to not react when the beam is broken
   c. no noticeable effect on the photocell operation
   d. a stronger response from the photo-cell

9. Describe the following terms:

   polarized scan
   convergent beam scan
   fiber optic scan method
   specular scan
   diffused scan
   current sink output
   current source output

10. The resistance of a dark photo-cell should be_____ times _____ when the photo-cell is lighted.

UNIT X

MOTORS

Content Summary

A. Objectives: The student will be able to:

1. Identify the basic principles under which motors of all types operate.

2. Identify operating characteristics of different types of motors.

3. Select various methods for changing the direction of a motor.

4. Apply proper preventive maintenance procedures.

5. List the common causes of malfunctions, failures, and premature wear-out.

6. Understand current relationships in three phase wiring for motors.

7. Describe servo and synchro motors and their applications.

B. Methodology

1. A long lecturer on AC Motors is given including information on the basic operation, rotation of the stator field and magnetic field along with the principles of a rotating magnetic field. The concepts of split phase rotating fields, capacitor start rotating fields, centrifugal switch and the shaded pole rotating field are also introduced. Two phase and three phase rotating fields are also discussed.

2. A discussion on synchronous speed in two pole and four pole stators is conducted along with the general theory and operation of synchronous motors both single phase and three phase.

3. Induction motors are introduced with a discussion on and motor action, slip, and starting torque vs. operating torque characteristics. Multiple speed squirrel cage inducting motors are introduced AC commuter motors, repulsion motors and universal motors are also shown and discussed.

4. Students learn the differences in DC generators and AC alternators.

5. Wherever possible students observe the motors on equipment and review several motors on display in exploded views to understand motor construction.

6. Troubleshooting techniques are discussed.

C. Evaluation

See Attached Test

Electro-Mechanical Componentry
Unit X Test
Electric Motors

Name:_____

1. The most common motors used on Packaging Systems are <u>three phase induction alternating current type</u>. Describe in some detail what the underlined portion of this statement means.

2. Describe three phase in the form of a sketch with a written explanation of their relationship to each other in degrees.

3-5. An AC induction motor is made up of two cylinders one within another both on the same axis. The inner cylinder is mounted in bearings on endbells. What is it called._____ The outer cylinder is the _____ and is made of metal laminations as opposed to solid iron for the purpose of cutting down on _____ caused by transformer action.

6. What will happen to a three phase motor is one of the supply wires is accidently disconnected while it is running?

7. If you have four wires from your stator in a standard 120V 60 HZ environment and each of the first three carry an equal current, how much current would you expect the fourth wire to carry? How will the fourth wire be used.

8. How will the rotor direction of a three phase induction AC motor be reversed.

9. An 24 pole 3-phase synchronous motor in a standard 60HZ, 120V environment will turn at what speed?

10. All single phase induction motors share the problem of how they get started. Select one type of single phase induction motor of which you are most knowledgeable and describe how it will get started. (5 points)

11. Which of the following can be a single phase induction motor? Explain why not for those that apply. (Be careful)

Shaded Pole Motors
Split Phase Motors
Capacitor Start Motors
Series AC Motors
Synchronous

12. Shaded pole motors are either used for:

a) very low torque applications, or

b) very high torque applications

Select which is true and give an example of an application.

13. Explain how the direction of a shaded pole motor is changed.

14. Of all the single phase motors discussed in class, which is most applicable to high torque starting requirements? (Do not include repulsion motors in this answer)

15. Describe how a repulsion motor operates. (5 points)

16. Explain the function of a centrifugal switch, specifically in the application of capacitor start motors.

17. If a single phase motor hums, but does not turn, list two probable defects.

18. In what type motors are commutators used?

19. In what type motors are brushes used?

20. What is the greatest advantage of a Series AC/DC motor otherwise known as a universal motor? List one of the disadvantages.

21& 22. List two applications for a single phase synchronous motor. Include in your answer the unique feature of synchronous motors and why they are good for the applications selected.

23. If a single phase synchronous motor has 10 poles and is operated in a 60HZ, 240V environment what speed will it have?

24. How does a synchro system motor transfer power from one shaft to another?

25. What applications, ie; what specific needs require synchroservo motor systems?

26& 27. Describe the difference in slip rings and split rings, and where they are used differently.

28. You know that the speed of a given motor is 5252 revolutions per minute and you have measured the torque to be 10 ft-lbs. What horsepower rating will this motor have?

29. In classroom discussion motors limited to what horsepower are suggested for power sources of 120V?

30. In classroom discussion motors limited to what horsepower are suggested for power sources of 120V, 60AMP service?

31. What is the primary difference between generators and alternators?

32-35. Three conditions must exist for a generator to convert mechanical energy to electrical energy. List them.

36&37. Two methods are used to create the three conditions listed above. They are the rotating _____ method and the rotating _____ method.

38. The top speed of an AC/DC motor will run at as fast as _____ rpm.

39. The top speed of a squirrel cage AC motor is approximately _____rpm.

40. Briefly describe the difference in a four wire WYE configuration and a four wire DELTA configuration and where they will be used.

JOB MARKET
A GUIDE TO TODAY'S HOTTEST CAREERS
Published by the American Vocational Association 1410 King Street Alexandria, Va. 22314 (703) 683-3111

INSIDE

Like cars? Jobs as **automotive mechanics** will be plentiful for those with proper training. **Page 2.**

In-home child care workers are on the rise. Have you thought about being a **nanny?** **Page 3.**

Racetracks around the country offer job opportunities for **horse lovers.** Have you checked it out yet? **Page 5.**

There are many **Careers in Space** for technical, non-professionals. See if there is something for you. **Page 8.**

Packaging—from Napoleon's Army To Today's Kitchen

By Donald Lindemann, Packaging Instructor
Wisconsin Indianhead Technical College—New Richmond

What if you were told that YOU can master a specialty that presently offers 10 jobs for every qualified candidate nationwide?

What if you were told that salaries in this profession are among the highest paid to technical school graduates, starting between $20,000 and $30,000 annually? Some past graduates are earning $60,000 a year or more.

This area of specialization combines, as the nation's single largest industry, more than $70 billion a year. It continually introduces leading-edge technologies, and changes lives and the world we life in.

The industry is packaging. Yes, packaging! Packaging has been around as long as humankind.

Ninety percent of manufactured products are packaged. The United States alone uses 1.2 billion packages a day.

Nomadic tribes from the Peking man era produced containers from hollowed out bones (skulls were excellent). Others later developed packages from bamboo shoots and woven grasses. These were traded for different kinds of valuables. Still later, so-

continued on page 4

Author Donald Lindemann shows students how to feed material onto a labeling machine.

Law Protects Those Least Able To Protect Themselves

President George Bush this summer signed the Americans With Disabilities Act extending to workers with disabilities many of the protections already given to other workers by earlier civil rights laws. He called the new law a "clear and comprehensive mandate for the elimination of discrimination against individuals with disabilities."

This act shows Americans' growing impatience with employment practices that short-change people because of their sex, national origin, race, age, or other irrelevant characteristics. Title VII of the Civil Rights Act of 1964 prohibits employers of 15 or more from discriminating on the basis of traits that don't affect their ability to work.

Courts have ruled that employers can be breaking this law without themselves doing discriminatory acts. If, for example, they know that some of their employees are acting toward other employees in a racist or biased fashion, employers must take steps to stop such acts.

Also, it is not enough for employers merely to stop past unfair hiring, training, and promotion methods. Employers may be required to try extra hard to hire "protected classes" of workers, who previously were discriminated against by their companies or industries. This is sometimes called affirmative action.

Thus, in some cases, you may have an advantage if you are of a minority race, or a woman, or a disabled person. If your category is under-represented in a company or industry, employers may be trying to fill slots with people from your category. That is to make up for the unfairness of past policies.

The Civil Rights Act also prohibits discrimination on the basis of national origin, generally the country you or your ancestors originally came from.

This doesn't mean that employers are not allowed to prefer American citizens over equally qualified foreigners. But the U.S. Equal Employment Opportunity Commission says it may be illegal to prefer U.S. citizens if the effect is to disqualify too many people of a particular national origin. An example might be Hispanic crop workers in Southern California.

continued on page 4

185

it possible to imprint hun- | cian may be called on to | $35,000. Those in busi-

Those Least Able To Protect Themselves

idea is to avoid names that suggest that a particular job is only for men or only for women.

The law also forbids sexual harassment in the workplace. That is any unwelcome sexual conduct when it seems that an employee's job or chances for advancement may be affected. The law protects employers from allowing any kind of sexual conduct that creates an intimidating or offensive work environment.

Again, employers may be breaking the law even if they are not officially doing or encouraging other people to do these things. If any employer even knows or reasonably ought to know about harassment of a firm's employees, that employer may be required by law to take steps to stop the harassment.

Until the 1990 Americans With Disabilities Act was passed this summer, the main law protecting disabled people was the Rehabilitation Act of 1973. This applied only to government contractors and employers who got federal assistance. The Rehabilitation Act said that a person with a disability, who was otherwise qualified, could not be discriminated against in employment because of the disability.

The new act extends many of the provisions of the Civil Rights Act to disabled people. It goes further; it says that employers must provide "reasonable accommodations" for otherwise qualified employees with disabilities. This could mean things like special tools and equipment or ramps for wheelchair access.

By the way, the new act specifically says that drug addicts and alcoholics—even though their diseases may be considered disabilities—may be held to the same standards as any other employees. So if an employer forbids drinking or drug use on the job, it is no excuse to claim that you're an addict or alcoholic and can't help.

Packaging

continued from page 1

ciety put a high value on the craft of extracting malleable metals and pounding them into containers.

Early glass containers went to only the richest in the land. Also valued were wood, paper, and pottery containers.

In 1809, Napoleon offered a fortune of 12,000 francs to anyone who could devise a way to package food for his armies so that it would not spoil when transported great distances over long times. Within a year, heat-processed canned foods were invented.

Today, extraordinary opportunities await creative and mechanically-inclined men and women in varied packaging specializations.

Ten schools in America currently offer two-year automated packaging systems degrees. Wisconsin Indianhead Technical College started its packaging program in 1976. Its program attracts excellent students, often from farm backgrounds, with strong work ethics.

Students of packaging at WITC learn machine basics, with courses in power transmission componentry, electro-mechanical componentry, fluid power componentry, blueprint reading, machine troubleshooting, applied electronics, digital logic, and programmable logic. The program supplements the courses with shop time in an 8,000-square-foot shop and electronics lab, on full- scale packaging machinery in a simulated production environment. Courses also are offered in packaging materials, industry concerns, humans relations, and communications.

Industry more and more is upgrading its packaging lines with the latest machinery, increasing efficiency, and automation. This means that packaging students continually need more information on electronics, programmable logic control, advanced electro- mechanical componentry, and statistical process control.

As the packaging industry becomes ever more diverse and product markets become increasingly focused, the opportunities for well- trained packaging mechanics and technicians will continue to grow well into the next century.

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WISCONSIN VOCATIONAL ASSOCIATION WVA

VIEWS & VISIONS

VOLUME 28 NUMBER 1 AUGUST, 1991

Packaging Profession Opens Doors To Many Opportunities

By Donald Lindemann, WITC Packaging Instructor

Jobs are becoming increasingly more difficult to obtain, largely due to changing economics and more and more workers flooding the workplace.

What if you were told there is an area of specialization that you can master, which presently enjoys a ratio of 10 jobs per qualified candidate nationwide?

What if you were told salaries in this profession are among the highest paid to technical school graduates, starting between $20,000 and $30,000 annually, with reports of some past graduates earning upwards of $60,000.

This area of specialization is also the nations single largest (over $70 billion per year), and it continually introduces leading edge technologies, changing lives and the world in which we live in.

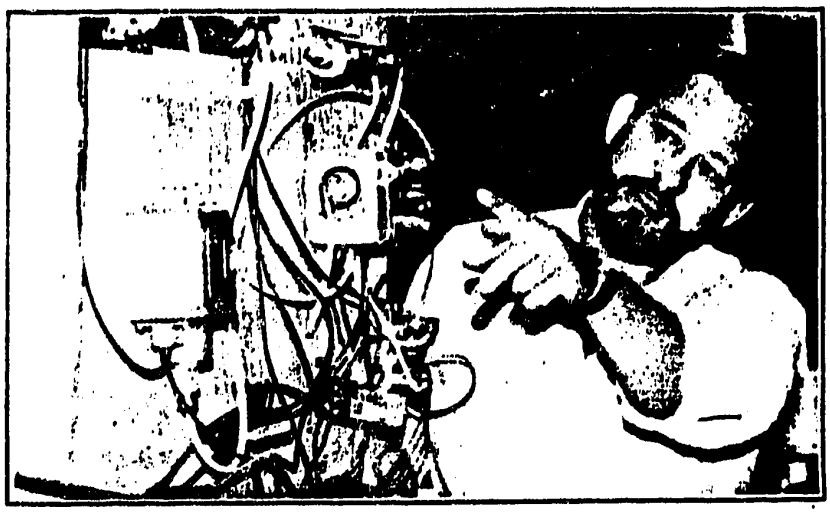
The worlds single largest industry is Packaging.

Presently, 90 percent of all products are packaged throughout the world, with the United States consuming 1.2 billion packages per day.

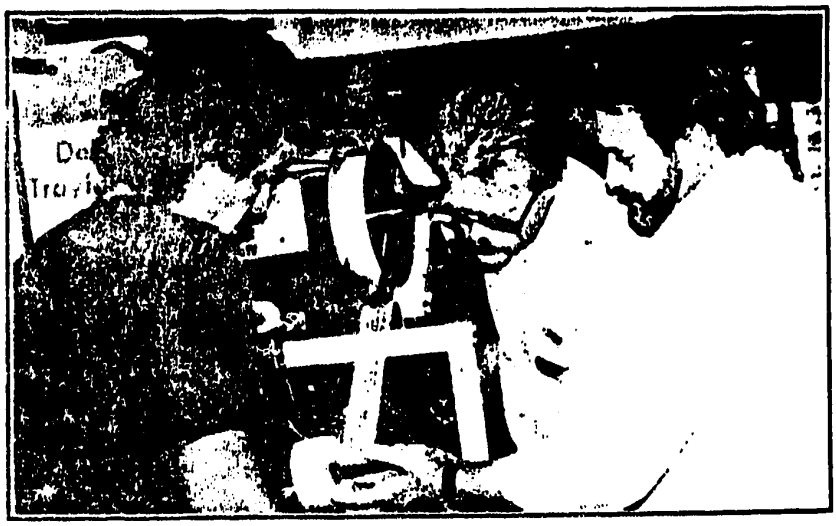
Wisconsin Indianhead Technical College - New Richmond started its Packaging program in 1976 and is presently one of only 10 schools in the nation offering a two year Automated Packaging Systems Degree.

WITC was fortunate in the beginning to have the efforts of Bill Ballou, former Plant Engineer for Green Giant Company. Ballou taught the program in its infancy giving his unwavering support and seem-

(Continued on Page 2)



WITC Packaging Instructor, Donald Lindemann, uses a training board to show how electro-mechanical devices interact with pneumatic devices.



Far Right: Donald Lindemann, Packaging instructor at WITC, shows students how to feed material onto a Doboy Mark IV Labeler. The labeler was donated by Doboy Packaging Machinery to aid in creating a realistic work environment and to give students hands-on experience in the packaging field.

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ingly endless supply of contacts for the benefit of the students and industry. He also brought with him many years of experience and a Mechanical Engineering Degree from the University of Minnesota.

Kevin Lipsky, present lead instructor, graduated from the WTIC Packaging Machinery program in 1979 and later went on to a four-year Packaging and Machinery program at the University of Wisconsin - Stout. Upon graduation, Lipsky worked for Bemis, one of the country's largest packaging companies, in the customer service department. He worked with machine operators, travelling to 11 different countries in less than five years. Later in 1986, Lipsky was hired as lead Packaging Machinery instructor after meeting several WITC instructors at a Wisconsin Vocational Education Association conference held in Green Bay. He later turned the one year program into a two year program.

Donald Lindemann, the latest addition to the Packaging staff, was recruited one year ago, bringing with him a Bachelor of Science Industrial Degree in Packaging, and more than 10 years experience in the field as a Packaging Engineer in both a research and production environment. Among Lindemann's accomplishments are five United States patents, selection for Who's Who Among Students in American Universities and Colleges, and he was also a Medallion Award Recipient which was given to less than one percent of his graduating class for outstanding achievements and contributions to the University.

A number of administrators at WITC helped create the packaging program through unwavering commitment, patience and knowledge of what would make the program successful. Among these individuals are Marilyn McCarth, Campus Administrator; Gary Moldenhouer, Trade and Industry Supervisor; Lois Eichman, Program and Curriculum Development Administrator; and David Hildebrand, WITC District Director.

"Administration played an important part in implementing the Packaging program," Lipsky said. "They played a crucial role in laying out courses, setting-up meetings, developing grant proposals for equipment, and they were very supportive in helping to make the program a success," said Lipsky.

WITC has enjoyed the enthusiastic support of numerous packaging companies over the years. Major support efforts from Doboy Packaging Machinery, Incorporated, New Richmond; Quality Park Paper Products, St. Paul, Minnesota; Friday Canning Company, New Richmond; and Tetra-Pak in St. Paul have been a tremendous benefit to the program. Their support is greatly appreciated.

Students of Packaging at WITC learn machine basics with courses in Power Transmission Componentry, Electo-Mechanical Componentry, Fluid Power Componentry, Blueprint Reading, Machine Troubleshooting, Applied Electronics, Digital Logic and Programmable Logic for machine Control. All courses are supplemented with shop-time in an 8000 square foot shop and electronics lab, on full scale packaging machinery in a simulated production environment.

The curriculum is continuously updated as WITC receives feedback from advisory committee members and from the results of surveys conducted across a wid spectrum of packaging end users.

WITC has found that there is a tren among users to upgrade their packagin lines with state-of-the-art machinery offer ing more automation, better accuracy, an faster speeds. This means infusing mor information on electronics, programmabl logic control, advanced electro-mechani cal componentry and statistical proce control into the Packaging curriculum This goal was reached when the progra went from a one-year to a two-year mod fication.

Students in the Automated Packagin Systems program become involved in pro jects building prototypes, modifying old equipment with PLCs, and solving prob lems brought to us from outside industry.

According to Kevin Lipsky, lea WITC Packaging instructor: "Our progra focuses on elements that go beyond th technical expertise of mechanics in th field. Today's employers want people wh understand what quality means, wh understand the meaning of productivity, Lipsky said. "Any production slowdow or system downtime can be very expen sive. Self-motivated individuals wh understand this concern become valuabl employees. We put a strong emphasis o thinking and problem solving, so that ou students are not only technically compe tent, but can appreciate an employers con cerns as well.

As the packaging industry become more diverse and product markets becom ever more defined, the opportunities an challenges for well trained mechanics an technicians will continue to grow well int the next century.

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C454356CO/APRFTCOURS/S30QTXT

WISCONSIN INDIANHEAD VTAE DISTRICT
Course Description/Outline 04/07/92

COURSE TITLE	Electro-Mechanical Componentry			
COURSE NUMBER	32-454-356	CLASSROOM PRESENTATIONS	(A)	72.0
SEMESTER HOURS	108.0	LAB/CLINICAL/SHOP EXPERIENCE	(B)	36.0
CREDITS	3.0	INDIVIDUAL/INDEPENDENT INSTRUCTION	(C)	
CEU'S		SIMULATED/ACTUAL OCCUPATIONAL EXP	(D)	
CEC'S		ON-THE-JOB EXPERIENCE	(E)	

COURSE DESCRIPTION:

This course is intended to give the student a thorough understanding of the electrical componentry used in packaging equipment. In addition to the study of electro-mechanical componentry, students will conduct exercises that apply their knowledge to control of machine functions. This course also introduces students to electrical standards, advanced troubleshooting, maintenance procedures, and the functions of programmable logic controllers.

COURSE COMPETENCIES:
Upon successful completion of this course, the student in accordance with the grading standards will be able to:

1. Verbalize in a knowledgeable manner the types, functions and applications of electro-mechanical componentry in motion control.

2. Apply preventive maintenance procedures in the care of electro-mechanical components.

3. Recognize and compare related components used in packaging systems with the ability to recommend the most efficient method of accomplishing a desired motion control.

4. Verbalize the uses and relations of electricity and mechanical properties to perform work.

5. Apply the symbols and standards of electro-mechanical componentry.

6. Identify safe and unsafe procedures and processes and make recommendations for change accordingly.

PREPARED BY: D. Lindemann, Instructor SUBMITTED BY: Gary Moldenhauer
COORD. APPROVAL: Walt Peters DATE: 8/07/89 REVISED:
DISTRICT APPROVAL: Lois L. Eichman DATE: 8/31/89

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COURSE OUTLINE BY UNITS:	TYPE OF HOURS A	TYPE OF HOURS B
I. Principles of Electricity and Introduction to Electro-Mechanical Componentry	4.00	
II. Switches and Solenoids A. Solenoids B. Switches 1. Pressure and pressure transducers 2. Temperature controllers 3. Limit 4. Proximity 5. Vane 6. Controller outputs 7. Selector 8. Drum 9. HD 10. Indicator lights 11. Toggle 12. Push button 13. Rotary C. Preventive Maintenance and Repair	4.00	4.00
III. Control Relays, Time Delay Relays, and Contactors A. Operation and Use B. Timing Relays, Pneumatic Timers, Latching Relay, Plug In, etc. C. Maintenance and Repair	6.00	2.00
IV. Fuses, Circuit Breakers and Disconnect Switches A. Protective Factors B. Fuse Construction and Operation C. Selecting Protective Devices D. Maintenance and Repair	4.00	2.00
V. Photoelectric and Sonic Sensors A. Operation and Use B. Maintenance	4.00	5.00
VI. Control Systems A. Temperature Controllers B. Weight Controllers C. Counters 1. Preset electrical impulses 2. Circuit applications D. Registration Controllers	6.00	4.00
VII. Timers A. Dash Pot B. Synchronous Motor Driven C. Solid State D. Selected Operations	4.00	2.00

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VIII.	Transformers A. Operations B. Control Transformers C. Selecting a Transformer D. Maintenance	4.00	2.00
IX.	Motors A. Theory of Operation B. 3-Phase, Single Phase, Shaded Pole, Split Phase, Capacitor, Series AC/DC C. Maintenance	8.00	4.00
X.	Motor Starters A. Overload Relays B. Across the Line (Full Voltage) Starters C. Reversing, Multi-Speed, Reduced-Voltage D. Starting Sequence	4.00	2.00
IX.	Heaters A. Applications B. Calculating Heat Requirements C. Selection and Application of Heating Elements D. Preventive Maintenance	4.00	2.00
XII.	Static Electricity A. Basic Principles and Control	2.00	1.00
XIII.	Codes and Standards A. Wiring Methods and Practices B. Safeguarding Personnel C. Grounding Circuits and Equipment Grounding D. Accessories and Lighting	6.00	2.00
XIV.	Solid State Control A. Symbols and Circuit Applications	4.00	2.00
XV.	Programmable Control A. Inputs/Outputs B. The Central Processing Unit C. Peripheral Devices D. Industrial Applications and Motion Control	8.00	2.00
	Totals	72.00	36.00

RECOMMENDED/SUGGESTED TEXTS & MATERIALS:

PMMI, BASIC ELECTRICAL COMPONENTS, C. Glenn Davis
ELECTRICAL CONTROL FOR MACHINES, Kenneth B. Rutherford, Delmar Publications

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WISCONSIN INDIANHEAD VTAE DISTRICT
Course Description/Outline

COURSE TITLE: Packaging Industry Concerns
COURSE NUMBER: 32-454-361

SEMESTER HOURS	54.00	CLASSROOM PRESENTATION	(A)44
CREDITS	2.00	LAB/FIELD TRIP	(B)10

COURSE DESCRIPTION:
This course is designed to give the student an industry perspective of packaging and an appreciation for the important roles they will play in relationship to other functions within a corporate enterprise. Students will become involved in round table discussions developing active problem solving skills working within the framework of a corporate setting. Additionally, students will learn standards, OSHA compliance considerations, manufacturing practices, and liability concerns. Finally, the student will address ethical considerations and the problems the Packaging industry has faced with consumers disposal of refuse and recycling.

COURSE COMPETENCIES
Upon successful completion of this course the student, in accordance with grading procedures, will be able to:

1. Describe the processes within a manufacturing organization and the role Packaging plays within the enterprise.
2. Identify industries that use Packaging.
3. Explain the use of standards and manufacturing practices in the Packaging industry.
4. Analyze the product safety and liability concerns of the Packaging industry.
5. Describe the considerations undertaken when Packaging equipment is purchased, when marketing introduces a new concept, when Engineering changes product design and the implications to the Packaging professional and the enterprise at large.
6. Understand the workings of corporate cultures and the roles each department plays in carrying out the business of the enterprise.
7. Develop effective problem solving (team playing) skills congruent with the roles of the Packaging professional within an organization.
8. Evaluate the role of Unions, Supervisors, Managers and their relationship to the enterprise.
9. Appraise ethical considerations in Packaging and the problems posed for society in refuse disposal and possibilities in recycling.
10. Develop sensitivities to cultural diversity in the workplace and the special concerns of women including sexual harrasment policies and discrimination.
11. Develop an awareness of the global pressures arising from packaging, waste, and Hazardous Materials.

PREPARED BY: [redacted] SUBMITTED BY: G. Moldenhauer
COORD. APPROVAL: Walt Peters 10-7-91 DATE: [redacted]
DISTRICT APPROVAL: Lois L. Eichman DATE: 12-15-91

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COURSE TITLE: Packaging Industry Concerns
COURSE NUMBER: 32-454-361

COURSE OUTLINE BY UNITS:

	Type of Hours A	Type of Hours B
I. The scope of Packaging A. History B. Consumer C. Industrial D. Military	4	
II. Procedures & Practices A. ASTM B. OSHA C. GMPs D. Liability considerations	6	
III. The Packaging function within the organization. A. Purchasing B. Marketing C. Sales D. Engineering E. R&D F. Quality G. Logistics H. Maintenance I. Distribution	7	
IV. Problem solving skills A. Politics of the Enterprise B. The team concepts C. Channels of Communication D. Behaviors conducive to success	9	
* Case study designed to work through a proposed 10 problem with emphasis on the development of behaviors conducive to successful problem solving within the framework of the organization.	8	
V. The role of the Union, Supervisors, Managers, co-workers, and their relationship to the enterprise.	6	
VI. Ethical considerations	4	
VII. Ethnic/cultural Diversity Sexual Harrassment Policies	4	
VIII. Consumer concerns A. Recycling B. Hazardous Waste		6
Totals	54	

RECOMMENDED/SUGGESTED TEXTS & MATERIALS:
PACKAGING PERSPECTIVES, Donald L. Abbott, Kendall/Hunt Pub. 1989
Packaging Magazine: The Cahners Publication for decision makers.
LRC Ref. requirement: Packaging Digest: LRC Ref. requirement.

C454361CO/APRFTCOURS/S38QTXT

WISCONSIN INDIANHEAD VTAE DISTRICT
Course Description/Outline 04/07/92

COURSE TITLE	Packaging Industry Concerns		
COURSE NUMBER	32-454-361	CLASSROOM PRESENTATIONS	(A) 54.00
SEMESTER HOURS	54.00	LAB/CLINICAL/SHOP EXPERIENCE	(B)
CREDITS	2.00	INDIVIDUAL/INDEPENDENT INSTRUCTION	(C)
CEU'S		SIMULATED/ACTUAL OCCUPATIONAL EXP	(D)
CEC'S		ON-THE-JOB EXPERIENCE	(E)

COURSE DESCRIPTION:

This course is designed to give the student an industry perspective of packaging and an appreciation for the important roles they will play in relationship to other functions within a corporate enterprise. Students will become involved in round table discussions developing active problem solving skills working within the framework of a corporate setting. Additionally, students will learn standards, OSHA compliance considerations, manufacturing practices, and liability concerns. Finally, the student will address ethical considerations and the problems the packaging industry has faced with consumers' disposal of refuse and recycling.

COURSE COMPETENCIES:
Upon successful completion of this course, the student in accordance with the grading standards will be able to:

1. Describe the processes within a manufacturing organization and the role packaging plays within the enterprise.
2. Identify industries that use packaging.
3. Explain the use of standards and manufacturing practices in the packaging industry.
4. Analyze the product safety and liability concerns of the packaging industry.
5. Describe the considerations undertaking when packaging equipment is purchased, when marketing introduces a new concept, when engineering changes product design, and the implications to the packaging professional and the enterprise at large.
6. Understand the workings of corporate cultures and the roles each department plays in carrying out the business of the enterprise.
7. Develop effective problem solving (team playing) skills congruent with the roles of the packaging professional within an organization.
8. Evaluate the role of unions, supervisors, managers, and their relationship to the enterprise.
9. Appraise ethical considerations in packaging and the problems posed for society in refuse disposal and recycling.

PREPARED BY: Don Lindemann, Instructor SUBMITTED BY: Gary Moldenhauer
COORD. APPROVAL: Walt Peters DATE: 10/10/89 REVISED:
DISTRICT APPROVAL: Lois L. Eichman DATE: 10/12/89

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COURSE TITLE: Packaging Industry Concerns
COURSE NUMBER: 32-454-361

COURSE OUTLINE BY UNITS:	TYPE OF HOURS A	B
I. The Scope of Packaging A. History B. Consumer C. Industrial D. Military	4.00	
II. Procedures and Practices A. ASTM B. OSHA C. GMPs D. Liability Considerations	6.00	
III. The Packaging Function Within the Organization A. Purchasing B. Marketing C. Sales D. Engineering E. R and D F. Quality G. Logistics H. Maintenance I. Distribution	7.00	
IV. Problem Solving Skills A. Politics of the Enterprise B. The Team Concepts C. Channels of Communication	9.00	
** Case Study designed to work through a proposed problem with emphasis on the development of behaviors conducive to successful problem solving within the framework of the organization	10.00	
V. The Role of the Union, Supervisors, Managers, Co-Workers, and Their Relationship to the Enterprise	6.00	
VI. Ethical Considerations	6.00	
VII. Consumer Concerns A. Recycling	6.00	
Totals	54.00	0

RECOMMENDED/SUGGESTED TEXTS & MATERIALS:

PACKAGING PERSPECTIVES, Donald L. Abbott, Kendall/Hunt Publishers, 1989
Packaging Magazine: THE CAHNERS PUBLICATION FOR DECISION MAKERS
LRC Ref. requirement
PACKAGING DIGEST: LRC Ref. requirement

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WISCONSIN INDIANHEAD VTAE DISTRICT
Course Description/Outline 04/07/92

COURSE TITLE	Introduction to the Packaging Industry		
COURSE NUMBER	32-454-350	CLASSROOM PRESENTATIONS	(A) 54.00
SEMESTER HOURS	54.00	LAB/CLINICAL/SHOP EXPERIENCE	(B)
CREDITS	2.00	INDIVIDUAL/INDEPENDENT INSTRUCTION	(C)
CEU'S		SIMULATED/ACTUAL OCCUPATIONAL EXP	(D)
CEC'S		ON-THE-JOB EXPERIENCE	(E)

COURSE DESCRIPTION:

An introduction to the vocation of packaging, the history of packaging, and the enormous impact packaging has had on today's society. A review of career opportunities in packaging will be discussed along with an examination of the interests and expectations of each student. An overview of each of the industry categories, machinery, and materials is presented. Field trips and speakers are included to support coursework.

COURSE COMPETENCIES:
Upon successful completion of this course, the student in accordance with the grading standards will be able to:

1. Recognize employee responsibilities associated with job descriptions of careers in packaging.

2. Identify the purposes of packaging and its impact on society.

3. Develop a clear understanding of the opportunities in packaging with written goals and time lines for their personal success in the packaging industry.

4. Summarize the history of packaging.

5. Define the industry at large, the machines of packaging, and the materials of packaging.

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PREPARED BY: D. Lindemann, Instructor SUBMITTED BY: Gary Moldenhauer
COORD. APPROVAL: Walt Peters DATE: 8/07/89 REVISED:
DISTRICT APPROVAL: Lois L. Eichman DATE: 8/30/89

COURSE TITLE: Introduction to the Packaging Industry 2
COURSE NUMBER: 32-454-350 04/07/92

COURSE OUTLINE BY UNITS:	TYPE OF HOURS A	B
I. The Vocation of Packaging	15.00	
A. Function		
B. History		
C. Annual Per Capita Consumption		
D. Trends/Growth/Costs		
II. The Industry at Large (An Overview)	25.00	
A. The Machines of Packaging		
B. Packaging Graphics		
C. Laws and Regulations		
D. Distribution Packaging/Transportation		
E. Industrial Packaging		
F. Military Packaging		
G. Pharmaceutical Packaging		
H. Cosmetic Packaging		
I. Food and Beverage Packaging		
J. Adhesives in Packaging		
H. Packaging Closures		
I. Aerosol and Tube Packaging		
J. Flexible Packaging		
K. The Materials of Packaging		
III. Career Opportunities	8.00	
A. All Packaging Professions		
B. Machinery Occupations		
C. Directories		
D. Organizations		
IV. Student Interest Survey	6.00	
A. Interests and Expectations		
B. Goals		
C. Job Skills Matrix		
Totals	54.00	0

RECOMMENDED/SUGGESTED TEXTS & MATERIALS:

PACKAGING PERSPECTIVES, Donald L. Abbott, Kendall/Hunt Publishing, 1989.
THE CAHNERS PUBLICATION FOR DECISION MAKERS, packaging magazine.
PACKAGING DIGEST: LRC Ref. requirement.

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WISCONSIN INDIANHEAD VTAE DISTRICT
Course Description/Outline 04/07/92

COURSE TITLE	Packaging Machine Maintenance			
COURSE NUMBER	32-454-351	CLASSROOM PRESENTATIONS	(A)	
SEMESTER HOURS	144.0	LAB/CLINICAL/SHOP EXPERIENCE	(B)	144.0
CREDITS	4.0	INDIVIDUAL/INDEPENDENT INSTRUCTION	(C)	
CEU'S		SIMULATED/ACTUAL OCCUPATIONAL EXP	(D)	
CEC'S		ON-THE-JOB EXPERIENCE	(E)	

COURSE DESCRIPTION:

This course is intended to give the student an introduction to the safe use and operation of the tools used in maintenance, troubleshooting, and repair. Students will be introduced to manuals, operation procedures, troubleshooting methodology, analysis of maintenance problems, major trouble spots and housekeeping, trouble patterns, and the equipment for troubleshooting. Students will select projects per instructor approval to work on during shop time.

COURSE COMPETENCIES:
Upon successful completion of this course, the student in accordance with the grading standards will be able to:

1. Apply safety and safe practices in the use of shop tools and packaging equipment in the shop.

2. Demonstrate use of machine operation and repair manuals.

3. Perform tool crib duties including the ordering of supplies, tool inventory control, tool use management, and housekeeping responsibilities.

4. Develop shop reports detailing work conducted on equipment.

5. Report to the instructor any safety concerns, problems, or shop activities that present a safety problem either verbally or in writing.

6. Display logical steps in troubleshooting methodology.

7. Analyze maintenance problems and discuss approaches to problem solutions.

8. Correctly use several of the tools for troubleshooting.

PREPARED BY: Don Lindemann-Instructor SUBMITTED BY: Gary Moldenhauer
COORD. APPROVAL: Walt Peters DATE: 8/07/89 REVISED:
DISTRICT APPROVAL: Lois L. Eichman DATE: 8/30/89

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COURSE TITLE: Packaging Machine Maintenance 2
COURSE NUMBER: 32-454-351 04/07/92

COURSE OUTLINE BY UNITS:	TYPE OF HOURS A	B
I. Introduction A. Movie on Safety B. Tool Crib Responsibilities C. Housekeeping D. Safe Use of Hand Tools		15.00
II. Introduction to Troubleshooting Methodology A. Analyzing the Problem B. Major Trouble Spots C. Grounding D. Equipment for Troubleshooting E. Procedures Used in Troubleshooting F. Recognizing Trouble Patterns		25.00
III. Equipment Familiarization A. Review of the Operations of Each Piece of Equipment		15.00
IV. Project Selection-Teacher/Student Conference		5.00
V. Introduction to the Use of Manuals		5.00
VI. Maintenance Reports		25.00
VII. Purchasing Procedure		25.00
VIII. Lubrication Procedures		15.00
IX. Inspection		14.00
Totals	0	144.00

RECOMMENDED/SUGGESTED TEXTS & MATERIALS:

ELECTRICAL CONTROL FOR MACHINES, Kenneth B. Rutherford, Delmar
Delmar Publications
Shop manuals for all packaging and lab equipment
Shop supply catalogs and technical library

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WISCONSIN INDIANHEAD VTAE DISTRICT
Course Description/Outline 04/07/92

COURSE TITLE	Schematics, Prints, and Layouts		
COURSE NUMBER	32-454-354	CLASSROOM PRESENTATIONS	(A) 72.00
SEMESTER HOURS	90.00	LAB/CLINICAL/SHOP EXPERIENCE	(B) 18.00
CREDITS	3.00	INDIVIDUAL/INDEPENDENT INSTRUCTION	(C)
CEU'S		SIMULATED/ACTUAL OCCUPATIONAL EXP	(D)
CEC'S		ON-THE-JOB EXPERIENCE	(E)

COURSE DESCRIPTION:

This course is an introduction to the basics of blueprint reading and interpretation. Lesson plans include exercises involving prints in mechanical, electrical, and fluid power machine systems. Machinery installation layout drawings, wiring diagrams, and schematics are also included. Students sketch parts in orthographic projections and isometrics. Geometric dimensioning and tolerancing are introduced. (PREREQUISITES: High school drafting is useful but not required at this time. Basic mathematical skills are required, i.e., fractions, decimals, percentages, converting, etc.)

COURSE COMPETENCIES:
Upon successful completion of this course, the student in accordance with the grading standards will be able to:

1. Use blueprints to effectively understand the operations of machinery.

2. Use sketching and shop notes to modify machinery components or functions.

3. Visualize in 3-D the objects described in orthographic drawings.

4. Interpret layout drawings for installation.

5. Trace wiring diagrams from any point A to any point B on a piece of equipment.

6. Use schematics and wiring diagrams for troubleshooting.

7. Use blueprints to identify parts for placing purchase orders.

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PREPARED BY: D. Lindemann, Instructor SUBMITTED BY: Gary Moldenhauer
COORD. APPROVAL: Walt Peters DATE: 8/07/89 REVISED:
DISTRICT APPROVAL: Lois L. Fichman DATE: 8/30/89

COURSE TITLE: Schematics, Prints, and Layouts
COURSE NUMBER: 32-454-354

COURSE OUTLINE BY UNITS:	TYPE OF HOURS A	B
I. Introduction to Blueprints	16.00	
A. Blueprints and Drawings		
B. Identification Information		
II. Mechanical Drawings	18.00	
A. Lines		
B. Visualizing Shapes		
C. Reading Mechanical Drawings		
1. Holes		
2. Threads		
3. Contours		
4. Sectional views		
5. Angles		
6. Necks		
7. Grooves		
8. Slots		
9. Keyways		
10. Keysets		
11. Flats		
12. Bosses		
13. Pads		
D. Geometric Dimensioning and Tolerancing Introduction		
E. Sketching in Orthographic Projections		4.00
F. Sketching in 3-D		4.00
III. Electrical Drawings	16.00	
A. Electrical Symbols		
B. Wiring Diagrams		
C. Schematics		
D. Reading Electrical Drawings		4.00
IV. Fluid Power Drawings	6.00	
A. Symbols		
B. Reading Fluid Power Drawings		4.00
V. Machinery Layout and Installation Drawings	16.00	2.00
Totals	72.00	18.00

RECOMMENDED/SUGGESTED TEXTS & MATERIALS:

PMMI, BLUEPRINT READING, INDUSTRIAL MACHINERY, 2nd Ed., C. Glenn Davis

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WISCONSIN INDIANHEAD VTAE DISTRICT
Course Description/Outline 04/07/92

COURSE TITLE	Power Transmission Componentry			
COURSE NUMBER	32-454-357	CLASSROOM PRESENTATIONS	(A)	36.00
SEMESTER HOURS	72.00	LAB/CLINICAL/SHOP EXPERIENCE	(B)	36.00
CREDITS	2.00	INDIVIDUAL/INDEPENDENT INSTRUCTION	(C)	
CEU'S		SIMULATED/ACTUAL OCCUPATIONAL EXP	(D)	
CEC'S		ON-THE-JOB EXPERIENCE	(E)	

COURSE DESCRIPTION:

This course is intended to give the student a thorough understanding of mechanical devices such as belt drives, chains, sprockets, gear trains, brakes, clutches, speed reducers, adjustable speed drives, bearings, springs, shafts, couplings, levers, cranks, linkages, fly wheels, timing components, and conveyors used in the transmission of power and machine control in packaging equipment. In addition to covering the mechanics of how each component operates, preventive maintenance procedures and typical malfunctions are reviewed.

COURSE COMPETENCIES:
Upon successful completion of this course, the student in accordance with the grading standards will be able to:

1. Identify characteristics of the following: belt drives, chains, sprockets, gear trains, brakes, clutches, speed reducers, adjustable speed drives, bearings, springs, shafts, couplings, levers, cranks, linkages, cams, starwheels, timing components, and conveyors.

2. Calculate speeds of shafts and pulleys, the proper sizing and pitch of sprockets, gears, and pulleys, and the number of teeth required on a given pulley or sprocket in a gear train.

3. Demonstrate ability to achieve desired machine control using timing components.

4. Recognize advantages and disadvantages of power transmission components and their proper use.

5. Recognize malfunctions and failures for each mechanical component.

. Conduct preventive maintenance procedures.

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PREPARED BY: Kevin Lipsky SUBMITTED BY: Gary Moldenhauer
COORD. APPROVAL: Walt Peters DATE: 10/10/89 REVISED: 8/21/91
DISTRICT APPROVAL: Lois L. Eichman DATE: 08/29/91

COURSE TITLE: Power Transmission Componentry
COURSE NUMBER: 32-454-357

COURSE OUTLINE BY UNITS:		TYPE OF HOURS A	B
I.	Machine Bearings	2.00	2.00
II.	Belt Drives	4.00	4.00
III.	Chains and Sprockets	4.00	4.00
IV.	Gear Trains	3.00	3.00
V.	Levers, Cranks and Linkages, and Cams	6.00	6.00
VI.	Shafts and Couplings, Springs, and Brakes and Clutches	9.00	9.00
VII.	Speed Reducers and Adjustable Speed Drives, Timing Components, and Conveyors	8.00	8.00
	Totals	36.00	36.00

RECOMMENDED/SUGGESTED TEXTS & MATERIALS:

PMMI, BASIC MECHANICAL COMPONENTS, C. Glenn Davis
PMMI, PACKAGING CONVERTING MACHINERY COMPONENTS, C. Glenn Davis
PRINCIPLES OF MACHINE MAINTENANCE, Dick Jeffrey

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C454352CO/APRFTCOURS/S38QTXT

WISCONSIN INDIANHEAD VTAE DISTRICT
Course Description/Outline 04/07/92

COURSE TITLE	Packaging Machine Installation and Setup			
COURSE NUMBER	32-454-352	CLASSROOM PRESENTATIONS	(A)	
SEMESTER HOURS	144.0	LAB/CLINICAL/SHOP EXPERIENCE	(B)	144.0
CREDITS	4.0	INDIVIDUAL/INDEPENDENT INSTRUCTION	(C)	
CEU'S		SIMULATED/ACTUAL OCCUPATIONAL EXP	(D)	
CEC'S		ON-THE-JOB EXPERIENCE	(E)	

COURSE DESCRIPTION:

This course is designed to give the student an understanding of the elements of machinery installation and operation. Hands-on exercises with mechanical, fluid power, electrical components, and utility requirements and their relation to packaging system functions are included. Students will use manuals to complete an installation, learning the use of creative space-saving techniques. Additionally, students will learn operator requirements, supply requirements, material handling requirements, and safety in a total system as they relate to product quality and efficient process control.

COURSE COMPETENCIES:
Upon successful completion of this course, the student in accordance with the grading standards will be able to:

1. Use machine manuals to obtain information necessary for proper machinery installation.

2. Apply knowledge of machine operation simulating actual production conditions.

3. Articulate the safety, utility, and space requirements of any given machine per manual instructions along with the requirements of the operator, and necessary accessories and supplies.

4. Demonstrate the correct use of testing and measuring equipment for packages.

5. Apply knowledge on line layout and function to combine machines into systems.

6. Demonstrate the use of methods of identification in storage and inventory.

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PREPARED BY: Don Lindemann-Instructor SUBMITTED BY: Gary Moldenhauer
COORD. APPROVAL: Walt Peters DATE: 8/07/89 REVISED:
DISTRICT APPROVAL: Lois L. Eichman DATE: 8/30/89

COURSE TITLE: Packaging Machine Installation and Setup 2
COURSE NUMBER: 32-454-352 04/07/92

COURSE OUTLINE BY UNITS:	TYPE OF HOURS A	HOURS B
I. Machine Requirements A. Utilities Power, Air, Gas, Support Materials, etc. B. Specifications C. Space Requirements Creative Use of Limited Space D. Safety Considerations		31.00
II. Operation of Equipment A. Operator Space Requirements B. Operator Accessories C. Housekeeping		50.00
III. Products A. Regulatory Requirements B. Product Quality		21.00
IV. Floor Plans and Layouts A. Blueprint Requirements B. Supplies C. Material Handling		22.00
V. Storage and Inventory		20.00
Totals	0	144.00

RECOMMENDED/SUGGESTED TEXTS & MATERIALS:

Equipment manuals

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C414361C02/APRFTCOURS/S38QTXT

WISCONSIN INDIANHEAD VTAE DISTRICT
Course Description/Outline 04/07/92

COURSE TITLE	Digital Logic			
COURSE NUMBER	32-414-361	CLASSROOM PRESENTATIONS	(A)	72.0
SEMESTER HOURS	126.0	LAB/CLINICAL/SHOP EXPERIENCE	(B)	54.0
CREDITS	4.0	INDIVIDUAL/INDEPENDENT INSTRUCTION	(C)	
CEU'S		SIMULATED/ACTUAL OCCUPATIONAL EXP	(D)	
CEC'S		ON-THE-JOB EXPERIENCE	(E)	

COURSE DESCRIPTION:

Digital electronics concepts including the binary and hexadecimal number systems, logic gates and flip-flops, shift registers and counters, and integrated circuit logic families. Combinational and sequential logic-circuit design techniques. Analog-to-digital and digital-to-analog conversion methods. Laboratory work emphasizes the use of the logic probe and oscilloscope for troubleshooting digital circuits. Assembly skills include the use of wire wrapping as a prototyping technique. The logic statements in BASIC are used to develop computer models for logic networks.

COURSE COMPETENCIES:
Upon successful completion of this course, the student in accordance with the grading standards will be able to:

1. Comprehend and apply the vocabulary and theory of digital electronics.

2. Breadboard a digital integrated circuit logic design and verify its operation with a logic probe and oscilloscope.

3. Write BASIC computer programs that utilize the logical operators AND, OR, AND NOT.

4. Wire wrap a prototype circuit.

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PREPARED BY: John Uffenbeck SUBMITTED BY: James Junker
COORD. APPROVAL: Kurt L. Bents DATE: 08/01/86 REVISED:
DISTRICT APPROVAL: Lois L. Eichman DATE: 10/06/86 REVISED:

COURSE TITLE: Digital Logic
COURSE NUMBER: 32-414-361

COURSE OUTLINE BY UNITS:	TYPE OF HOURS A	TYPE OF HOURS B
I. Introduction A. Digital vs. analog B. Pulse characteristics C. Digital computers	4.00	2.00
II. Combination Logic Circuits A. Logic gates B. Boolean Algebra C. Design Techniques	22.00	18.00
III. Sequential Logic Circuits A. Flip-flops B. Excitation tables C. Design techniques D. Shift registers and counters	22.00	18.00
IV. Integrated Circuit Logic Families A. TTL B. SSI, MSI, LSI, VLSI C. MOS D. CMOS	8.00	6.00
V. Analog Interfacing A. DAC techniques B. ADC techniques	16.00	10.00
Totals	72.00	54.00

RECOMMENDED/SUGGESTED TEXTS & MATERIALS:

DIGITAL SYSTEMS, Tocci, Prentice-Hall, 1980.

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C454359CO/APRFTCOURS/S38QTXT

WISCONSIN INDIANHEAD VTAE DISTRICT
Course Description/Outline 04/07/92

COURSE TITLE	Packaging Materials/Processes		
COURSE NUMBER	32-454-359	CLASSROOM PRESENTATIONS	(A) 54.00
SEMESTER HOURS	54.00	LAB/CLINICAL/SHOP EXPERIENCE	(B)
CREDITS	2.00	INDIVIDUAL/INDEPENDENT INSTRUCTION	(C)
CEU'S		SIMULATED/ACTUAL OCCUPATIONAL EXP	(D)
CEC'S		ON-THE-JOB EXPERIENCE	(E)

COURSE DESCRIPTION:

Packaging materials are studied in depth with emphasis on machining characteristics. Processes of manufacturing and converting with each medium are reviewed. Material specifications and their impact on machine performance are examined. Material testing apparatus is introduced stressing specification compliance. Field trips structured to introduce complex systems of material converting are incorporated in the program.

COURSE COMPETENCIES:
Upon successful completion of this course, the student in accordance with the grading standards will be able to:

1. List performance attributes and properties of each packaging medium.

2. Describe the processes of manufacture for each packaging medium.

3. Apply testing procedures for specification verification.

4. Associate processes in converting with a given packaging medium for specific packages or containers.

5. Develop a working knowledge of form, fill, and seal processes.

6. Evaluate the operation and maintenance of bottling, canning, cartoning, bagging, and case packing processes.

7. Evaluate and recommend material specification changes to achieve optimal machine/material compatibility as measured by machine performance.

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PREPARED BY: Don Lindemann, Instructor SUBMITTED BY: G. Moldenhauer
COORD. APPROVAL: Walt Peters DATE: 8/07/89 REVISED:
DISTRICT APPROVAL: Lois L. Eichman DATE: 8/30/89

COURSE TITLE: Packaging Materials/Processes
COURSE NUMBER: 32-454-359

COURSE OUTLINE BY UNITS:	TYPE OF HOURS A	B
I. Materials		
A. Glass in Packaging	3.00	
1. History		
2. Properties/Testing Procedures		
3. Manufacturing of Glass		
4. Bottles		
5. Advantages and Disadvantages		
B. Metals in Packaging	2.00	
1. History		
2. The Manufacturing of Cans		
3. Types of Metals		
4. Properties, Applications, and Testing Procedures		
5. Composites		
6. Metalized Films and Papers		
7. Advantages and Disadvantages		
C. Paper in Packaging	6.00	
1. History		
2. The Manufacture of Paper		
3. Paper Terminology, Properties, and Testing Procedures		
4. Coating Technologies		
5. Cellophane		
6. Paperboard, Chipboard, Linerboard		
7. Corrugated Construction, Flutes, Properties		
8. Applications		
D. Plastics in Packaging	8.00	
1. Thermoplastics-Thermosets		
2. Polymerization		
3. History 1843 to Present		
4. Advantages-Disadvantages		
5. Films/Sheets		
6. The 12 Film Types - Properties, Applications, and Test Procedures		
7. Laminations, Coatings, Coextrusions		
8. Blown, Cast, Tenter		
9. Foamed Plastics		
10. Injection Molding		
11. Thermoforming		
12. Applications		
E. Wood in Packaging	1.00	
1. History		
2. Costs		
3. Wood Fasteners		
4. Wooden Containers - Crates, Wooden Boxes, Barrels, Wire Bound Boxes, Pallets		

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5. Properties, Applications, and Test Procedures

F. The Flexible Packaging Industry 3.00
1. Combinations of Papers, Plastics, and Metal Foils
2. Machinability Considerations
3. Property Manipulations
4. Package Applications
5. Retort Packaging
6. Aseptic Packaging
7. Semi-Flexible Packaging

G. Aerosol and Tube Packaging 2.00
1. Rationale
2. History 1947 to Present
3. How They Work
4. The Four Aerosol Systems
5. Product Applications
6. Industry Concerns
7. Collapsible and Squeeze Tubes

H. Packaging Closures 1.00
1. History 600 B.C. to Present
2. Closure Types

I. Adhesives in Packaging 6.00
1. History
2. The Industry
3. Natural/Synthetic
4. Applications

II. Packaging Processes
A. Form/Fill/Sealing Processes 7.00
1. Vertical Pillow Pouches
2. Tetrahedron, Shaped and Flat Bottom Bags
3. Horizontally Formed Pillow Pouches
4. Side Seal Pouches (Three and Four)
5. Liquid and Semi-Viscous Filling
6. Dry Product Filling
7. Special Operations

B. Canning Lines 3.00
1. Field Trips

C. Bottling Lines 3.00
1. Field Trips

D. Film Converting Operations 3.00
1. Field Trips

E. Carton, Bag in a Box, and Corrugated 3.00
1. Field Trips - Pillsbury, General Mills

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F. Case Packing Operations	3.00	
Totals	54.00	0

RECOMMENDED/SUGGESTED TEXTS & MATERIALS:

PACKAGING PERSPECTIVES, Donald L. Abbott, Kendall/Hunt Publishing, 1989.
THE CAHNERS PUBLICATION FOR DECISION MAKERS, Packaging magazine, LRC Ref. requirement.
PACKAGING DIGEST, LRC Ref. requirement.

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C454353CO/APRFTCOURS/S38QTXT

WISCONSIN INDIANHEAD VTAE DISTRICT
Course Description/Outline 04/07/92

COURSE TITLE	Fluid Power Systems		
COURSE NUMBER	32-454-353	CLASSROOM PRESENTATIONS	(A) 36.00
SEMESTER HOURS	72.00	LAB/CLINICAL/SHOP EXPERIENCE	(B) 36.00
CREDITS	2.00	INDIVIDUAL/INDEPENDENT INSTRUCTION	(C)
CEU'S		SIMULATED/ACTUAL OCCUPATIONAL EXP	(D)
CEC'S		ON-THE-JOB EXPERIENCE	(E)

COURSE DESCRIPTION:

This course covers the theory and use of hydraulic and pneumatic principles as they relate to packaging machinery componetry. The course is designed to prepare individuals to understand and maintain fluid power systems. Special emphasis is placed on fluidics for logic control and electronic control of machinery componetry actuated by fluid power. Lab experiments using electronically equipped fluid power trainers along with maintenance of full scale packaging equipment in the shop bring a hands-on approach to the fundamentals of fluid power.

COURSE COMPETENCIES:
Upon successful completion of this course, the student in accordance with the grading standards will be able to:

1. Comprehend and apply the vocabulary and theory of fluid power.
2. Recognize hardware and related symbols for various fluid power systems.
3. Install and test systems actuated by fluid power with electronic controls.
4. Apply preventive maintenance procedures for pumps, compressors, and components using pneumatic and hydraulic fluids.
5. Apply the skills of repair and adjustment to fluid power systems.
6. Design a fluid power circuit to accomplish a desired process function.

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PREPARED BY: Don Lindemann-Instructor SUBMITTED BY: Gary Moldenhauer
COORD. APPROVAL: Walt Peters DATE: 10/10/89 REVISED:
DISTRICT APPROVAL: Lois L. Eichman DATE: 10/12/89

COURSE TITLE: Fluid Power Systems
COURSE NUMBER: 32-454-353

COURSE OUTLINE BY UNITS:	TYPE OF HOURS A	B
I. Introduction to Fluid Power (Overview)	2.00	
A. Developing Fluid Power		
B. Accessories		
C. Fluid Properties		
II. Pneumatics and Hydraulics	24.00	
A. Applications and Advantages		
Lab: Equipment Orientation		1.00
B. Pressure, Volume and Flow		
Lab: Pressure Measurement		3.00
The Volume-Pressure Relationship		
Compression and Heat		
Measuring Flow and Pressure Drop		
Hydraulic Circuits		
C. Basic Pneumatic and Hydraulic Controls		
Lab: Pressure Switch Operation		1.00
Pressure Regulator Operation		
D. Graphic Symbol Development		
E. Compressed Fluids Generation and Distribution		
F. Linear Actuators		
Lab: Force/Area/Pressure Relationships		2.00
G. Rotary Actuator		
Lab: Rotary Actuator Operation (Continuous Rotation Type)		1.00
H. Pneumatic and Hydraulic Directional Control Valves and Circuits		
Lab: Controlling Actuators with 4-Way DCV		1.00
I. Speed Control and Sequencing		
Lab: Speed Control		1.00
J. Pressure Devices		
Lab: Relief Valve Operation		3.00
Linear Actuator Operation		
Air Bearings		
Velocity-Pressure Measurements		
K. Check Valves, Cylinders and Motors		
Lab: Using Check Valves		3.00
Pressure Compensation Control Valves		
Cam Operated Valves		
Pilot Operated Check Valves		
L. Directional Control Valves		
Lab: Actuator Control with 3-Way DCV		4.00
Exploring 4-Way Valve Operation		
Multiple Speed Control		
Sequencing Actuators		
Pressure Reduction Valves		
Sequence Valves and Circuits		
Cylinder Synchronization		
M. Compressed Air Conditioning		
Lab: Compressed Air Filter Performance		1.00
N. Hydraulic Motors and Pumps		

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	Lab: Braking Circuits Pressure Compensated Flow Control Valves Unloading Circuit		2.00
	D. Accumulators		
	Lab: Accumulator Operations and Circuits		1.00
III.	Electrical Control of Fluid Power	10.00	
	A. Electrical Control Basics		3.00
	1. Control Concepts Inputs - Limit Switches, Push Buttons Logic - Relay Networks, Timers Output - Solenoids, etc. 2. Ladder Diagram Basics		
	B. Systems Operations		3.00
	1. Control Transformers, Fuses and Circuit Breakers, Solenoid-Operated Valves, Push Buttons, Selector Switches, Indicator Lights, Control Relays, Limit Switches		
	C. Applications		3.00
	1. Motor Control, Cylinder Reciprocation, Multiple Actuator Control, Manual Controls, Rapid Traverse-Slow Feed, Electrical Pressure Control, Safety Shutdown Systems		
	D. Advanced Systems Operations		3.00
	1. Time Delay Relay, Pressure Switches, Photoelectric Cells		
	Totals	36.00	36.00

RECOMMENDED/SUGGESTED TEXTS & MATERIALS:

PMMI PACKAGING CONVERTING MACHINERY COMPONENTS, 4th Ed., C. Glenn Davis
PMMI BASIC HYDRAULIC AND PNEUMATIC COMPONENTS, C. Glenn Davis
REF. Amatrol Intermediate Pneumatics Operations Manual
REF. Amatrol Intermediate Hydraulics Operations Manual
REF. Amatrol Electrical Control of Fluid Power

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Revised for 1991-1992 School year

WISCONSIN INDIANHEAD VTAE DISTRICT
Course Description/Outline

COURSE TITLE: MICROCOMPUTER CONCEPTS & TRADE APPLICATIONS
COURSE NUMBER: 699-300

SEMESTER HOURS	72.00	CLASSROOM PRESENTATIONS (A)	20
CREDITS	2.00	LAB (B)	52

COURSE DESCRIPTION:
A general purpose course for students in a two year Automated Systems program. Instruction is DOS based, building skills on IBMs and compatibles. Instruction will begin with a Works package whereby the student will learn word processing, data base and spreadsheet applications on one integrated system. An introduction to industry specific software will follow focusing on troubleshooting, material control, inventory and quality control applications, with special emphasis on software applications for machine control. Students will be introduced to programming in BASIC and machine language as applicable to programmable logic controllers.

PREREQUISITE: Keyboarding skills are desireable.

COURSE COMPETENCIES:
Upon successful completion of this course the student, in accordance with grading procedures, will be able to:

1. Explain what computers are, their history, how they work, their components, and their useful advantages.
2. Explain the purposes of software, software limitations, and proper selection of software for a given application.
3. Perform the rudiments of DOS, 10 basic functions.
4. Discuss what word processors are, their capabilities and applications.
5. Create documents, manipulate text, create tables, headers, footers, use spelling checkers and Thesaurus.
6. Describe what Data Base is, both manual and computerized. Design a DB record and manipulate data to reach desired results.
7. Plan, Store, Print, and manipulate data by spreadsheet.
8. Integrate software systems in a works package.
9. Demonstrate intermediate skills in BASIC Programming.
10. Demonstrate the use of industry specific software as available; ie, machine control, purchasing, materials management, inventory control, troubleshooting applications, and ASRS applications.
11. Write a simple program for a PLC application.

PREPARED BY: Don Lindemann-Instructor SUBMITTED BY:
COORD. APPROVAL: DATE: REVISED:
DISTRICT APPROVAL: DATE:

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COURSE TITLE: MICROCOMPUTER CONCEPTS & TRADE APPLICATIONS
COURSE NUMBER: 499-300

COURSE OUTLINE BY UNITS:	TYPE OF HOURS	
	A	B
I. An Introduction to Computers	1	2
II. Introducing Word Processors	1	2
III. Manipulating Text w/ Word Processors	1	4
IV. Introducing Spreadsheet	1	2
V. Manipulating Data w/ spreadsheet	1	6
VI. Introducing Data Base	1	2
VII. Manipulating Data with Data Base	1	4
VIII. Introduction to programming in BASIC	2	6
IX. Electronic Software ladder & digital	1	4
X. Cape Software-Package Design & layout	1	4
XI. MBS Maintenance scheduling software	1	4
XII. Preventive Maintenance Applications	1	4
XIII. Inventory Control Applications	2	2
XIV. Pkg. Systems Layout Applications	1	2
XV. Introduction to CAD (CADKEY)	4	4
Totals	20	52

RECOMMENDED/SUGGESTED TEXTS & MATERIALS:

An Introduction to Computing Using Microsoft Works; IBM PC & Compatibles; **Lawrenceville Press, B. Presley, W. Freitas** 2 Floppy Disks, Misc. Industrial Applications Software as indicated in Units outlined above-TBD. Use of IBM Lab and Microsoft Works Software; $5.00 supplies fee to be paid at registration.

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C499300C02/APRFTCOURS/S38QTXT

WISCONSIN INDIANHEAD VTAE DISTRICT
Course Description/Outline 04/07/92

COURSE TITLE	Microcomputer Concepts and Trade Applications		
COURSE NUMBER	32-499-300	CLASSROOM PRESENTATIONS	(A) 18.00
SEMESTER HOURS	72.00	LAB/CLINICAL/SHOP EXPERIENCE	(B) 54.00
CREDITS	2.00	INDIVIDUAL/INDEPENDENT INSTRUCTION	(C)
CEU'S		SIMULATED/ACTUAL OCCUPATIONAL EXP	(D)
CEC'S		ON-THE-JOB EXPERIENCE	(E)

COURSE DESCRIPTION:

A general purpose course for Trade and Industry one- and two-year vocational program majors which starts with beginning microcomputer function, applicable for use by persons in the industrial trades occupations. Instruction will focus on the use and limitations of microcomputers and software applications in trades occupations. (NOTE: Keyboarding skills are desirable.)

COURSE COMPETENCIES:
Upon successful completion of this course, the student in accordance with the grading standards will be able to:

1. Recognize hardware requirements for software packages.
2. Use microcomputer hardware and peripherals.
3. Explain the purpose of software packages.
4. Select useable software.
5. Recognize limitation of software packages.
6. Explain the purpose of software documentation.
7. Use software documentation.
8. Create an information file using a reporting software package.
9. Print reports using a reporting software package.
10. Create a worksheet using a spreadsheet software package.
11. Use a spreadsheet for accounting, forecasting, and scheduling.
12. Create, edit, and print a document using a word processing software package.
13. Create an information file using a filing software package.
14. Add, delete, and change information in a file using a filing software package.
15. Use other available occupationally specific software.

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PREPARED BY: Jim Lenz SUBMITTED BY: Jim Lenz
COORD. APPROVAL: Kurt Bents DATE: 1988 REVISED:
DISTRICT APPROVAL: Lois L. Eichman DATE: 1988

COURSE TITLE: Microcomputer Concepts and Trade Applications 2
COURSE NUMBER: 31-499-300 04/07/92

COURSE OUTLINE BY UNITS:		TYPE OF HOURS A	B
I.	Purpose of Software Packages	1.00	
II.	Hardware Requirements for Software Packages	1.00	4.00
III.	Selection of Software Packages	2.00	
IV.	Limitations of Software Packages	1.00	
V.	Purpose and Use of Software Documentation	1.00	2.00
VI.	Use of Word Processing Software Package	2.00	8.00
VII.	Use of Electronic Filing Software Package	2.00	8.00
VIII.	Use of Reporting Software Package	3.00	4.00
IX.	Use of Electronic Spreadsheet Software Package	3.00	8.00
X.	Occupationally Specific Software Packages and Applications	2.00	20.00
	Totals	18.00	54.00

RECOMMENDED/SUGGESTED TEXTS & MATERIALS:

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Attachment #7

Hand-out on USA Food & Beverage Packaging

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Approximately one-half of all packaging material in the USA, both volume and value, are used for food and beverage packaging. The percentage of disposable income spent on food in the United States is about 16% and, when compared to Western Europe at 32% and some South American countries that are as high as 85%, it makes the USA's food costs very favorable. The United States is in a unique position in that it has available a wider variety and greater abundance of food than any other country in the world. This availability is attributed extensively to advances in food processing, package technology, and marketing. In the USA there are over 25,000 different food processing companies, not including the 4,000 beverage firms that are bottling carbonated and still beverages of all types. The processing companies service some 300,000 retail food stores which includes 4,400 supermarkets and 35,000 self service stores that have 90% of all sales of food and beverage for home consumed foods. A unique thing about food and beverage packaging is that it has to compete for the shopping dollar and it still must protect the product. The food package must be pleasing to the consumer and must provide directions, utility and assist in shelving or display and still be within government, federal, state and local compliance. Marketing studies indicate that the package alone will influence the first sale of an item and, if that product is accepted by the consumer, the product will generate resale, and the package will then stand as an identifier and protector. The unique thingabout food is that it must be available year round in an interesting variety, irrespective of the food growing season. Foods must be presented in a way that is convenient to purchase

A SNAP-SHOT OF US PACKAGING INDUSTRY AND IT'S PART OF THE FOOD & BEVERAGE INDUSTRY
1993 HAND-OUT AT UGANDA
FOOD & BEVERAGE PACKAGING SEMINAR

and use, and in most instances, this means that it must be packaged. The single factor requiring food packaging is availability.

When packaging departments search for proper package materials for items, they must know four sets of facts to successfully package the product. First, they need to know about the product—the materials and the manner in which these materials can deteriorate, the size and shape of the product, the weight and density of the product, the overall weakness, breakability, bendability and integrity of the product, and how the product is to be used. Second, they must know the transportation hazards, whether the product is sensitive to heat, cold, vibration, shock and how much stacking height can the product within the package tolerate. Third, the market must be taken into consideration. They must know market lighting, the shelf life under normal storage conditions, display conditions, shelf size, location, and how high they would normally be stacked on a shelf. Fourth, they must know the forms of packages that are suitable, the machinery that's available for this packaging system, and the labor that is required to fully package and distribute the product.

Fresh fruits also need packaging. The saying about fresh fruits is that life begins at 40, meaning that above 40 degrees fahrenheit microorganisms start to thrive and cause an accelerated deterioration of fresh fruits.

Most red meats require oxygen to produce an attractive surface. If red meats are stored in an oxygen free environment, the surface of the meat will be less attractive and less likely to be selected by the consumer at a self service store. Most meats must be quickly cooled down to 50 degrees fahrenheit as soon as possible and then held at about 34 degrees fahrenheit, which is considered to be the best holding temperature. Beef and veal can be held for 21 days without suffering deterioration. Lamb can only be held for about 15 days, pork 14 days, poultry 7 to 10 days, and internal organs such as liver and kidneys, only 7 days. The quality in storage is effected by the growth of microorganisms, enzyme activity and oxidation, all of which can be slowed down by lower temperatures.

Fish products are the most susceptible to spoilage. The bacteria in seafoods are cold loving that can be active at temperatures below 40 degrees, therefore, when first harvested from the sea, these products must be packed in ice right away. Spoilage of seafoods can occur within two to three days from harvest and must be kept at near freezing temperatures.

Fruits and vegetables are unique in that they are still alive after harvest. They continue to respire by taking up oxygen and giving off carbon dioxide. They tend to be bulky, taking up a lot of space and are easily damaged by handling. Most are water based. This water can easily be lost which decreases the look and quality of the fruit and vegetable. The deterioration of fruits and vegetables starts from the time they are harvested. They are damaged both by heat and cold, and affected by oxygen, carbon dioxide, ethylene gas and other volatiles in the atmosphere. Packaging of fresh fruits and vegetables is based on a need for easy handling for distribution and the need to be chilled to reduce respiration. Fresh fruits and vegetables have two types of spoilage and deterioration. First, there is the biological spoilage which is the normal process of aging, and second, there is an anaerobic spoilage which is the due to internal reactions that will result in off-flavors, off-colors and off-textures.

Processing and packaging of some fruits and vegetables can be done. Some products can be heat processed, which destroys microorganisms like retorting canned goods, pasteurization of milks, juices and other beverages, irradiation sterilization all of which kills microorganisms. Food and beverage irradiation does not leave a toxic residue but there is public concern about its use. In the USA, irradiation is mostly used for sterilization of medical devices after they have been packaged, and very few food items are radiated. Foods can be refrigerated or frozen which slows or stops the natural processes of deterioration. The package for frozen foods serves to keep out other microorganisms and to control freezer burn. Some food products can be dried and chemically processed. Drying reduces water content to the level that microorganisms cannot live. Drying is used for pasta, freeze dried foods, beef jerky and others. Chemically processed foods are mostly salted and packaged in a vaccum package that is free of oxygen and is used for bacon, ham and others.

The food and beverage package has to be unique to the product, to its properties, to exclude gases and moisture, or in some cases, to allow penetration of some gases and moisture. In the future, food packaging will continue to receive emphasis because of its large market. The trend may be towards more microwavable food items in smaller unit size packages for easy convenience of use especially for smaller families and working families. In the future there should be an emphasis on providing more convenience and better quality of packaged foods and beverages.

Attachment #8

Business Cards

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DEPARTMENT OF FOOD SCIENCES & TECHNOLOGY

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JOHN W.A.R. NUWAGIRA
Science Secretary

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UGANDA NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY

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Mehmet Şeker
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Q.A. Mang

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FOURWAYS INVESTMENTS LTD

Ian Walker
ADMINISTRATION MANAGER

Plot Nos. 36-42,
Port Bell Road,
Luzira,
P.O. Box 20028,
Kampala, Uganda

Tel. Nos.: 220793/761/413
Residence: 268584
Fax Nos.: 220894/241807
Telex: 61152 Fiat UG
Cables: Fourways Kampala

MUKWANO FRIENDSHIP

SURJIT SINGH B.Sc. (Engg.) (Hons) C.U; (USA)
Production Manager

MUKWANO INDUSTRIES (U) LTD.
(Regd. In Uganda)
Manufacturers of Edible Oil and Soap

30 Press House Road, P. O. BOX 2671, Kampala
Tel:235701/6; Fax:235704 Res: 233863.
KAMPALA, UGANDA.

NICE
HOUSE OF PLASTICS

EDDIE K. SENKUMBA
GENERAL MANAGER WORKS

SHIP TOOTHBRUSH FACTOTY LTD.
P.O. BOX 5961
KAMPALA, UGANDA

TEL. 00256-41-259358/241802
FAX 00256-41-242455
TELEX 61281 SHIP UGA

Boniface K. Mwamuye
CHIEF EXECUTIVE
B.Sc., Dip. MALTING & BREWING

UGANDA BREWERIES LIMITED

P.O. Box 7130
Kampala, Uganda.

Tel: 220224/221587
Telex: 61218 UGA BREW.

Abdul Rahim
FACTORY MANAGER

AMBROSIA INTERNATIONAL LTD.
Head Office: POLKA ANNEX HOTEL METROPOLE BLDG.
CLUB ROAD, KARACHI-17
Factory: A-106-111 & 126-131 H.I.T.E. BALUCHISTAN
PHONES: Head Office: 526059-524271
Factory: 0202 - 32406
0202-32500-5-Lines

N. Matembe
Head Brewer
Bsc (MUK), Dip. H.W. (I.B.G.)

UGANDA BREWERIES LTD.

P.O.Box 7130,
KAMPALA UGANDA

Tel: 220224
Tlx: 61218 UGA BREW

Printpak

c/o Jang

SAEED A. CHAUDHRY

Printpak Uganda Limited

Plot 22 Eden Road
P O Box 1307, JINJA
Uganda.

Phone:-
20943/9
22167

TEAM CONSULTANTS Ltd

287.453

Stephen P. Nagenda
Director, Corporate Affairs,

P.O. Box 8658, Kampala, Uganda. Tel: 231737 Telex: 61081

225

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ASSOCIATED PAPER INDUSTRIES LTD.

KENNETH P.M. KABOYO
General Manager

Plot 11 - 15 Miro Road,
P.O. Box 1375 Jinja, Uganda

043-21306 (Dir) 21307 (Gen.)
Telefax:043-21306 Telex:64155

Telegrams:"UGAKRAFT"

V.K. Chaturvedi B.Sc. B.E. (Electrical)
RESIDENT DIRECTOR

CABLE CORPORATION LIMITED

Office & Works: P. O. Box 255, LUGAZI, UGANDA
Phone: (044) 48211/2/3
Dir: 48239

Kampala Office: Udyam House, Jinja Road
Phone: 041-341589
Telex: 041-61088
Fax: 041-345493

Midwest Chemists Limited

Pharmaceutical Stockists and Distributors

FRED T. TUMWESIGYE
EXECUTIVE DIRECTOR

15 Cooper Road
P.O. Box 3435, Kampala, Uganda

Telephone 242908
Res: 232446

MUKWANO FRIENDSHIP

C. J. SARASAN B.Sc. (Engg.) M. Tech
Factory Manager

MUKWANO INDUSTRIES (U) LTD.
(Regd. In Uganda)
Manufacturers of Edible Oil and Soap

30 Press House Road, P. O. BOX 2671, Kampala
Tel:235701/6; Fax:235704
KAMPALA,UGANDA.

IGNATIUS B. NGOBI
Production Manager

Dairy Corporation

PLOT 49/55 5th. Street
P.O. Box 7078
KAMPALA (Uganda)

TEL: 258751/5
TELEX: 61072
KAMPALA.

WABUYAAYU HONEY PROCESSORS CO. LTD.

JAMES K. BABUMBA
GENERAL MANAGER

P.O. BOX ~~[illegible]~~ 75
WOBULENZI (Uganda) East Africa

NGUVU

ABASI KAZIBWE MUSISI
PRODUCTION MANAGER

KAMPALA JELLITONE SUPPLIERS LTD.
(Coffee Roasters & Packers)
Plot No.259 SIR ALBERT COOK RD-NATETE
P.O. BOX 30430 - KAMPALA - UGANDA
TEL.OFFICE 241475 FACTORY 270887

MUKWANO FRIENDSHIP

Amirali Karmali
Managing Director

Mukwano Industries (Uganda) Ltd
30 Press House Road
P.O. Box 2671, Kampala
UGANDA

Tel: 235701/6
Fax: 235704
Telex: 61539

226

UMA
CONSULTANCY and INFORMATION SERVICES

William S. Kalema, Ph.D.
DIRECTOR

Plot 10, Kalitunsi Road
Industrial Area
P.O. Box 9113
Kampala, UGANDA

Tel (256) - 41 -236182
Fax (256) - 41 - 242455

UMA
CONSULTANCY and INFORMATION SERVICES

Fred Zake
LLM (L.S.E.), LLB Hons. (M.U.K.), Dip. L.P. (LDC)
SENIOR RESEARCH OFFICER

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Fax: (256) - 41 - 242455/236148

Plot 10 Kalitunsi Road, Industrial Area P.O.Box 9113, Kampala - Uganda

---

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BUSINESS ANALYST

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Fax (256) - 41 - 242455

Plot 10 Kalitunsi Road Industrial Area P.O.Box 9113 Kampala, Uganda

---

Erisa O. Ochieng
Director

EXPORT POLICY ANALYSIS AND DEVELOPMENT UNIT

Ministry of Finance
and Economic Planning

2nd Floor Impala House
Kimathi Avenue, Kampala
P.O. Box 10961
Phone: 231390
Direct: 231363
Fax: 231329

[redacted]

THE REPUBLIC OF UGANDA

HON. HENRY K. KYEMBA
B.A. (Hons) Hist., (London); M.A. (M.U.) U.S.A
MINISTER OF STATE FOR AGRICULTURE, ANIMAL INDUSTRY & FISHERIES

P.O. Box 102
Entebbe,
Uganda

P.O. Box 6997
Kampala
Uganda

Tel: Off. 20841 Entebbe
Res: 532492
Kampala
Jinja: 20731

Paschal Nyabuntu
Post Harvest & Marketing Specialist

EXPORT POLICY ANALYSIS AND DEVELOPMENT UNIT

Ministry of Finance
and Economic Planning

2nd Floor Impala House
Kimathi Avenue, Kampala
P.O. Box 10961
Phone: 231390
231363
Fax: 231329

Barnabas M Sekabembe
Agricultural Economist
Marketing Specialist

EXPORT POLICY ANALYSIS AND DEVELOPMENT UNIT

Ministry of Finance
and Economic Planning

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Kimathi Avenue, Kampala
P.O. Box10961
Phone/Fax: 231329

UMA
CONSULTANCY AND INFORMATION SERVICES LTD.

Frances Naonal
Research Officer

Plot 10, Kalitunsi Road
Bugolobi
P. O. Box 9113
Kampala, Uganda
Tel: (041) 236182
Fax: (041) 243292/242455/236148

James Mulwana
CHAIRMAN

UGANDA MANUFACTURERS ASSOCIATION

Plot 10 Kalitunsi Road, P.O. Box 5961, Kampala, Uganda
Telephone : 236148, 236182, Fax: 256-41-242455

Keith W. Sherper
DIRECTOR
UNITED STATES
AGENCY FOR INTERNATIONAL DEVELOPMENT
MISSION TO UGANDA

USAID
42 NAKASERO ROAD
KAMPALA, UGANDA

TELEPHONE 242[illegible]
241521
FAX. 256-41-233417

227

UGANDA NATIONAL BUREAU OF STANDARDS

Dr. E. Kasirye-Alemu

Executive Director

Plot 3/5 1st Street Industrial Area

P.O. Box 6329 Tel. (Off) 236606
Kampala, Uganda (Res) 236788

Mayambala Ronnie
C/Engineer
B.M.K. Industries
P.O. Box 10218
Kampala
Tel. 230783

CISSY NYARWA
NVIWODA
P.O. BOX 100714, KAMPALA
JAM JARS - 500gms CONTENT

E.C. Mugarura
Managing Director

Nile Grill International Limited

Uganda House Arcade
Plot 10 Kampala Road
P.O. Box 3583 KAMPALA UGANDA.
Telephone 243253 & 254623
Telex: 62034 'MEGA'
Fax: 233916

IN, Kwan-ihl
PRESIDENT

OVERSEAS ENTERPRISE LTD. OSEL
Manufacturers, Importers, Exporters.

RM. 1104, DAEHEUNG BLDG.
648-23, YEUKSAM-DONG,
KANGNAM-KU, SEOUL, KOREA
C.P.O. BOX 2988 SEOUL KOREA
FAX NO: 822-552-9322
822-563-4406
822-579-3667

TELEX: K25290 OVERSEL
CABLE: "KINSTEELCO" SEOUL
TEL: 822-552-9984
822-552-9985
822-552-9986

RAVI

Phones:
OFFICE: (042) 5831273
PLANT: (0468) 312720
RESIDENCE: (042) 440351

CONSULTANT /ADVISOR
M. AKHTAR DURRANI
M.Sc. (HONS.)
FOOD TECHNOLOGY

RAVI AGRICULTURAL & DAIRY PRODUCTS LTD.
AKRAM COMPLEX
MODEL TOWN/TOWN SHIP
LINK ROAD - LAHORE. PAKISTAN.

109_RAVI BLOCK
IQBAL TOWN
LAHORE 54570
PAKISTAN

M. Taner Atlagan
Production Manager

MIS DAIRY PRODUCTS INDUSTRY CO. INC.
Kemerdere Mevkii Yukari Dudullu 81250 Umraniye - Istanbul
Phone : (1) 364 10 18 / 6 Lines Direct : (1) 364 10 24 Telefax : (1) 364 10 64

Dr. M J HORNSBY MIM MIBF CEng
Senior Consultant
Manufacturing Systems

Myson House, Railway Terrace, Rugby CV21 3HT, UK
Tel: (0788) 560631 • Telex: 317466 ITDG G • Fax: (0788) 540270

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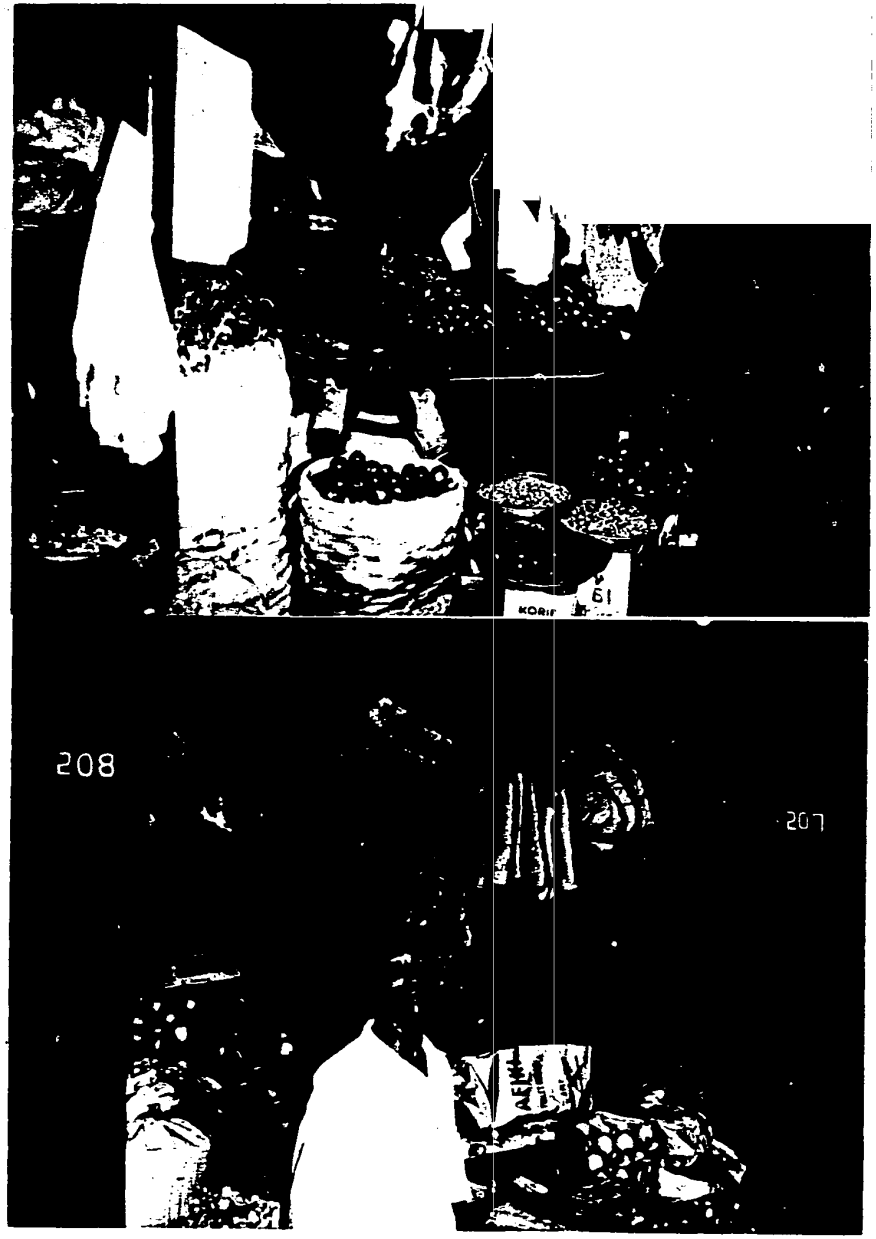
228

Attachment #9

Photographs of Uganda



BEST AVAILABLE COPY **The Open Market**

230

231

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As much as 50% of all food will be lost to vermin and spoilage

Dried Talapia Fish at Open Market

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232

Open Market Scenes (People have much to eat)

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Friendly Faces at the Open Market

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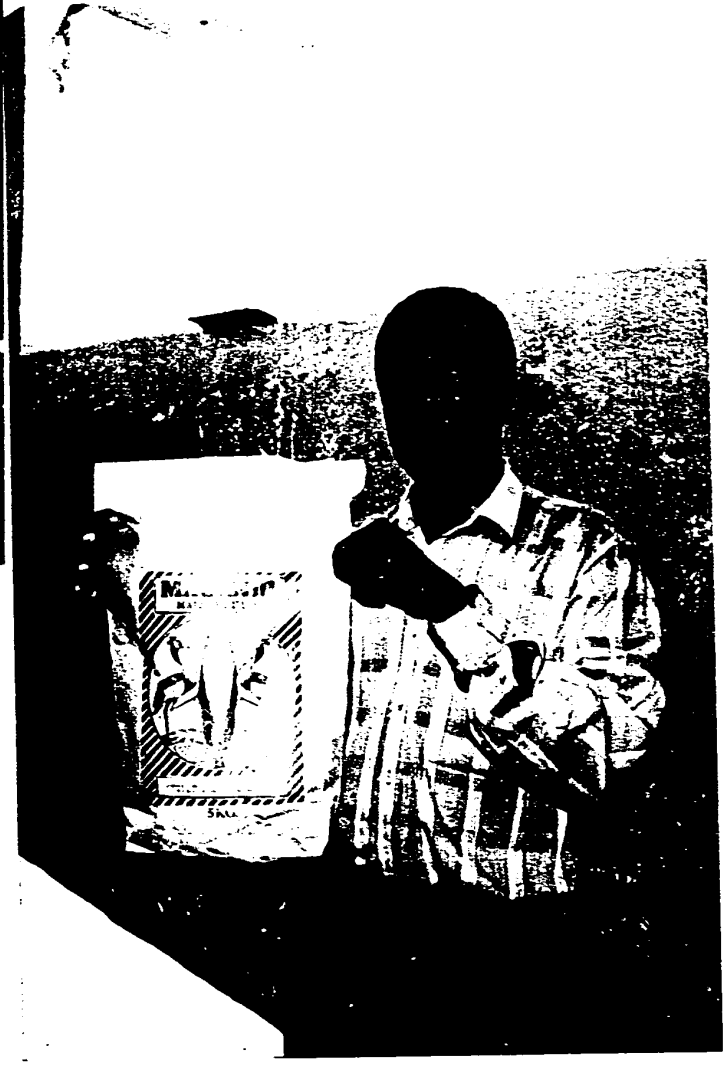

Magamba Millers

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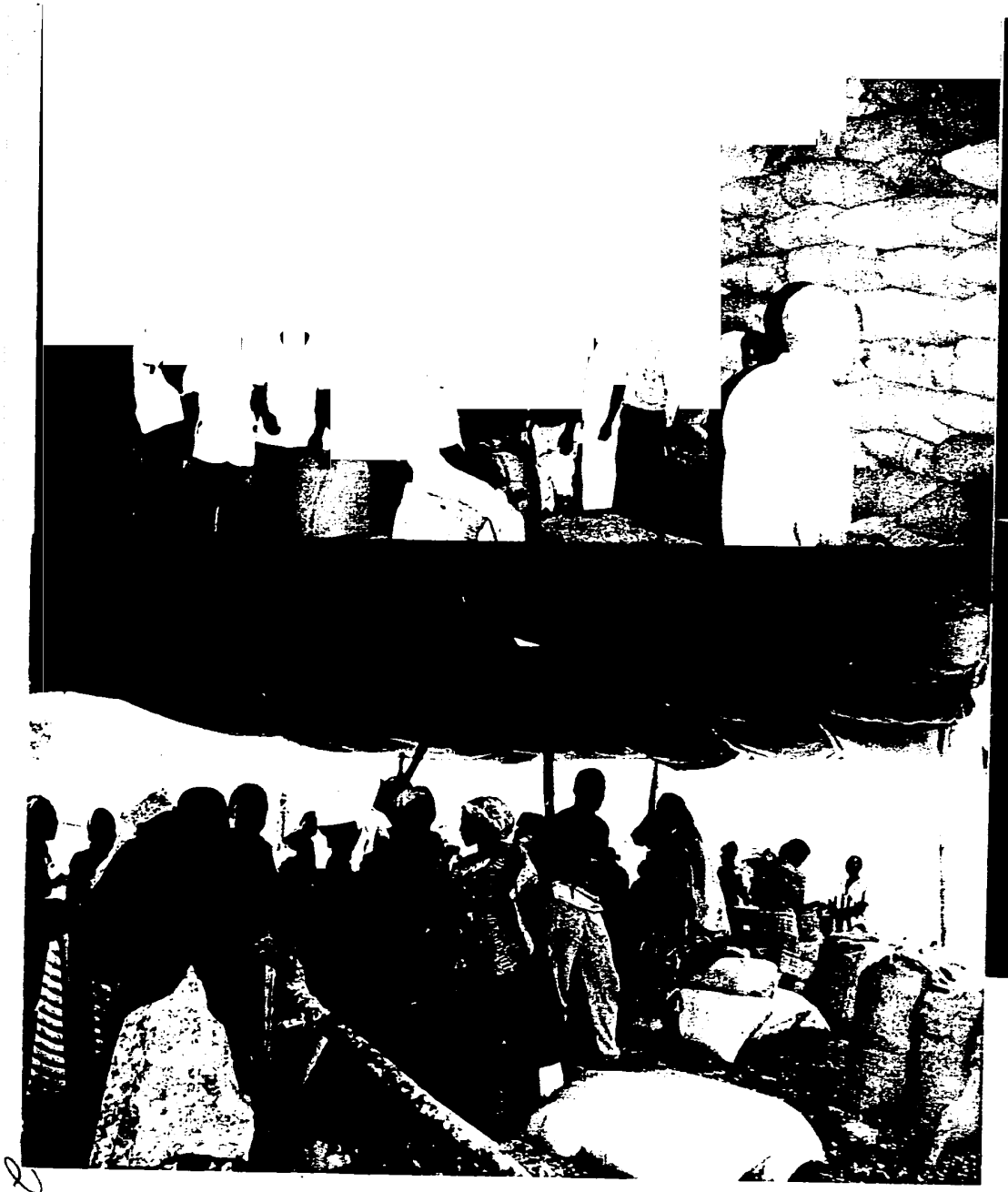

Maganjo Grain Millers' Employees

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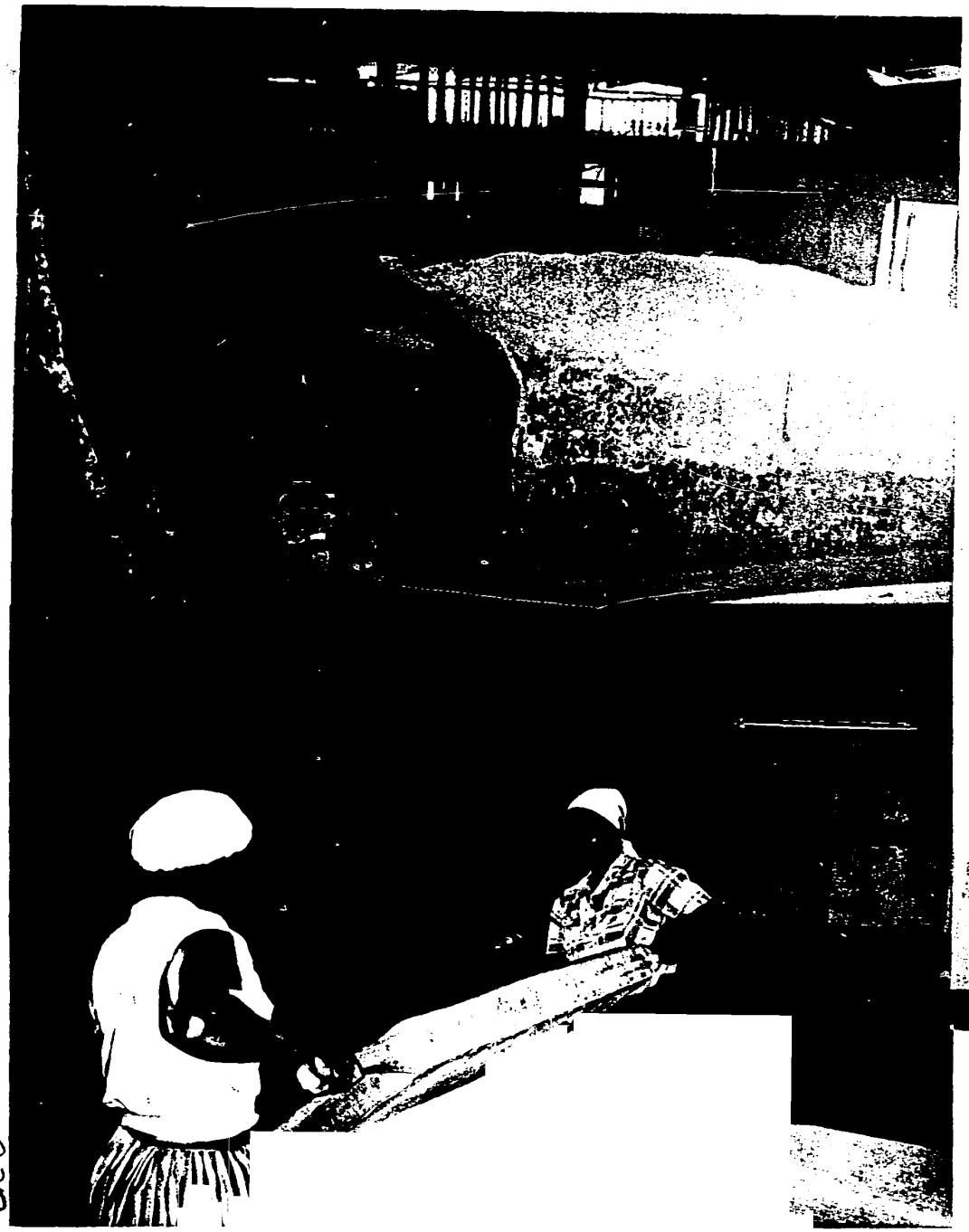
236



Wood Furnace (top left) for Roasting Soy

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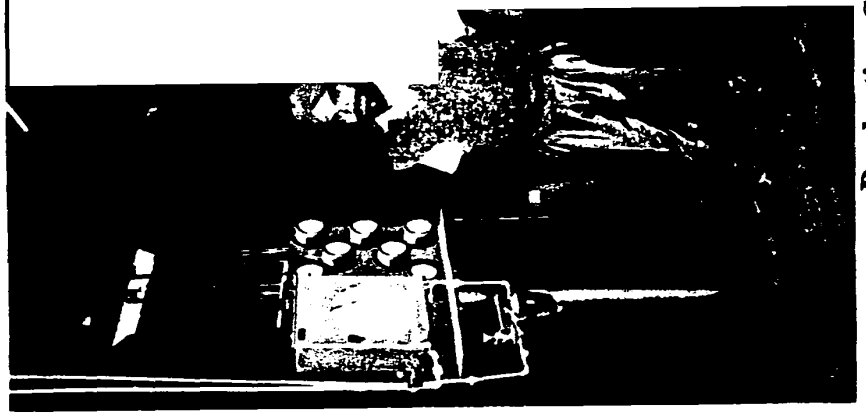
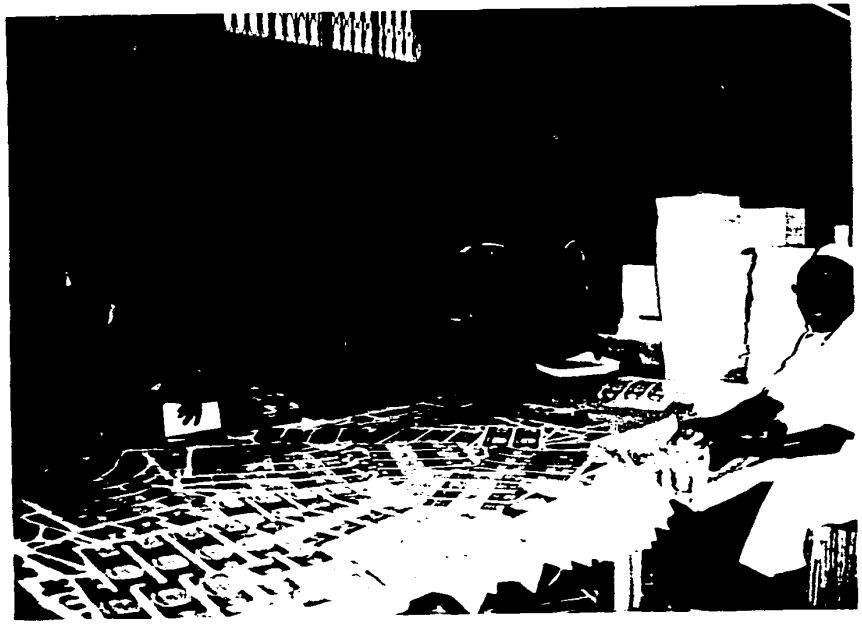
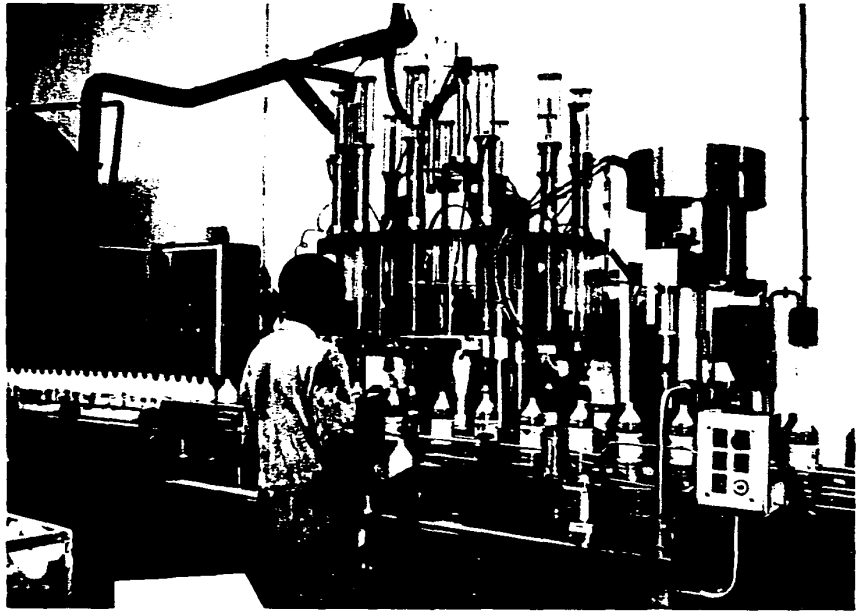


Production Supervisor



Mukwano Industries Label Makers



Cooking Oil Lines

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238

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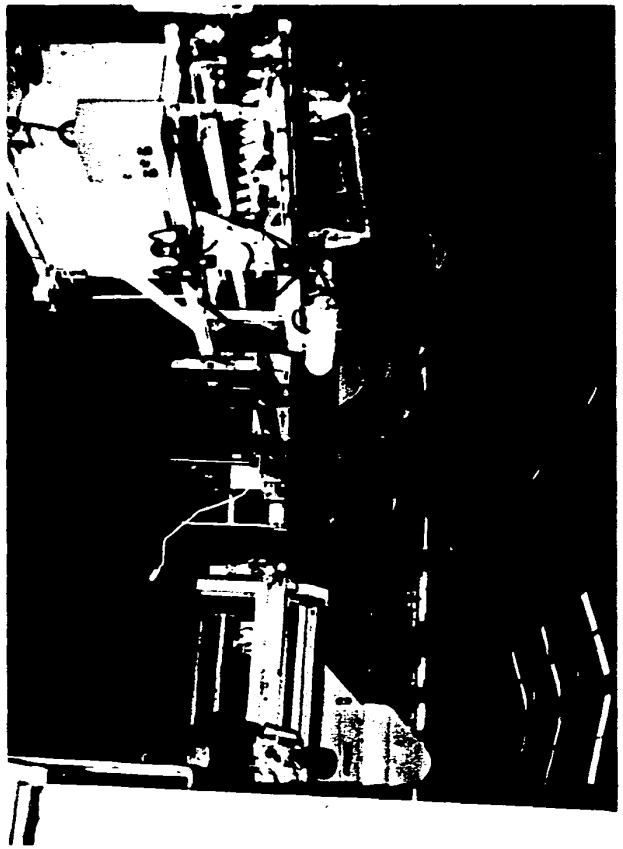
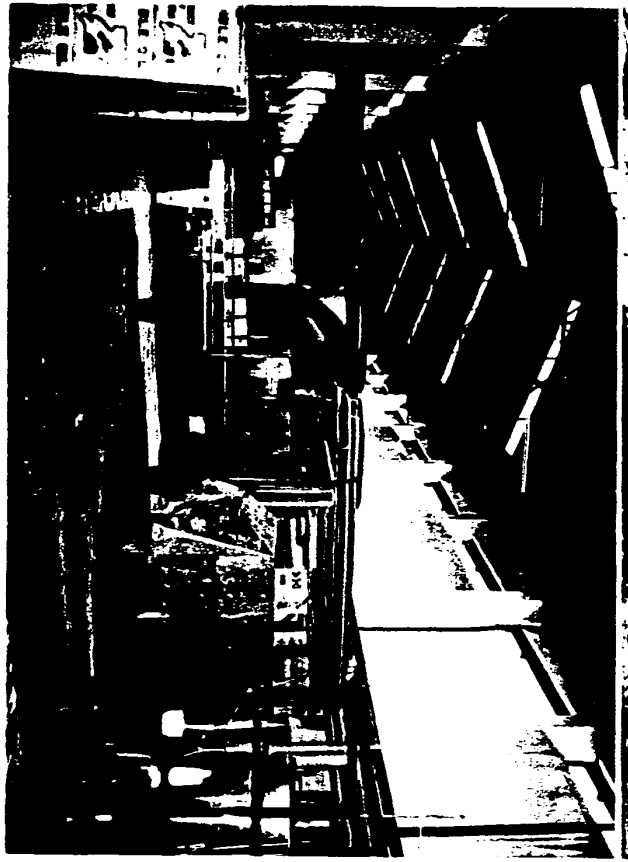
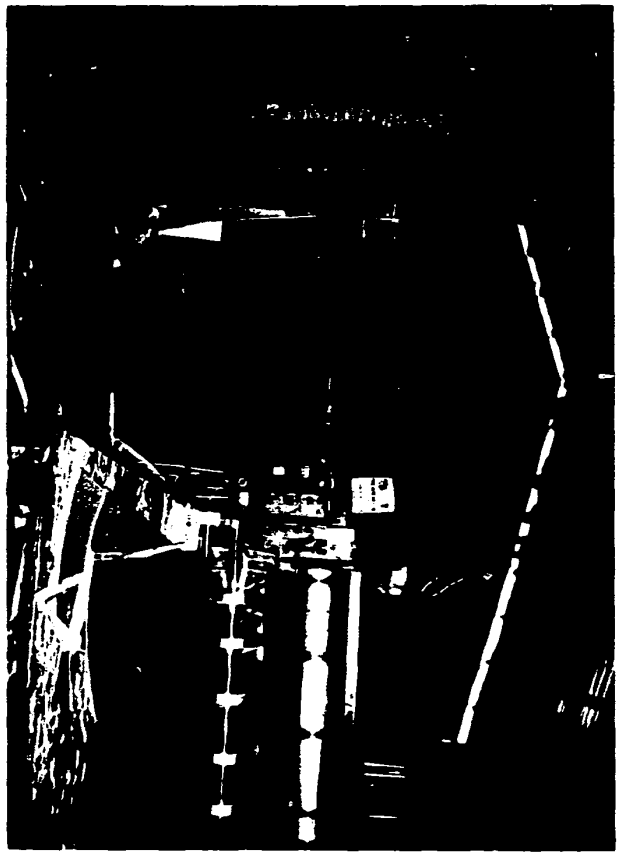


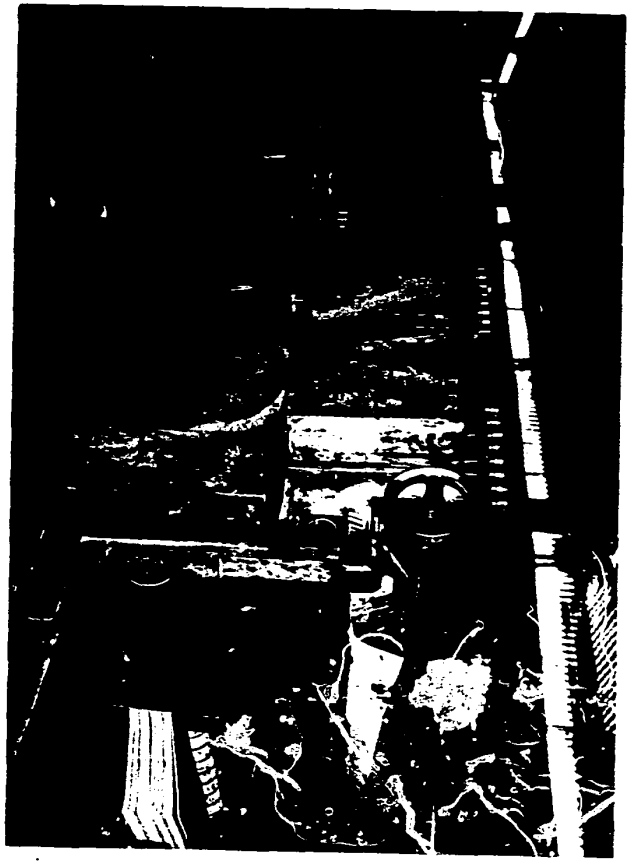
Mukwano Ind. Bar Soap Line



Automated Bottling/Pail Lines

Waste Water Treatment





Mukwano Ind.
Corrugated Shippers Made, Printed, and Stapled into Finished Boxes

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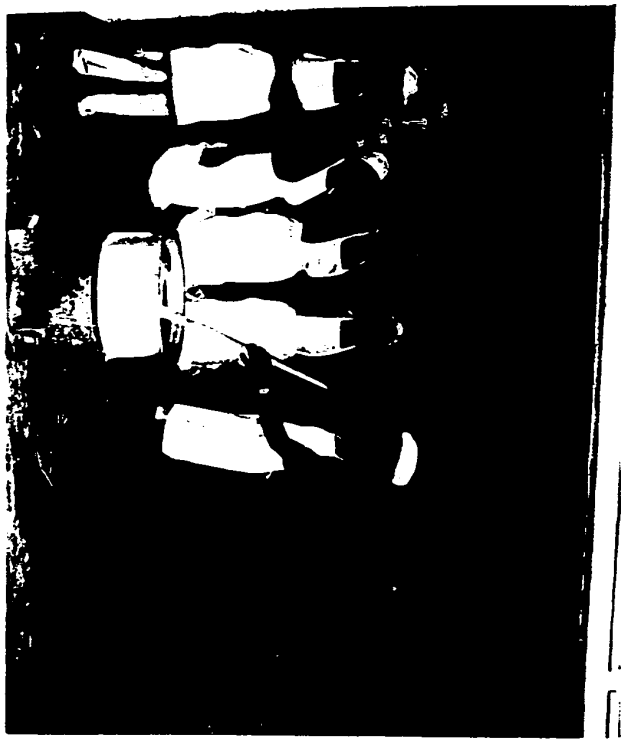
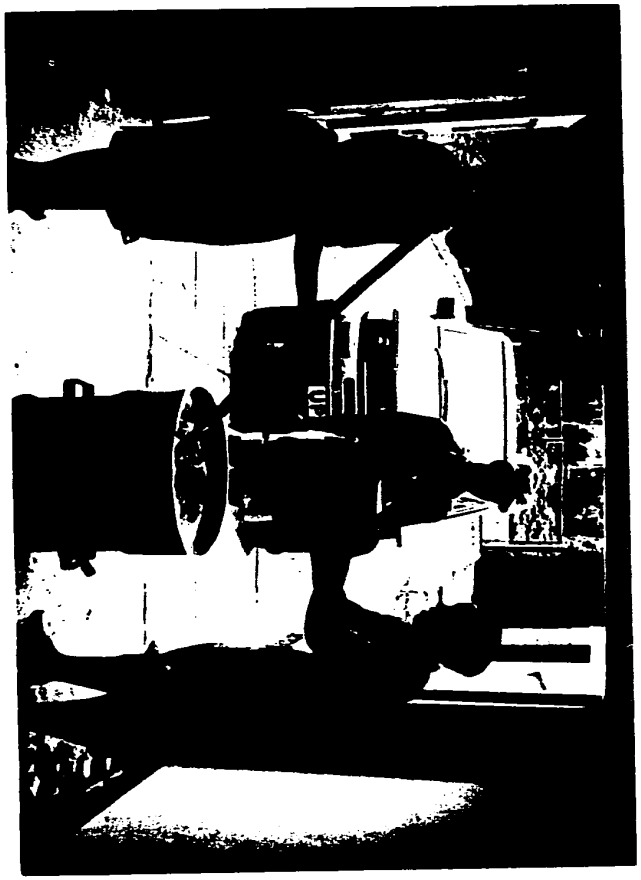
240





Jewel of the Nile "Jams and Jellies" Team

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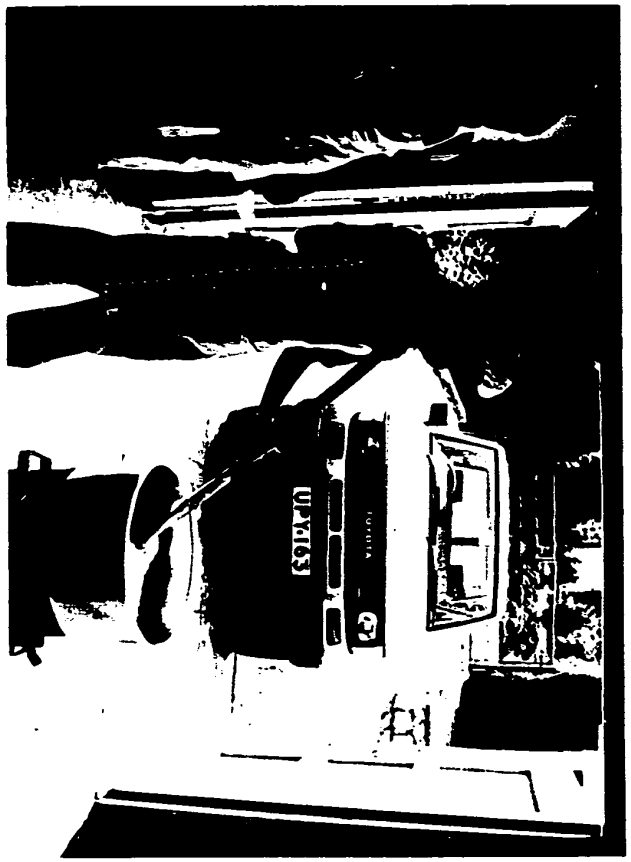

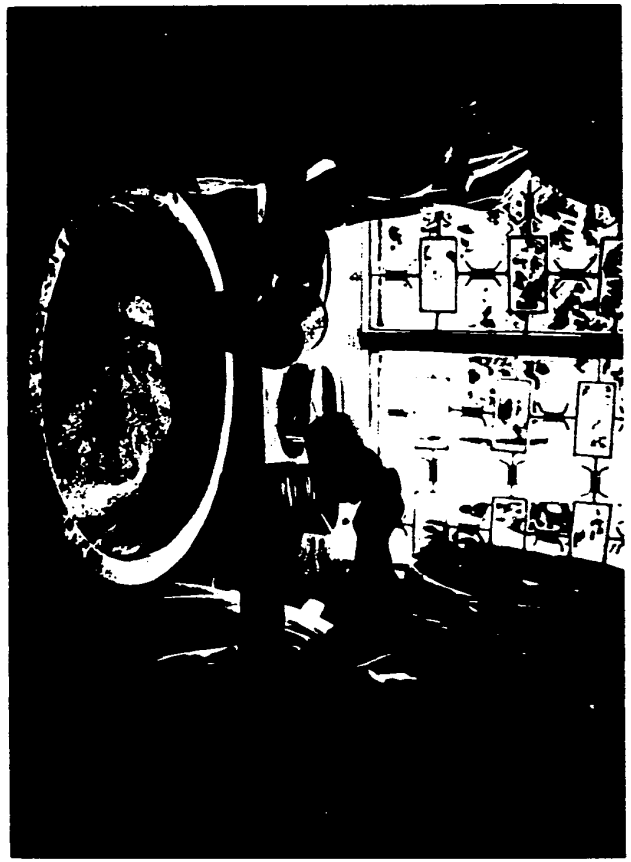

Jewel of the Nile "Jams and Jellies"

242

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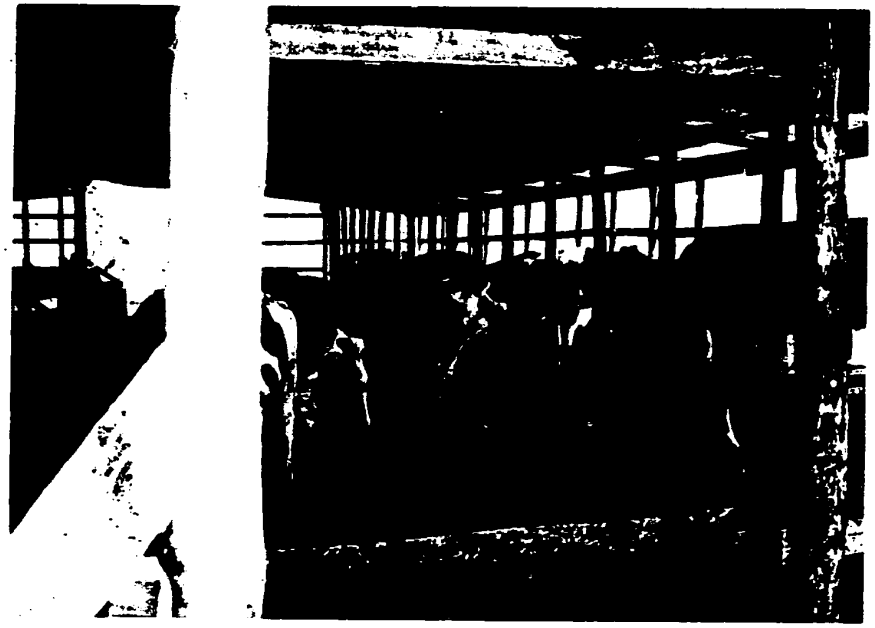
Mr. Bakoja & his Home on Lake Victoria

In-ground Silo, Silage Remains Fresh and Moist Year-around



Stables at Liberty Dairies

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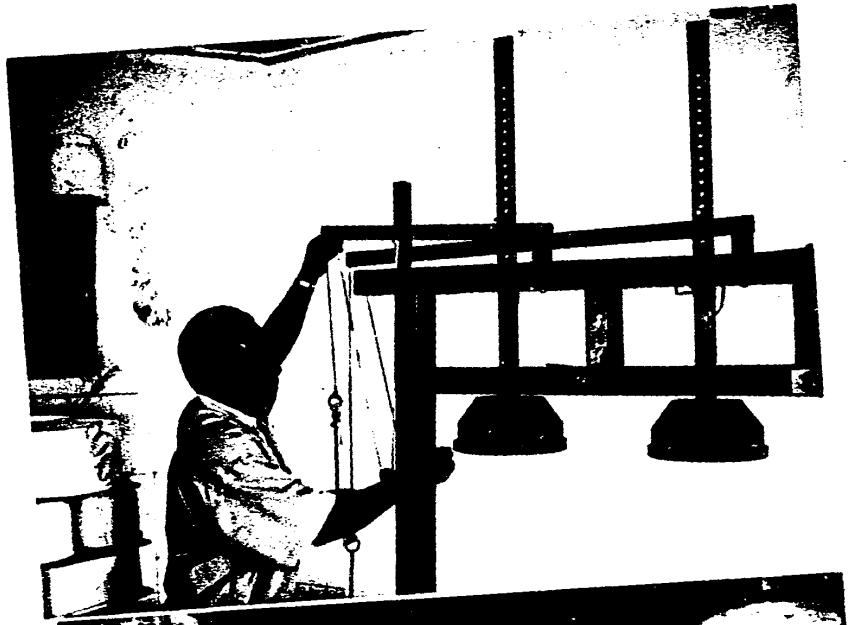
244



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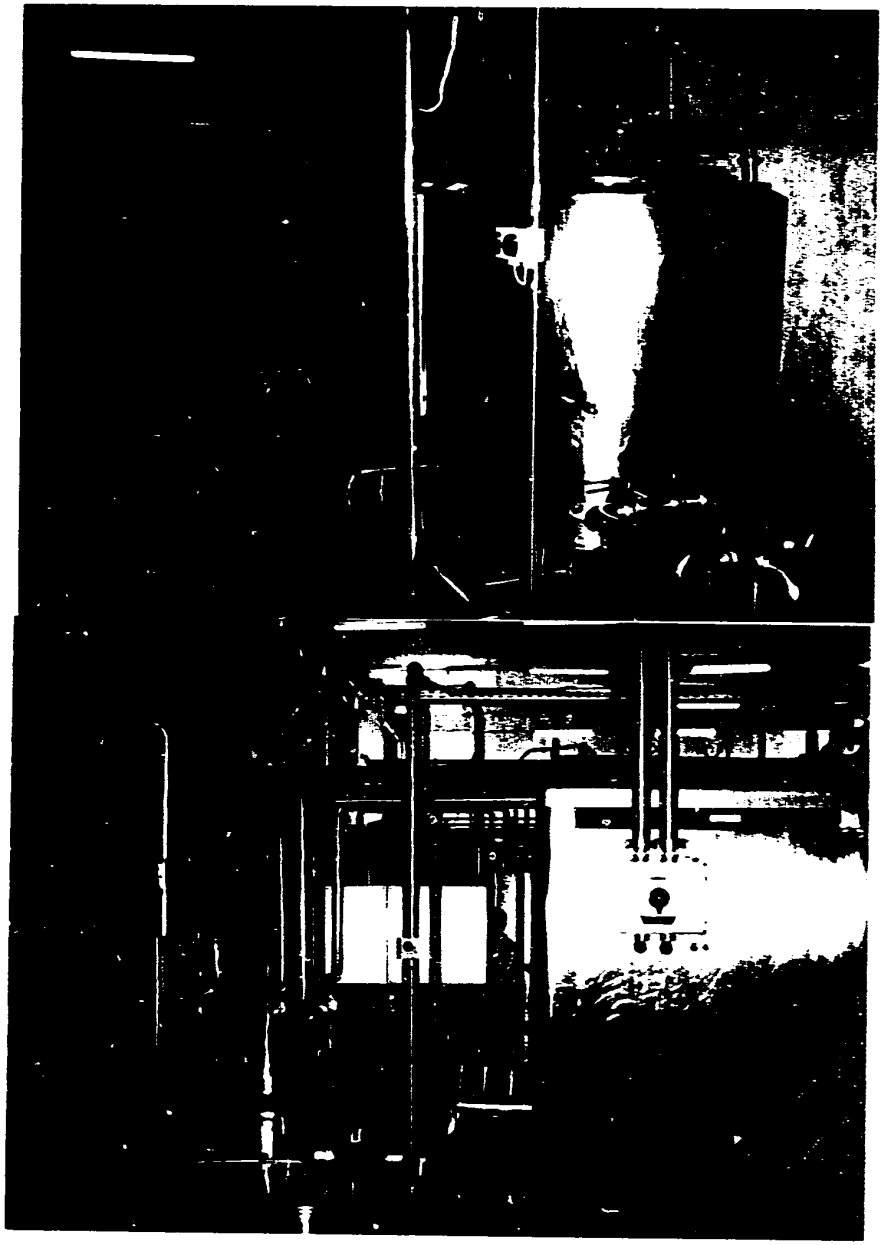
Gouda Cheese Operation at Liberty Dairies



The Facilities at the Dairy Corporation

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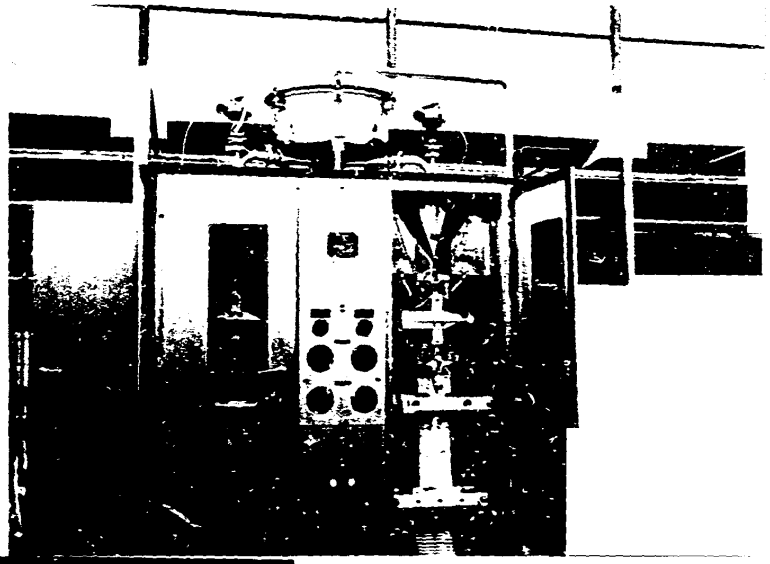

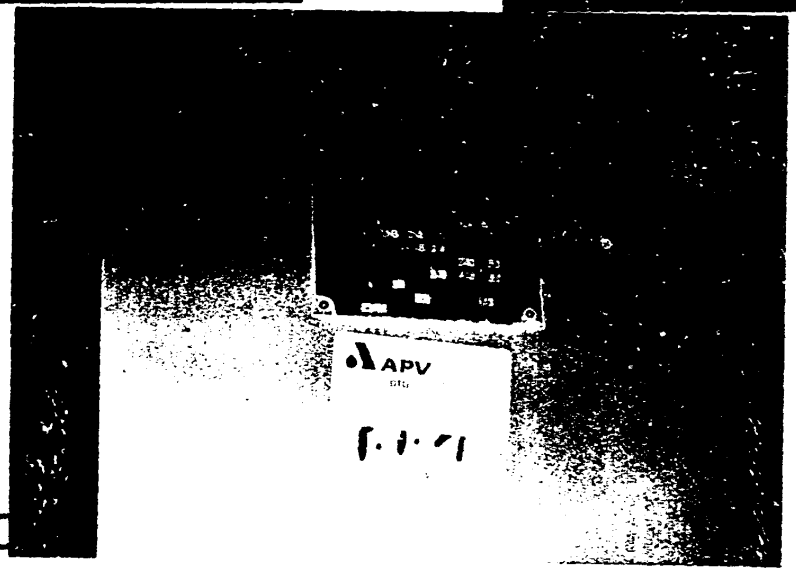

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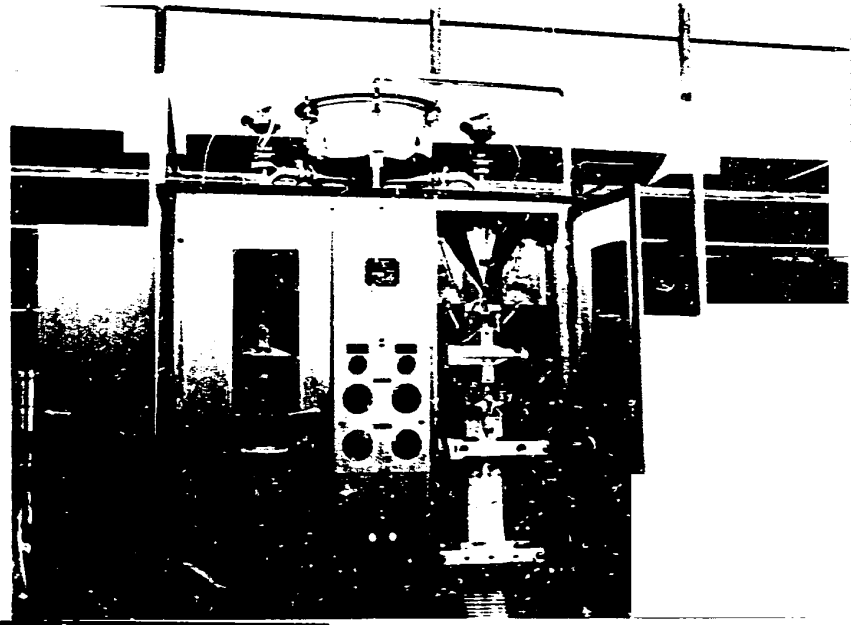
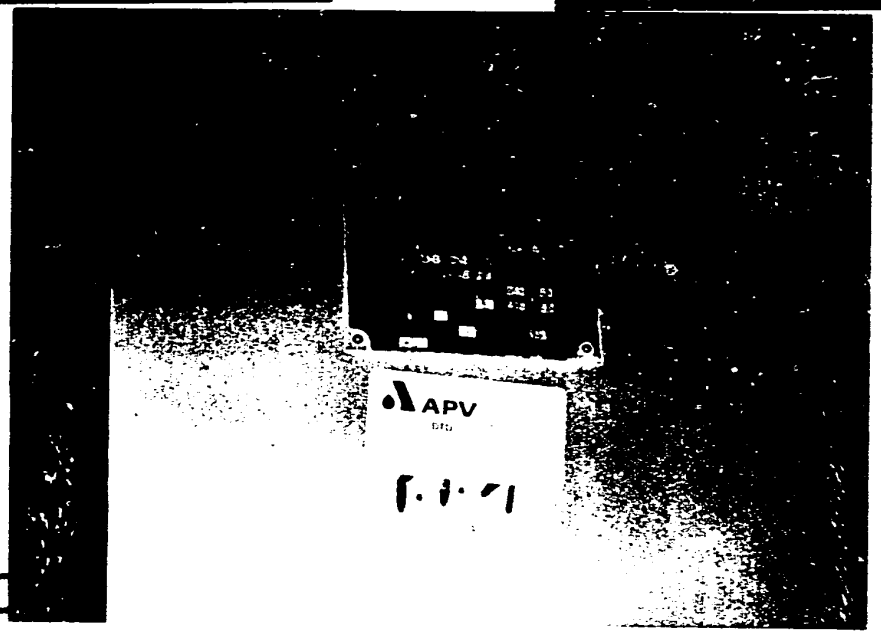
Top of the Line Dairy Equipment at the Dairy Corporation





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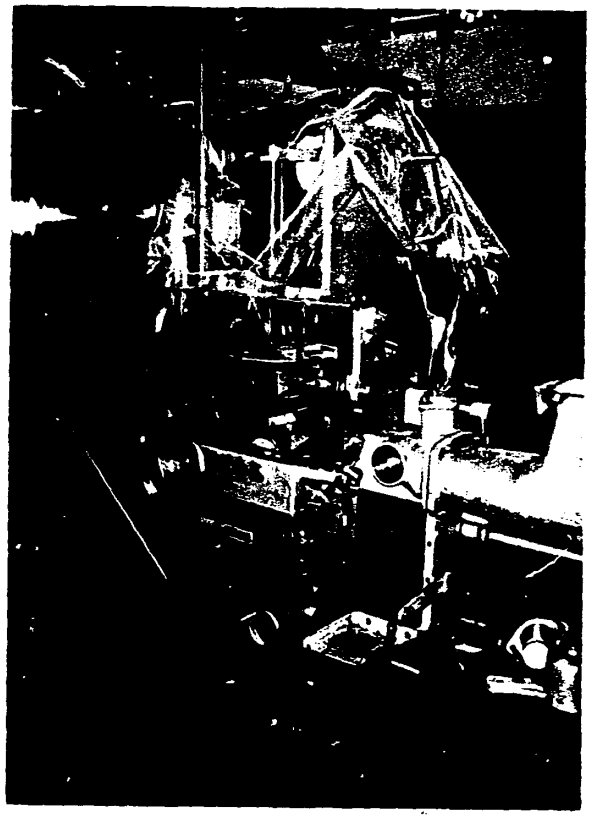
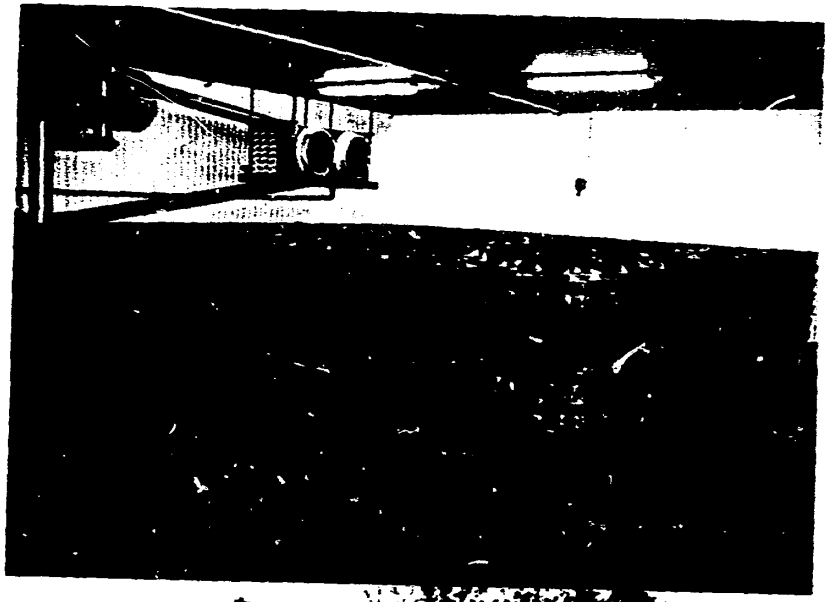
Top of the Line Dairy Equipment at the Dairy Corporation



Dairy Corporation Equipment



Bags of Milk in Cooler
Ready for Distribution

Beef Cattle from Achuli Tribe

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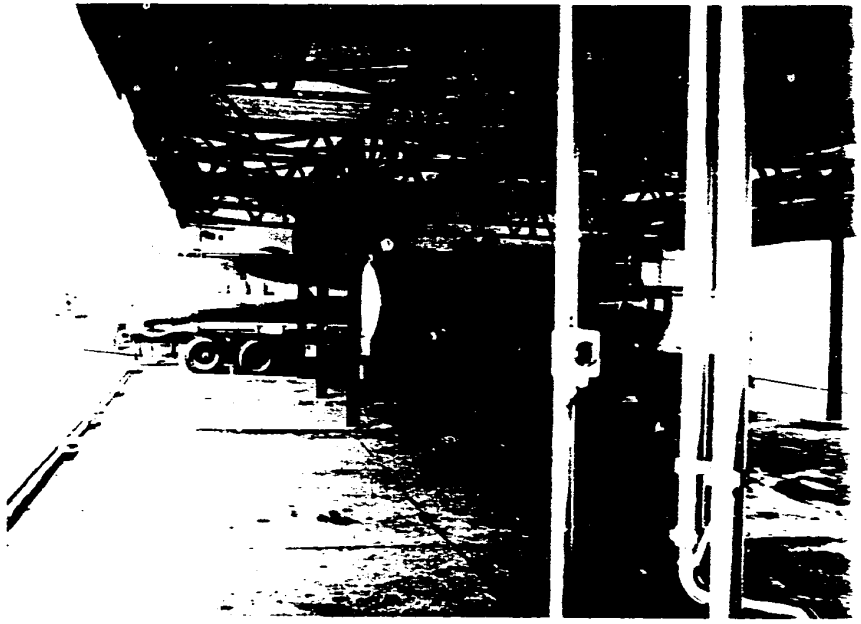

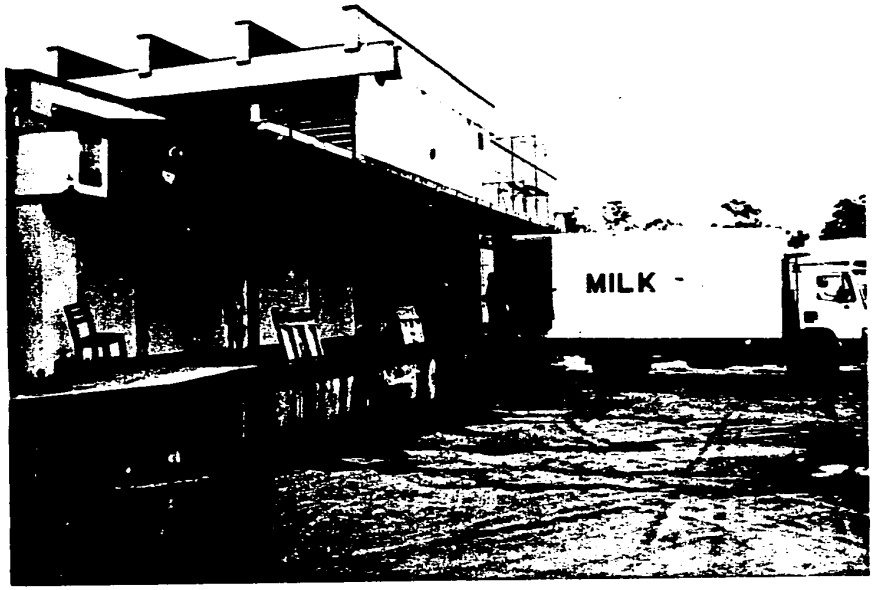

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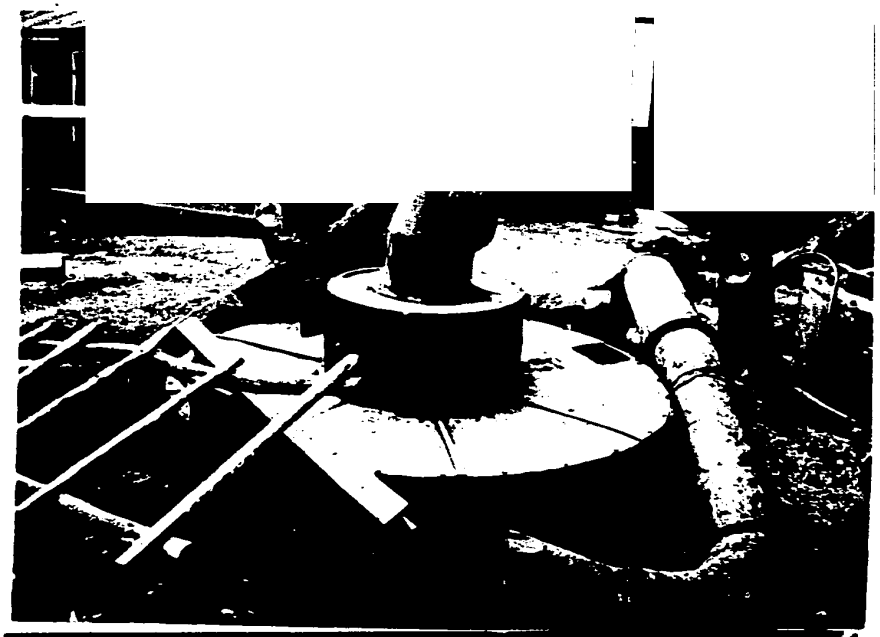
Loading Docks and Transportation at the Dairy Corporation

245



Hand Made Roaster

Coffee Producer who Fabricates All his Own Equipment from Collected Junk

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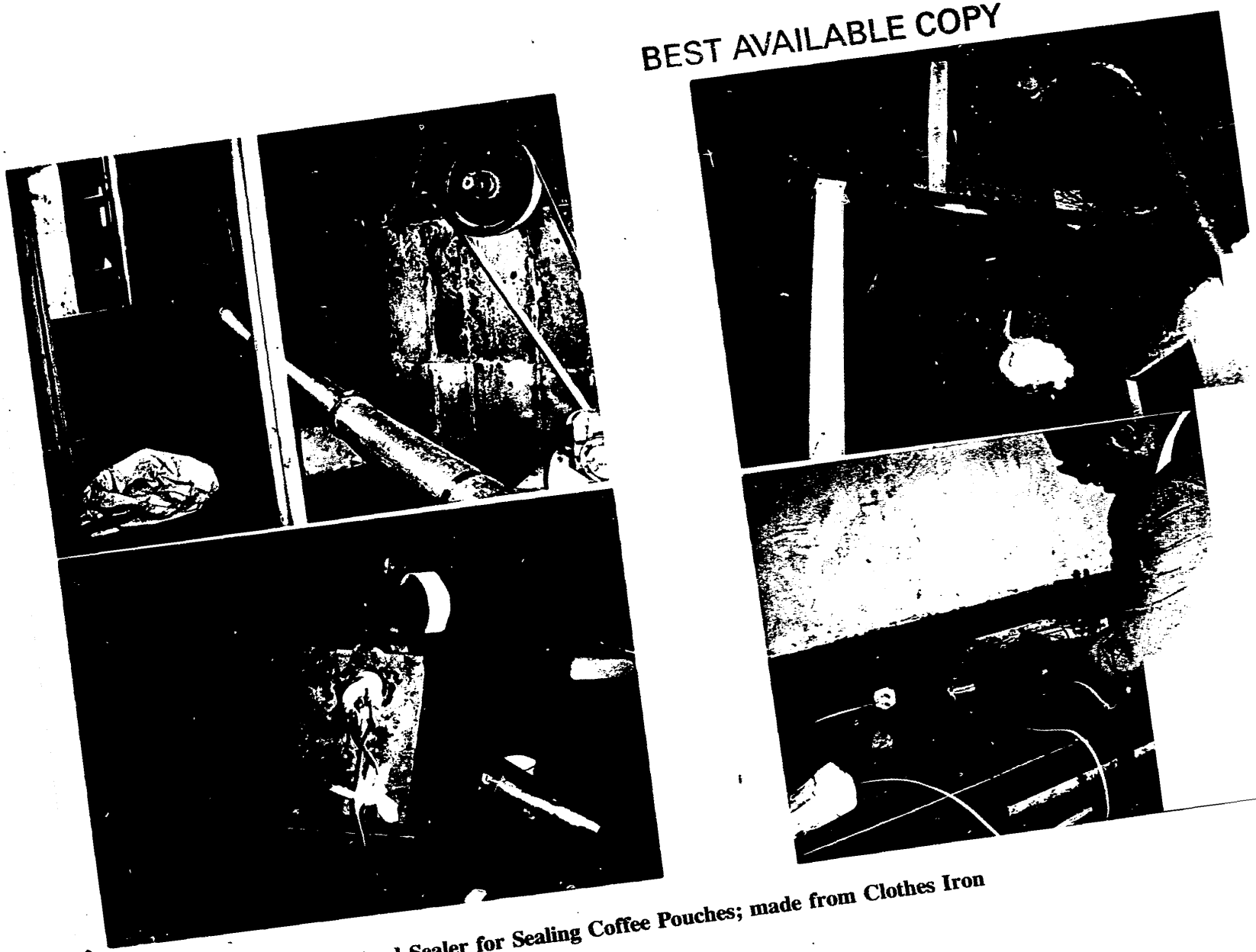
BEST AVAILABLE COPY



Hand Sealer for Sealing Coffee Pouches; made from Clothes Iron

Mr. Musisi (top left) and his "Family" of Employees (top right)
More Hand Fabricated Equipment Below

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Scenes from Uganda Country-side

Water Buck Hippopotami

Musk Oxen (Water Buffalo)

Wart Hogs

You Never Know What You Might Run into Along the Road

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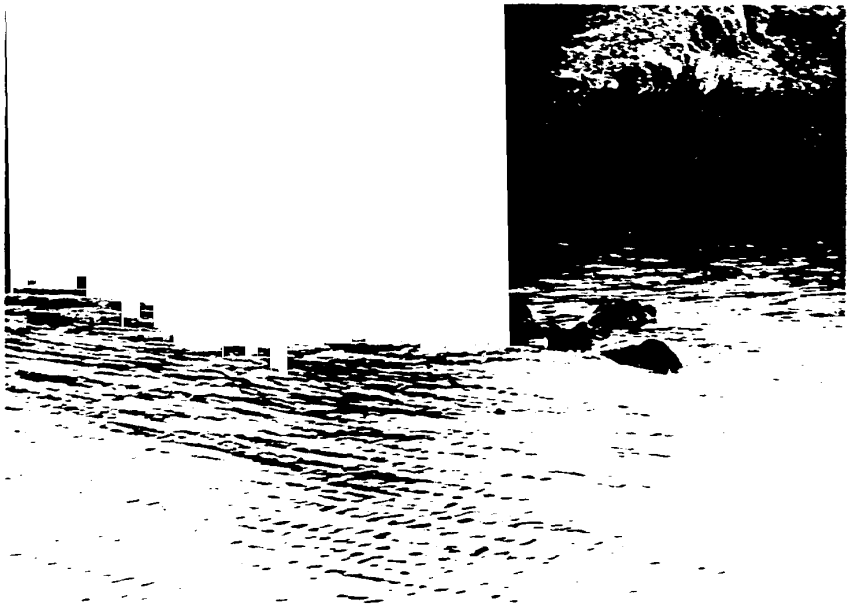
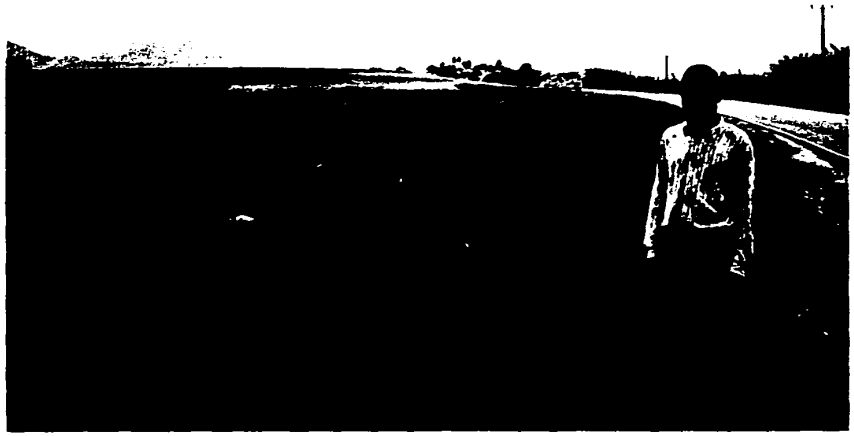
Sample of Some of Uganda Wild-Life





Tea Plantation

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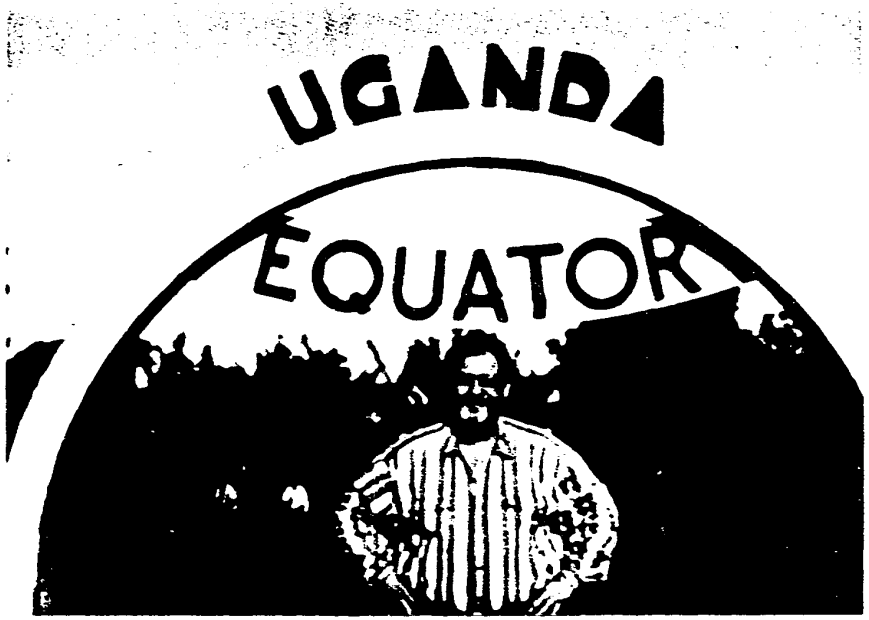
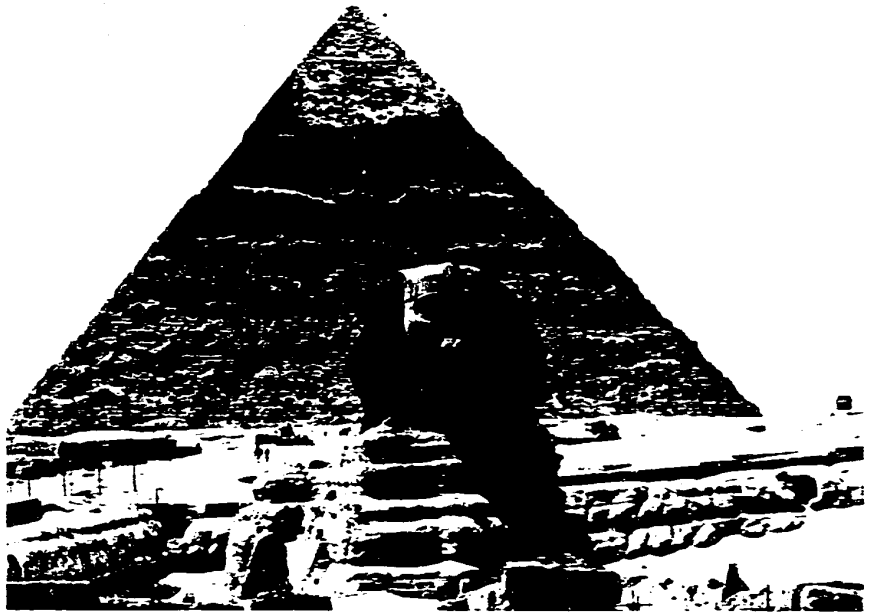
256

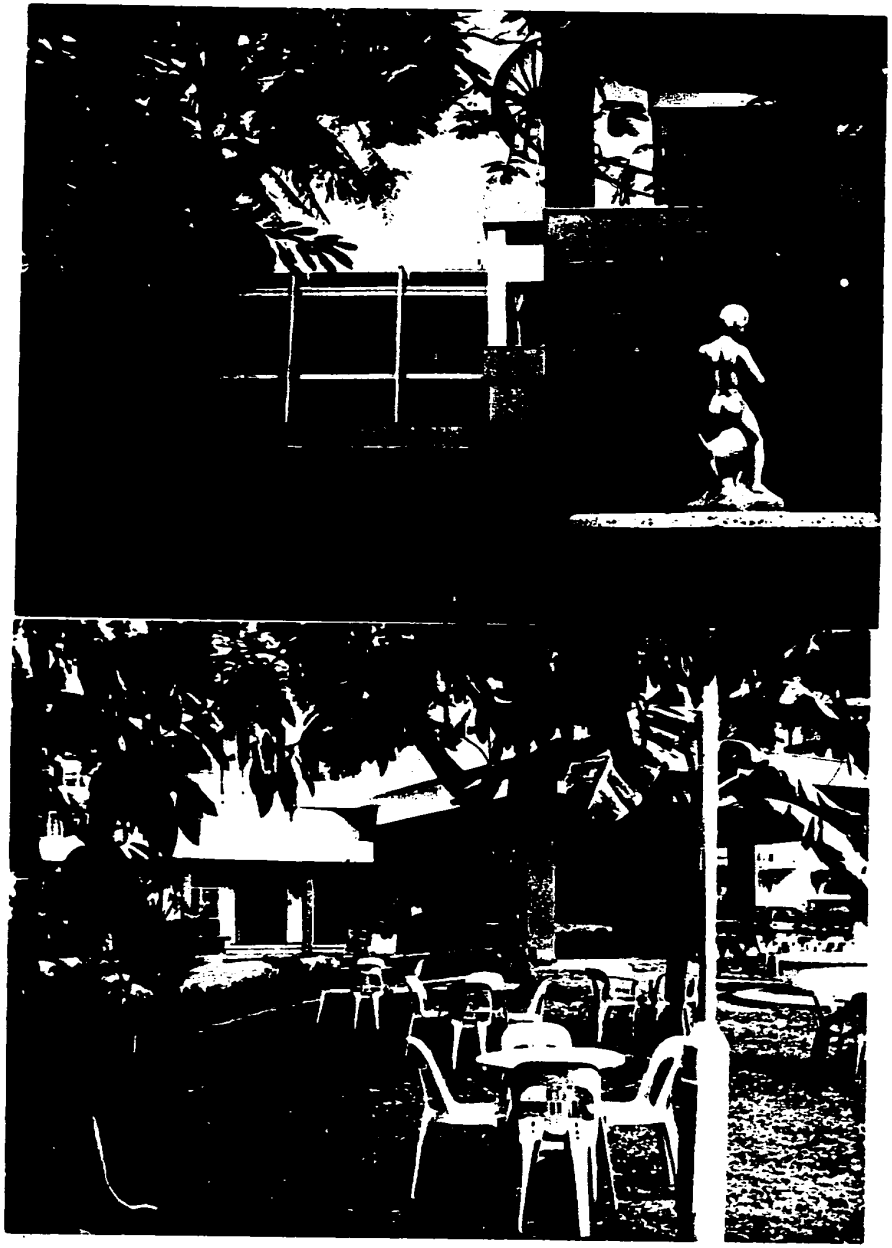
Traditional Home (top left)
Women using Traditional "Bark" Clothing





One of the Great Pictures taken at Giza on the Way Home

BEST AVAILABLE COPY



Fairway Hotel

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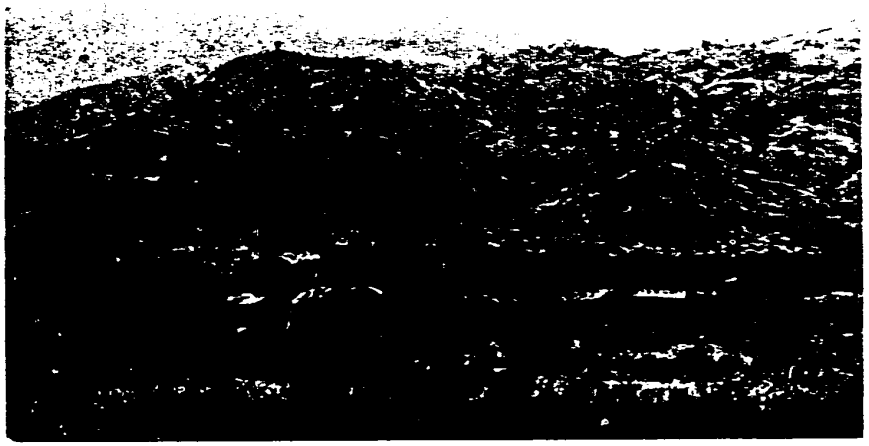
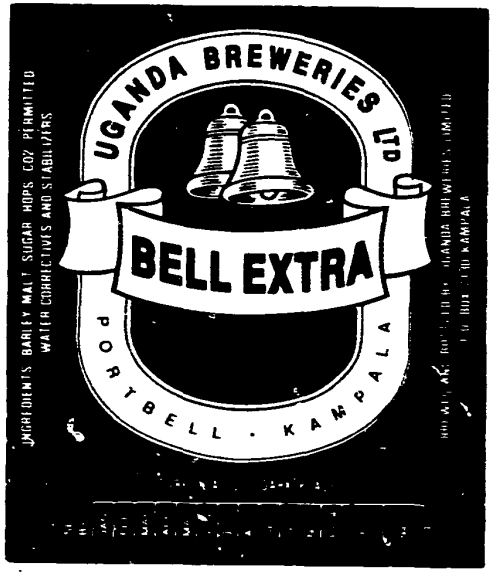


Contrast with Rural Hotel near Zaire Border and Rzori Mountains



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960

III. REPORT BY UGANDA MANUFACTURERS ASSOCIATION

UGANDA MANUFACTURERS' ASSOCIATION CONSULTANCY AND INFORMATION SERVICES (UMACIS)

SHARING UNITED STATES TECHNOLOGY IN THE IMPROVEMENT OF NUTRITION (SUSTAIN) PROGRAM IN UGANDA

Visit to Uganda by Mr. Don Lindemann,
Senior Packaging Engineer, Land O' Lakes, Inc.

August 22 - September 1, 1993

261

INTRODUCTION

The Uganda Manufacturers Association, UMA, has been selected by Project SUSTAIN (Sharing U. S. Technology to Aid in the Improvement of Nutrition) as the coordinating institution for its activities in Uganda. With the support of the United States Agency for International Development (USAID) and SUSTAIN, the UMA hopes to strengthen the local food processing industry and improve nutrition in Uganda. This will be done through USAID funded workshops on product packaging, quality control/quality assurance and product marketing, and one-on-one consultations by SUSTAIN consultants with individual companies. The first workshop on Product Packaging was from August 24-25, 1993.

PRODUCT PACKAGING WORKSHOP

Introduction

Mr. Don Lindemann, Packaging Consultant and Packaging Engineer, Land O' Lakes was in Uganda from August 22 to September 1, 1993, during which he conducted a two day Packaging Workshop for packaging and food processing companies. Mr Lindemann also had one-on-one consultations with food processors in different sectors and packaging companies.

The two day Packaging Workshop from August 25-26, 1993 was held at the Uganda International Conference Centre, Kampala. The workshop was attended by over seventy participants from the food processing and the packaging industry. Participants also included representatives from the USAID, Volunteers in Overseas Cooperative Assistance (VOCA), the National Council for Science and Technology, the Ministry of Agriculture, Animal Industry and Fisheries and the Ministry of Trade and Industry, the Food Science and Technology Department, Makerere University, the Export Policy Analysis and Development Unit (EPADU), and the Uganda National Bureau of Standards, (UNBS).

Specific Objectives of the workshop

The packaging workshop was aimed at emphasising the role of packaging in the maintenance of product quality. The workshop addressed:

- the importance of packaging and the various aspects that have to be considered in good packaging practice.
- available packaging technologies, materials and packaging methods on the international market.

The workshop was opened by Honourable Henry Kyemba, Minister of State for Agriculture, Animal Industry and Fisheries and was chaired by Dr William Kalema, Director UMACIS. Mr. Don Lindemann of Project SUSTAIN, conducted the workshop which was also addressed by representatives from the Food Science and Technology Department – Makerere University, UNBS and EPADU. UNBS, Makerere University and EPADU used this workshop to raise awareness among food processors and other entrepreneurs who need to improve their product packaging, of the facilities and services offered by these agencies. The presentations by the Food Science and Technology Department – Makerere University, the Uganda National Bureau of Standards and the Export Policy Analysis and Development Unit (EPADU), described the role of each organisation in promoting good packaging practice in Uganda. Copies of these presentations are attached.

Mr Lindemann used samples, slides, video tapes, books and magazines to illustrate the different packaging materials and methods used in industries world-wide. Participants were divided into groups according to their different sectors. This was to enable participants to discuss their problems and arrive at common solutions. Working group recommendations were shared with other groups in the general discussion. At the end of the workshop each participant was requested to comment on the organisation, arrangements and substance of the workshop deliberations and to list the problems faced by their companies, and how these problems could be solved.

Working Group Discussions

Participants were divided into three discussion groups; dairy and meat industries, fruit and vegetable processing industries, cereals and edible oil processing industry. Each group had a representative from the packaging industry. The purpose of the working group discussions was to hear from participants how their industries are faring, the problems they are facing and to enable participants to make recommendations as to how some of these problems can be solved.

Participants appreciated the role of good product packaging in maintenance of product quality in addition to adding aesthetic appeal to the product. For the next workshop, participants would be very interested in discussions on sources of packaging technologies that can be used by developing countries. They would also like to know advantages and disadvantages of locally available packaging materials for different products and ways of improving their quality.

SITE VISITS

Mr Don Lindemann visited twelve companies (see attached programme) in the food processing and in the packaging industry before and after the workshop, to enable him to make an on-the-spot assessment of the packaging materials available, the problems these companies are facing, the issues in packaging which need to be seriously emphasised in the workshop and what locally available capabilities could be developed to improve the quality of existing packaging. Mr Lindemann visited twelve companies involved in making kraft paper packaging, corrugated paper packaging, high density polyethylene bottles and low density polyethylene film plastics packaging, grain milling, jam making from pineapple and pawpaws, coffee processing, cheese making, dairy processing, edible oil processing, meat and fish processing, and brewing.

MEETINGS AND DISCUSSIONS

Meetings and discussions were also held with the Chairman, Uganda Manufacturers Association, the USAID Mission Director and Staff, the Executive Director, Uganda National Bureau of Standards, the Director, Export Policy Development and Analysis Unit (EPADU) and with the Acting Head, Food Science and Technology Department Makerere University.

Problems identified

- Low quality of local packaging materials and labels; currently labels produced by local industries have inconsistent quality and designs. Good labels have to be imported and this increases packaging costs. Some companies compromise the quality of their packaging to keep production costs low. Packages are also not always strong enough to withstand the stress subjected to them.
- There is under investment in research and local industrialists do not seem to attach much importance to the role of packaging in maintenance of product quality.
- Lack of information on existing cost effective packaging technologies on the market, that can be adopted by developing countries such as Uganda.
- Low quality labels.
- Lack of trained personnel in packaging technology.
- Lack of information on the different packaging materials available. Most companies end up importing at high costs, packaging materials that are not suitable for their products. In addition, food processing companies lack information on food grade packaging materials especially food grade plastics.

Recommendations

- Local industrialists, Makerere University and the Uganda National Bureau of Standards should increase their cooperation and share information on good food processing techniques and how to improve quality of available packaging and food grade packaging materials. Emphasis should be on environmentally friendly packaging materials;
- The University requires funding to carry out its research work; Industrialists should be involved in research work from which they will directly benefit. Their contributions would include funds for laboratories, equipment and research materials at the Food Science Department, Makerere University.
- A Packaging school should be established to train both students and industrialists in use of packaging technologies, improvement of packaging materials and good packaging methods.
- Local designers and label making companies need technical assistance on technologies and ways of how to improve on quality of their products;

CONCLUSION

The workshop was an important step forward in the direction of improving the quality of packaging in contemporary Uganda. It enabled the various industries and support institutions to meet and exchange ideas and to make recommendations aimed at improving packaging. It is hoped that the lessons learnt will be implemented, and follow up action by the various institutions so as to help local industries to improve their packaging methods will be made. This will ensure that the efforts initiated by Project SUSTAIN have not been in vain and will also build manufacturers' confidence in the different institutions. As long as good packaging practice is implemented in our food processing companies, the Ugandan population will be assured of better quality food products.

PACKAGING WORKSHOP
AUGUST 25 - 26, 1993

LIST OF PARTICIPANTS

1.	African Basic Foods	Mpyisi Mr. Esri
2.	Associated Paper Industries	Chatwiredi Mr. V.K.
3.	Associated Paper Industries	Kaboyo Mr. Kenneth
4.	Associated Press	Odong Mr. James
5.	B.K. Industries	Kyakulumbye, Mr. A.K.
6.	Beatie-Ka	Kasekende Ms. Jacque
7.	Beatie-Ka	Katabarwa Mrs. Beatrice
8.	Bunyama Construction	Ssebowa Mr. P.
9.	Casacorp	Kotecha Mr. Surendra
10.	Century Bottling Company	Mwanja, Ms. Eleanor
11.	Corpus Food Processors and Packers	Gamwanga Mr. Godfrey
12.	Crafts Bazaar (U) Ltd.	Nsibirwa Ms. A.
13.	Dairy Corporation	Ngobi Mr. I.B.
14.	Dairy Corporation	Oyo Mr. Constatine Mike
15.	Deeps	Namukasa Ms. Aida
16.	East Ankole Diocese	Tibamwerayo Rev. A.
17.	Eje Enterprises Ltd.	Emomen Mr. Julius
18.	EPADU	Nyabuntu Mr. Pascal
19.	EPADU	Ochieng Prof. Erisa
20	Farmfoods Manufacturing Co.	Baingana Ms. Martha
21.	Finance and Trade Press	Sebbowa Ms. Ester
22.	Food Pak	Ocitti Ms. Harriet
23.	Makerere University	Byaruhanga Mr. Yusuf
24.	G.M. Combine	Kajubi Mr. Tom
25.	Jewel of the Nile	Mirembe Ms. Faith
26.	Jewel of the Nile	Okiror Mrs. Miriam
27.	Kabuli Farmers and Millers Ltd.	Wambuzi Mr. Robert
28.	Kakira Sugar Works	Kamate Mr. R.P.
29.	Kakira Sugar Works	Margabhandu Mr. A.J.
30.	Ministry of Agriculture, Animal Industry and Fisheries	Sentubwe Dr. Juliet

31.	Kampala Bottlers Ltd.	Sepuya Ms. Mary
32.	Kampala Jellitone Suppliers Ltd.	Musisi Mr. A.K.
33.	Kamwezi Agricultural Enterprises Ltd.	Magezi Mr. John
34.	Lenco Ltd.	Opweiwiyo Mr. A.
35.	Low Cost Printing Point	Kalule Mr. Lawrence
36.	Maganjo Grain Millers Ltd.	Bahemuka Mr. Wilson
37.	Makerere University	Kyamuhangire Mr. William
38.	Makerere University	Mmiro Mr. Dennis
39.	Masaka Food Processors	Kawuma Mr. Dan
40.	Masaka Food Processors	Ssegggwanyi Mr. D.
41.	Medipharm Industries (E.A) Ltd.	Mukasa Mr. Eliphaz
42.	Megatrends Ltd.	Musoke Mr. Stephen
43.	Midwest Enterprises	Tumwesigye Mr. F.
44.	Ministry of Information and Broadcasting	Aleyo Mr. Moses
45.	Ministry of Trade and Industry	Kapasi-Kakama Mr. J.
46.	Ministry of Trade and Industry	Pia Ms. Jayne
47.	Mityana Agrobasket Ltd.	Musoke, Mr. J.K.
48.	Mulbox	Kabeho Mr.
49.	Musenze Industries	Kumya Mr. Sam
50.	Musenze Industries	Muyigo Mr.
51.	Musenze Industries	Nalumansi Ms. Aminima
52.	Nagongera Millers and Farmers Ltd	Lwerere Mr. John
53.	Ngabo Newspaper	Sanya Mr. W.
54.	Ngege Ltd	Blick Mr. Paddy
55.	Ngege Ltd	Matsiko Mr. Rodgers
56.	AVSI	Raurizo Mr. Ravera
57.	Nile Breweries Ltd	Ngobi Mr. G.
58.	Nviwoda	Nyatwa Ms. Cissy
59.	Osso-Buco Enterprises	Jitta Mr. Willy
60.	Print-pak Jinja	Sared Chaudry
61.	Reco Industries	Baluku Mr. Wilson
62.	Ro-Sa Brothers Ltd.	Kibbuka Mrs. Sarah
63.	Shell Mulago	Kworoba Mr. E. K.
64.	Taibah High School	Lutombo Ms. Miriam
65.	Tamco Milling Company	Kiganda Mr. F.

66.	Tamco Milling Company	Mayirula Mr. R.
67.	TEAM Consultants	Nagenda Mr. S.P.
68.	The Star	Sserwanga Mr. Mukiibi
69.	Transexpo (U) Ltd	Wakatama Mr. Isaac
70.	U.S.A.I.D.	Komakech Mr. Bruno
71.	Uganda Breweries Ltd.	Bulegyaya Ms. Jolly
72.	Uganda Breweries Ltd.	Katorobo Mr. Edward
73.	Uganda Breweries Ltd.	Kawuki Mr. Charles
74.	Uganda Breweries Ltd.	Kinyera Mr. Isaac
75.	Uganda Fisheries Enterprises Ltd	Amongin Ms. Matilda
77.	Uganda Manufacturers Association (UMA)	Olet Ms. Dorothy
78.	Uganda National Bureau of Standards	Kasirye-Alemu Dr. Evelyn
79.	Uganda National Council for Science and Technology	Nuwagira Mr. J
80.	Uganda National Council for Science and Technology	Nyiira Dr. Z.M.
81	Uganda Seeds Product	Olupot Mr. A.
82.	UMA	Banya Mr. Patrick
83.	UMACIS	Alinange Mr. Dan
84.	UMACIS	Bbosa Mr. Wycliff
85.	UMACIS	Kalema Dr. William
86.	UMACIS	Nsonzi Miss Frances
87.	UMACIS	Zake Mr. Fred
88.	United Farmers Co. Ltd.	Adonga Ms. J.B.
89.	VOCA	Chase Ms. Holly
90.	VOCA	Nansubuga Ms. Mary
91.	Wabuyaayu Honey Processors	Babumba Mr. James K.

KEYNOTE ADDRESS AT THE OPENING OF TH E WORKSHOP FOR FOOD PROCESSORS ON PRODUCT PACKAGING 25 - 26 AUGUST 1993 BY HON HENRY KYEMBA, MINISTER OF STATE FOR AGRICULTURE, ANIMAL INDUSTRY AND FISHERIES

Mr. Chairman
Distinguished Guests
Ladies and Gentlemen

As a Minister responsible for the Food and Agricultural Sub-Sector of our economy, it gives me great pleasure in being here to officiate at the opening of a Workshop on Product Packaging for Food Processors. Product Packaging is a very important step in the food industry because it determines whether or not the product will appeal to consumers. In Uganda, there is a saying which underpins the importance of proper good product packaging. For those of you who understand Luganda, the saying is "ENSIBAMBI EDIBYA MUTERE", meaning that poor or improper packaging will discourage customers from buying the product called Mutere. Mutere is a form of dried bananas which is is not very appealing to the eye and consequently, difficult to sell unless it is packaged in an attractive fashion.

This proverb indicates that even in our ancient primitive food processing industry, packaging was important if only for aesthetic considerations. In a modern economy and in a developing food industry, packaging is important for more than aesthetic appeal. It is important for value added, for hygiene, for increased sales thereby stimulating increased production of raw agricultural commodities. My ministry, therefore, considers the development of a modern food industry as a sine qua non for increased production at the farm level.

Uganda is endowed with a favourable climate and fairly good soils for increased agricultural production. Also with existing technology and with available inputs, it is possible to double or even treble farm outputs. For example, the use of improved well selected seed can lead easily to 50 percent increase in the yields of maize, beans, simsim, and groundnuts. Proper spacing of these same crops can lead to a future 100 percent increase in yield. My Ministry has demonstrated as a result of On-farm Experiments, that an ordinary Ugandan Farmer can increase his maize yields from 1.5 tonnes per hectare to 5 tonnes per hectare. Our clones of Robusta Coffee are doubling yields at the farm level and better management of tea and cocoa plantations is increasing yields tremendously. Further, proper Animal husbandry can double live

gain weights of our cattle and treble milk yields. The story can be repeated for virtually every agricultural commodity adapted to our environment.

Farm outputs can further be increased by reducing both pre- and post-harvest losses. At present, farmers suffer as much as 40 percent post-harvest losses. If these losses are controlled, Uganda's prospects for increased food and other agricultural products become one of the brightest in Sub-Saharan African.

However, we must ask ourselves a very important question: "What shall we do with all that increased agricultural output?". There are a number of answers to this question viz.

(a) Offload the surplus on International markets.
(b) Export the surplus to Regional markets.
(c) Increase our own consumption.
(d) Improve quality through processing and export and/or consume the improved products locally.

The prospects for exports of Agricultural commodities look bleak for most developing countries including Uganda. Dr. Edourd Saouma, the FAO Director General had this to say in his Foreword to the FAO Commodity Review and Outlook 1992/93:

"The World Agricultural Trading System continues to suffer from deep structural problems. The export earnings of the developing countries from Agricultural Commodities are inadequate. Since the beginning of the eighties, the real prices of Agricultural, Fishery, and Forestry products exported by developing countries have fallen by 39 percent. Within this average figure, there have been some commodities with far larger declines in price such as coffee, cocoa, cotton, and natural rubber".

Clearly, this outlet for Uganda's Agricultural surplus will become more and more tenacious, and is an avenue which may not hold much for the future.

As Uganda's population increases at an annual rate of about 2.5 percent, the population may be able to absorb a modest increase of the expected agricultural surplus especially food. However, the population will not be able to absorb the large increases in food production resulting from the use of improved technologies.

The prospects for regional markets seem to be more promising. There is a substantial and increasing demand for maize and beans in all our neighbouring countries, which we have not fully exploited. However, this demand is also likely to decline as these countries strive to be self-sufficient or as the pressure for food aid on them from developed countries becomes more intensive.

The most sustainable manner of handling increased Farm Outputs is through processing. Therefore, the NRM Government is placing great emphasis on the processing of Agricultural products in order:

(a) To improve the food quality and thereby help upgrade the nutritional status of the population.
(b) To improve the shelf life of our food products.
(c) To increase the value of Agricultural products.
(d) Develop the basis for a light Manufacturing Industry based on Agricultural processing since the most abundant raw materials are agricultural, the industrial base of this country must be agro-based.
(e) To diversify the products from raw agricultural produce e.g. it is possible to obtain four products from maize, i.e. starch, gluten, oil, and animal feeds.

It is impossible to develop a modern food industry without proper packaging. Therefore, the organizers of this Workshop deserve praise for identifying product packaging as an important subject worthy a long and intensive discussion.

I wish you good deliberations, and I have much pleasure in declaring this important workshop open.

FOOD PROCESSORS PACKAGING WORKSHOP AUGUST 25 - 26, 1993
OPENING ADDRESS BY MR. DON LINDEMANN

Approximately one-half of all packaging material in the USA, both volume and value, are used for food and beverage packaging. The percentage of disposable income spent on food in the United States is about 16% and, when compared to Western Europe at 32% and some South American countries that are as high as 85%, it makes the USA's food costs very favorable. The United States is in a unique position in that it has available wider variety and greater abundance of food than any other country in the world. This availability is attracted extensively to advances in food processing, package technology, and marketing. In the USA there are over 25,000 different food processing companies, not including the 4,000 beverage firms that are bottling carbonated and still beverages of all types. The processing companies service some 300,000 retail food stores which includes 4,400 supermarkets and 35,000 self service stores that have 90% of all sales of food and beverage for home consumed foods. A unique thing about food and beverage packaging is that it has to compete for the shopping dollar and it still must protect the product. The food package must be pleasing t the consumer and must provide directions, utility and assist in shelving or display and still be within government, federal, state and local compliance. Marketing studies indicate that the package alone will influence the first sale of an item, and the package will then stand as an identifier and protector. The unique thing about food is that it must be available year round in an interesting variety, irrespective of the food growing season. Foods must be presented in a way that is convenient to purchase and use, and in most instances, this means that it must be packaged. The single factor requiring food packaging is availability.

When packaging departments search for proper materials for items, they must know four sets of facts to successfully package the product. First, they need to know about the product - the materials and the manner in which these materials can deteriorate, the size and shape of the product is to be used. Second, they must know the transportation hazards, whether the product is sensitive to heat, cold, vibration, shock and how much stacking height can t he product within the package tolerate. Third, the market must be taken into consideration. They must know market lighting, the shelf life under normal storage conditions, display conditions, shelf size, location, and how high they would normally be stacked on a shelf. Fourth, they must know the forms of packages that are suitable, the machinery that is available for this packaging system, and the labour that is required to fully package and distribute the product.

Fresh fruits also need packaging. The saying about fresh fruits is that life begins at 40, meaning that about 40 degrees Fahrenheit, micro-organisms start to thrive and cause an accelerated deterioration of fresh fruit s.

Most red meats require oxygen to produce an attractive surface. If red meats are stored in an oxygen free environment, the surface of the meat will be less attractive and less likely to be selected by the consumer at a self service store. Most meats must be quickly cooled down to 50 degrees Fahrenheit as soon as possible and then held at about 34 degrees Fahrenheit, which is considered to be the best holding temperature. Beef and veal can be held for 21 days without suffering deterioration. Lamb can only be held for about 15 days, pork 14 days, poultry 7 to 10 days, and internal organs such as liver and kidney, only 7 days. The quality in storage is effected by the growth of micro-organisms, enzyme activity and oxidation, all of which can be slowed down by lower temperatures.

Fruits and vegetable are unique in that they are still alive after harvest. They continue to respire by taking up oxygen and giving off carbon dioxide. They tend to be bulky, taking up a lot of space and are easily damaged by handling. Most are water based. This water can easily be lost which decreases the look and quality of the fr u it and vegetable. The deterioration of fruit s and vegetable starts from the time they are harvested. They are damaged both by heat and cold, and affected by oxygen, carbon dioxide, ethylene gas and other volatiles in the atmosphere. Packaging of fresh fruits and vegetable is based on a need for easy handling for distribution and the need to be chilled to reduce respiration. Fresh fruits and vegetables have two types of spoilage and deterioration. First, there is the biological spoilage which is the normal process of aging, and second, there is an anaerobic spoilage which is due to internal reactions that will result in off-flavors, off colors and off-textures.

Processing and packaging of some fruits and vegetables can be done. Some products can be heat processed, which destroys micro-organism like retorting canned goods, pasteurization of milks, juice and other beverages, irradiation sterilizaiton all of which kills micro-organism. Food and beverage irradiation does not leave a toxic residue but there is public concern about its use. In the USA, irradiation is mostly used sterilization of medical devices after they have been packaged, and very few food items are radiated. Foods can be refrigerated or frozen which slows or stops the natural processes of deterioration. The package for frozen foods serves to keep out other micro-organisms and to control freezer burn. Some food products can be dried and chemically processed. Drying reduces water content to the level that micro-

organisms cannot live. Drying is used for pasta, freeze dried foods, beef jerky and others. Chemically processed foods are mostly salted and packaged in a vacuum package that is free of oxygen and is used for bacon, ham and others.

PAPER ON THE ROLE OF UGANDA NATIONAL BUREAU OF STANDARDS IN FOOD INDUSTRY BY MR. WILLY MUSINGUZI, STANDARDS OFFICER (FOOD) UGANDA NATIONAL BUREAU OF STANDARDS

1.0 Introduction

The Uganda National Bureau of Standards was established as a corporate body under the then Ministry of Commerce, Industry and Cooperative by an Act of Parliament in June 1983. However, the act remained on paper until 1989 when the present government activated it by appointing the first Executive Director.

The Uganda National Bureau of Standards is a service institution, which is intended to serve exporters, traders, manufacturers, government departments, other relevant organizations or individuals and the general public. The main aims of the Bureau include:

(1) Protection of consumer interest through adequate and consistent quality of goods and services.

(2) Promotion of commerce, trade and overall economic development in terms of human effort, materials, power, etc.

(3) Ensuring safety, health and protection of life.

(4) Provision of a standard means of communication and expression among interested parties in production and consumption of goods. All the above objectives are of direct concern to industrialists who need good packaging of their products for quality preservation in storage and transit.

(5) Economic development through standadization.

(6) Harmonization of standards, with regional and international standards.

2.0 Functions of the Uganda National Bureau of Standards

In order to achieve the enumerated objectives, the Uganda National Bureau of Standards (UNBS) Act mandates the Bureau to carry out the following summarized functions:

2.1 To formulate national standards specifications for quality, safety performance and codes to practice for locally produced/manufactured or imported products.

2.2 Promote standadization in commerce, industry, health safely and social welfare, plus enforcement of standards in protection of public health.

2.3 Require certain products to comply with certain standards in manufacture, composition, treatment or performance and prohibit substandard goods where necessary.

2.4 To provide testing facilities of various products locally manufactured or imported to ascertain their compliance with standards.

2.5 To provide facilities to scientific and industrial metrology (measurements) and for calibration (tracing accuracy) of precision instruments.

2.6 Develop a National Library/Documentation Centre for standards and standard related information.

2.7 Encourage or undertake education work in the connection with standardization for the public.

2.8 Seek membership to any international organization for standadization in order to facilitate harmonization of local and international standards.

2.9 Assist government or private companies in preparation or training of internal or company standards.

3.0 The role of the Uganda National Bureau of Standards in Promotiong Good Packaging Practices for Food Processors

Direct relevance of the enumerated functions of the Bureau to local food processors may not be obvious at a glance. The brief elaboration below on the individual functions is intended to point out clearly what a local food processor stands to gain from the services by the Uganda National Bureau of Standards. A good package starts with appropriate design, suitable materials, correct manufacture and good quality of food product to be packed. All these components of good packaging need to be standardized.

3.1 Formulation of Food Standards.

3.1.1 *What a local food processor stands to gain.*

In brief, formulation of national standards, the Bureau provides the Secretariat and the interests of the standards (users of the standards such as industrialists etc) participate in technical committee meetings to give their views on the standards and approve them accordingly (formulation of standards see ORGANIZATION Annex I).

As it is indicated in the Annex I, Technical Committees comprise of interested parties (exporters, importers, industrialists, food processors, producers, relevant government agencies etc), who are invited to the Bureau to participate in deliberations on standards affecting them. In such meetings the interests exchange information and gain more knowledge for improvement in the quality of the food products they are processing or manufacturing. It is important to note here, that every food product standard specification contains clauses or guidelines on packaging and labelling of a particular product in it. Such guidelines help the users to improve their product packaging. Circulation of Draft Standards to other interests, who may not have had a chance to participate in such meetings, has to sensitize the affected on matters of quality, and on the other hand they improve on the standard being formulated. Implementation of such standard becomes easier when a wide scope of interests have contributed to its formulation.

3.2.1 *Approved Uganda Standards for Food Products*

Since its inception, the Uganda National Bureau of Standards had taken formulation of Food Standards as priority among other things. During the last 3 years, the Bureau has had 31 food standards approved and 10 Draft Uganda Standards are in their final stages of being formulated (See Annex II the list).

As I have indicated above, the Bureau has been involving food processors in the exercise of formulating these Uganda standards.

3.1.3 *Highlights on Uganda Specification of the Labelling of Pre-packaged Food US 7 : 1993.*

The above approved standard is available at Uganda National Bureau of Standards office, Plot 3/5 1st Street Industrial Area and will be printed in future for sale to the public. It provides guidelines for labelling of prepackaged foods to be offered as such to the consumer, or for catering purposes, and to certain aspects relating to the presentation thereof.

This standard specification highlights on mandatory information required in labelling of prepacked foods (internationally), which include:

(i) The name of the food,
(ii) List of ingredients,
(iii) Net contents and drained weight,
(iv) Country of origin (if imported or to be exported),,
(v) Lot identifications/batch number,
(vi) Mode of date marking and storage instructions,
(vii) Instructions for use.

Some local food processors have already benefited by consulting this approved standard.

3.2 Promotion of Standardization in commerce, industry, health, safety and social welfare.

Promotion of standardization generally involves implementation of standards in the above aspects.

The Bureau of Standards offers the following services to local processors, [illegible]rers and dealers of food:

(i) Advisory and consultancy services in food product development.
(ii) Inspection services in Food processing establishments, warehouses and other food storage facilities.

(iii) Surveillance of substandard foods in open market.

3.3 Testing facilities at UNBS

UNBS provides testing facilities for food products and chemicals. The Bureau acquired its own testing facilities early this year. Foods tested in these facilities include cooking oil, peanut butter, honey, sugar, salt, fresh and dry fish etc. to mention a few.

The food laboratory is capable of carrying out both chemical and microbiological parameters of food.

Type of testing include:

(1) Testing for consumer complaints.
(2) Testing for UNBS investigation purposes.
(3) Testing for standards and product development

3.4 Certification Scheme

UNBS has had its Quality Mark approved by the National Standards Council. There is upcoming service of third party certification scheme to boost food industrialists in respect of quality assurance of their products to consumers. The users of this Quality Mark will be required to fulfil conditions set by UNBS. When a firm is licensed to use this Quality Mark, the user may impregnate this mark on labels of his/her product.

3.5 Documentation Centre for Standards Information

The UNBS has a documentation centre available for use to members of the public. The centre has various sets of standard documents, international standards, publications, other documents related to quality matters and scientific textbooks. It is also a contact point for world wide FAO/WHO Food Standards Codex Alementarious publications.

The documentation centre exchanges information with international organizations concerned with food such as International Dairy Federation and other various national standards institutions, (e.g. Bureau of Indian Standards, British Standards Institution, etc). With such contacts the Bureau gets updated information on developments in various markets on matters of quality.

3.6 Creating public awareness about Standardization and Quality Assurance.
Promotion of standards requires concerted advertising and public relations. The Bureau holds seminars/workshops in various fields from time to time to create awareness on matters of quality. For example the Bureau in close collaboration with UMA conducted a seminar on standardization and quality control in industry on 10-12th September 1991 and was attended mostly by Quality Controllers and Production Managers from various industries.

UNBS conducts tailored in-house training of personnel in Food processing establishments on request by individual firms. Dairy Corporation benefited from such arrangement.

The Bureau participates in different fora in the country.

3.7 Assistance to Government agencies and private companies.

3.7.1 *Private Companies*
Many Ugandan manufacturers are also importers of raw materials (food) including packaging materials and have to learn to place orders for imports by referring to standards. The Bureau is capable of assisting such importers.

Food product standards are generally formulated at 4 levels namely company, national, regional and international. The company level is of great importance since it is one which has to be complied with first in production. The Bureau can assist interested companies in training up their individual standards with the aim of improving their quality. Many food processors have in the past benefited from such services.

3.7.2. *Government Agencies*
The Bureau assists and coordinates with various Government agencies in matters of quality. To mention a few, the Bureau has in the past coordinated and continues to work with the following agencies in implementation of their policies:

- Uganda Investment Authority
- Fisheries Department
- Uganda Revenue Authority
- Central Tender Board
- Government Chemist and Analytical Laboratory

4.0 Conclusion

The UNBS which is now only about 4 years old is prepared to render any services within its capacity to interested parties. The services that it can offer have been highlighted in this paper. However, the Ugandan food processor has to take the initiative to obtain information on standards if she/he hopes to have a sustained market. In competitive world where every manufacturer has to compete for a share of the local and international market, quality and standardization matters can only be ignored at one's peril.

ANNEX

UGANDA NATIONAL BUREAU OF STANDARDS
NATIONAL STANDARD SPECIFICATIONS

APPROVED FOOD STANDARDS
SPECIFICATION FOR

1.	Fresh Pineapples	US 2: 1992
2.	Fresh Avocado	US 3: 1992
3.	Infant Formula	US 4-CS 72: 1993
4.	Canned Baby Foods	US 5-CS 72: 1993
5.	Methods of Analysis for Infant and Children Foods	US 6: 1993
6.	Labelling of Prepackaged Foods	US 7: 1993
7.	Whole, Partly skimmed, and skimmed milk powders	US 8:-CS 5:1993
8.	Whole Maize meal	US 12-CS 154:1993
9.	Degermed Maize Meal and Maize Grits	US 13-CS 155:1993
10.	Pulses (including Beans)	US 14-CS 171:1993
11.	Sorghum Grains	US 16-CS 172:1993
12.	Maize Grains	US 17-CS 153:1993
13.	Honey	US 18: 1993
14.	Concentrated Pineaple Juice Preserved by Preservatives	US 19-CS 139:1993
15.	Butter and Whey Butter	US 20-CS 1:1993
16.	Yoghurt and Sweetened Yoghurt	US 21-CS 11:1993
17.	Flavoured Yoghurt	US 22-CS 11:1993
18.	Lemon Juice	US 23-CS 47:1993
19.	Wheat Flour	US 24:1993
20.	Pineaple Juice Preserved by Physical means	US 25:1993
21.	Pineaple Juice concentrate preserved by physical means	US 26:1993
22.	Margarine	US 27:1993
23.	Edible Sesame (sim-sim) seed oil	US 28:1993
24.	Edible Cotton seed oil	US 29:1993
25.	Edible Soya bean oil	US 30:1993
26.	Edible Sunflower seed oil	US 31:1993
27.	Edible Maize oil	US 32:1993
28.	Edible Ices and ice mixes	US 33:1993

29.	Instant Tea	US 34:1993
30.	Luncheon Meat	US 35:1993
31.	Corned Corn Beef	US 36:1993

Draft Uganda (food) standards

1.	Cocoa Bean	DUS 112
2.	Factory and Employees Requirements for food Factories	DUS 111
3.	Vanilla	DUS 113
4.	Raw Sugar	DUS 114
5.	Plantation (milk) white sugar	DUS 115
6.	Refined white sugar	DUS 116
7.	White and Wholesome wheat bread	DUS 117
8.	Carbonated Drink	DUS 118
9.	Beer	DUS 119
10.	Cocoa Beans - Sampling	DUS 120

METHOD OF APPROVING AT EVERY STAGE:
Is by consensus view

STAGES:

1) Initiation
2) Justification
3) Development (Technical Committee work)
4) Circulation
5) Final draft and approval
6) Publication

NOTE: An initial draft standard usually is produced after reference to other national or regional or international standards.

THE ROLE OF THE DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY IN THE FOOD INDUSTRY

By
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Department of Food Science and Technology, Makerere University

1. BACKGROUND

The Department of Food Science and Technology at Makerere University was established in 1989, in recognition of the need for health and nutrition education and to address the problems of post-harvest food losses through training and participating in finding solutions of these problems.

Staffing

The Department is manned by 5 full time lecturers all with M. Sc. degrees. Two other lecturers are abroad for training at PhD. level. There are assistant lecturers on contract terms. The establishment for the Department is 8 academic positions.

Students

There are 86 students in the Department of which 27 are in 4th year, 22 in 3rd year, 25 in the 2nd year and 15 in 1st year.

Curriculum

The Department offers a degree course in Food Science and Technology. The student start their course with those offering Agriculture and Forestry in 1st year and start Food Science subjects in 2nd year. The subjects offered can be divided into the following major categories:

Food Microbiology
Food Processing and Preservation (packaging)
Food Process Engineering
- Refrigeration
- Drying
- Evaporation
- Heat transfer
- Fluid flow
- Packaging

Food Chemistry
Human Nutrition
Specific product technologies

This course does not teach catering. It is intended to produce people capable of manning food industries in the following areas: Production, Quality Control (assurance), Research and Development, Marketing and Management.

The areas of marketing and management are included because of the integrated approach in running modern food industries and the need for such personnel to understand the process and products. In developed countries, managers and marketing personnel of any manufacturing concern have to understand the manufacturing process and the product they deal with. One cannot have basic industry. Secondly these jobs are not interchangeable - some one managing a tea processing plant cannot be transferred to go and manage a confectionery factory. The same applies to marketing.

2. The Role of the Department

Training

(a) The Department aims at producing technically capable personnel to manage and develop food processing industries so that in the long run the status of our food industries can be elevated.

(b) Then these trained people will strengthen the research capabilities in food and nutrition at Industrial level and other institutions. The graduates are also well equipped to perform in different sectors of the economy leading to development of the food industry e.g. Bureau of standards.

3. Collaborative Work

In order to create awareness of the importance of Science and Technology in the chain of food production and human nutrition, to develop sound food and nutrition policies and programmes and marketing which may lead to improved levels of nutrition, the Department is geared towards working with industrialists and the community, at large. Also horizontal linkage with other institutions involved in

research activities associated with food, nutrition and community health e.g. Mwanamugimu clinic.

A programme is in place to develop strong product-development research using local raw materials with local industries. This is aimed at import substitution to save foreign exchange and modernize local technology.

All this boils down to provision of employment to Uganda citizens through strengthening and development of food industries and related fields.

Research

The major thrust in research activities is aimed at production of high quality foods from locally available materials through proper processing, preservation and packaging to prevent waste, combat seasonal shortages and ensure proper nutrition. Traditional technology and foods are given due attention. It is the aim of the Department to develop products that the consumers are already familiar with. The following research projects have been completed or are still going on:

- Post Harvest Handling, Storage and Transport of fruits and Vegetables. This was done in collaboration with EPADU and a manual for both growers and exporters is about to be published.
- Banana Croping Systems Research Post Harvest problems and constraints.
- Development of Technology for processing, preserving and packaging of a banana beverage (on-going)
- Development of a pawpaw/passion fruit nectar.
- Use of passion fruit juice in flavoring Yoghurt
- Development and manufacture of tropical fruit juices and jams.
- Detoxification of cassava at household level and development of new products.
- Analysis of aflatoxin in Uganda grains
- Preservation of jack fruit
- Use of Banana juice as a starting material for wine.

These are some of the projects we have done so far but many more are in the pipeline and it will depend on the interest of the industrialists to come to us so that we can carry out research more suited to them and in collaboration. Some of the above technologies have been developed in our laboratory and we are ready to share them with interested parties.

In those researches that involved product development, there is no doubt that packaging has been a challenge to us. However, we have used recycled packaging materials where possible.

Relation of packaging and the food industry.

It is clear in Food Industries that one needs to understand the technical and functional properties of the product and those of the package in order to provide a suitable package for a product.

Therefore, packaging should not be separated from other activities in the plant. The package gives a name and image to the product. Some of the packaging problems the food industries have are due to ignorance by production staff and management. Therefore, all workers and executive need to be sensitized on the role packaging plays in ensuring the safety of the product and enhancing its image and consumer confidence in the market. A product that appeals to the market is what any manufacturer aims at.

GUIDELINES ON PACKAGING LEGISLATION OF THE EEC

A Paper Presented at UMA's Food Processors Packaging Workshop
August 25 - 26 1993

By Pascal Nyabuntu
Post-Harvest and Marketing Specialist
EXPORT POLICY ANALYSIS & DEVELOPMENT UNIT (EPADU)

Introduction

As mos t exporters and other business groups may be aware, the role of EPADU, to use one phrase "is to create a conducive environment for the development of non-traditional exports in Uganda".

The Units' activities therefore range from macro-to micro-policies of the export subsector, including on farm training, of growers and exporters. Of course one cannot talk about exporting without talking about packaging. Some of you will recall that the unit organised a seminar on packaging at the beginning of 1990. However, the Unit does not have a packaging engineer, thus we have tended to leave the technical elements of this issue to individual enterprises to sort out. Ours there fore, has been m ore on education on packaging requirements of various markets.

The Unit has always advised most exporters who call in our offices on packaging requirements by various countries. This morning I will briefly touch on EEC's packaging legislation to brief you what you may expect from this market.

The EEC's legislation on packaging and labelling is intended to harmonise the regulations of member states and therefore promote the movement of goods within the community. Other aims of the legislation include:

- Interests of consumers and manufacturers
- Environment and health protection

Non-EEC manufacturers and exporters intending to export to the EEC must fulfill the community's packaging and labelling regulations.

Already some directives have been adopted with very precise requirements on:

a) Packaging materials of many types, including plastic and cellulose film.

b) Packaging sizes for pre-packed goods

c) Label contents

d) Price information

Packaging materials are regulated only for food and drink products, but labelling requirements apply to non-food products e.g. cosmetics, textiles and toys.

Legislation on package size of prepacked goods applies to both food and non food products e.g. knitting yarn and washing powder.

And as part of an integrated system of environment protection there is a proposed legislation that calls for a reduction in the amount of packaging produced and even establishes targets and means of waste disposal.

The EC Packaging Legislation

The legislation covers two areas:

a) Materials and articles intended to come into contact with foodstuffs.

b) Prepackaged goods including common rules concerning weights, volumes and quantities.

Part of legislation under (a) could be still under consideration but the legislation under (b) should be near completion. Those exporting non-food products e.g. garments, need to look at the legislation in (b) to compare with their present packaging. Those intending to process food for export to the EEC need to re-examine their operations and they may need some modifications.

Legislation on materials and articles intended come in contact with foodstuffs.

Two principle have been passed: One on "inertness" and the other on and the other on "positive labelling" of the material.

The principles of "inertness" relates to the inertness of the material and purity of the foodstuffs, whereby the materials and articles must not transfer to food stuffs any of their constituents in quantities that could endanger human health and bring about an unacceptable change in the composition of the food stuffs or a deterioration in the organoleptic characteristics thereof. This applies not only to packaging but also to all articles whose surface can come into contact with food at any stage of production, storage, transport and consumption.

The positive labelling principle requires that materials and articles intended to come into contact with food stuffs must be accompanied by the words "for food" or where there are some restrictions on their uses, an indication of such limitations should be indicated.

What is the likely impact of the harmonized legislation

Once it comes into force, the food and drinks industry in each of EEC member states will probably draw up a code of practice in co-operation with its packaging industry so as to determine who is responsible for which operations in the manufacturing and supply chain.

Non-EEC food processors and exporters must be aware that their competitors in the EEC with approved lists of materials and migration tests requirements may have an advantage over manufacturers in countries with no such approvals; and manufacturers who develop and adopt appropriate test procedures will have an edge of commercial advantage over their non-EEC competitors. There is also a possibility of non-EEC food manufacturers making some savings when they purchase packaging and packaging materials for products destined for the EEC market. This will be so, because the current requirement to specify food contract suitability for each of the 12 EEC countries separately will no longer apply.

There is also a legislation regarding prepacked foodstuffs and non-food. Interested parties can contact EPADU on this.

Implications of the Proposed EC Packaging Directive

The imminent adoption of the EC's proposed directive on packaging and packaging waste will have far-reaching effects not only on EC manufacturers of packaged products but also importers and distributors of goods produced and packaged outside the community. The proposed directive has three main objectives:

- Reduce the impact of packaging waste on the environment;
- Encourage lower consumption of raw materials and energy; and
- Harmonise measures taken by member states that are related to the reduction of packaging waste.

The directive proposes to achieve these objectives in three ways:
- Minimise the creation of packaging waste in qualitative terms;
- Recover waste packaging; and
- Limit final disposal only to the residues from recovery.

The implications of this Directive for ACP exporters to the Community include the following practical measures it foresees:

- The use of reusable and/or recoverable packaging will be promoted to ensure that as from 1 January 2000, all packaging in the EC is reusable or recoverable.
- Limitations will be placed on the excessive use of packaging materials.

- The volume and weight of packaging will be reduced, at the same time ensure the same level of safety and consumer acceptance of the product.

- The size of packaging units will be 'optimised' (this 'optimization' remains to be defined).

- Wherever, possible large packs and bulk packaging will be promoted in preference to small packs.

- Standardised modular units will be promoted for transport and distribution packaging.

- Member States are to introduce measures that limit the concentration of noxious heavy metals in packaging materials, such as in inks, dyes, adhesives,

stabilisers and staples. These heavy metals are to be replaced gradually with alternative materials.

- In order to recover packaging waste, member states are obliged to establish 'take back' and/or 'collection schemes' and sorting facilities. Public authorities and 'economic operators' are expected to work closely together when designing and operating such systems. The proposed directive defines 'economic operators' as raw material suppliers, packaging producers and converters, fillers and users, traders and distributors. Importers of ACP products belong to the 'trader' category.

The 'economic instrument' proposed by the draft directive, intended to promote the prevention of packaging waste and its return for reuse and recovery, consists of a mandatory taxation scheme. Starting on 1 January after the date of directive enters into force, 'packers and fillers' will be required to pay a 'uniform product charge' into a fund set up in the country consuming the packet product. This charge will be levied on each packaging unit used within the EC, whether it is produced domestically or imported.

Consequently, packers and filches of goods that are packaged in non-EC countries and imported into the community also will pay the charge. The fund is to be known as the 'Packaging Waste Management Fund' and will be established in each member state at the same time.

Foodstuffs Labelling and Consumption Protection

Through Consumer lobbies, it has been agreed that key labelling legislation should require food and drink manufacturers to provide information about product contents in the language of the consumer on the label.

The EC Commission's 1985 White Paper, which sets out the 1992 programme, proposes:

"A well-developed and clear system of labelling, presentation and advertising... so that the producer may be protected against unfair competition and consumers against misleading practices". Misleading labelling is prohibited.

Compulsory Listing of Data on Food and Drink Labels under EC Directives include:

- Name of which the product is sold.
- List of ingredient
- Net quantity (for prepackaged foodstuffs only)
- Limit date of minimum durability ("shelf life")
- Special storage conditions and conditions of use
- Name and address of manufacturer or packager or seller established in the EEC.
- Place of origin or provenance of the foodstuff (if omission of such data would otherwise mislead the consumer as to its true origin)
- Instructions for use
- Alcoholic strength by volume (for beverages containing more than 1.2% by volume of alcohol.

Nutritional Labelling:

The directive that was adopted on 24/9/1990 is voluntary i.e. it does not oblige food manufacturers to provide nutritional information on the label, unless a nutritional claim is made; but there is a prescribed manner in which nutritional information must be presented if it is required.

Batch Identification Requirements

This requires that the "Indications or marks identifying the lot to which a foodstuff belongs" be shown on the package.

This increases the labelling requirements for packaged products sold in the EEC. These will have far reaching implications with regard to packaging, storage and shipping arrangements and therefore should be carefully studied by non-EEC exporters to the EEC market.

Before the entry into force of these directives, manufacturers serving the EC market voluntarily used batch codes according to their individual requirements; but under these directives all goods sold in the EEC must be marked with batch identification, although there are some exception.

Labelling of non-food Products.

EC directives have noted been adopted for food-stuffs only. Labelling provisions have been passed for other products.

Although the EC scheme is voluntary and is decentralised, in that it operates separately in each member state, the EC eco-label is expected to be adopted widely within the community in a short period. The EC Commission is now setting standards for the scheme through a regulatory committee made up of experts from member states.

The eco-label will be awarded nationally, with a centralised appeals procedure designed to avoid lax implementation and inappropriate usage. Any product - manufactured in the EC or imported - that satisfies the scheme's standards will be awarded the label for use throughout the Community. The scheme does not apply to products that are governed by separate EC legislation, including, food, pharmaceuticals and dangerous chemicals.

Conclusion:

Manufacturers and exporters of products destined for EEC markets face three main tasks in respect of EEC legislation related to packaging and labelling and the national regulations that must comply with it:

- The progress of proposed EEC measures must be followed closely because many of these measures consist of amendments to existing legislation, which introduce significant modifications. For example, proposed directives on plastics packaging could restrict or widen the present directive regulating the use of plastics in food packaging.

- The dates on which each body of relevant national regulations complies with the EEC directive should be noted. The date is likely to carry from country to country even though the EEC measure always stipulates the date on which it is to enter into force in Member States.

- The revised national regulations, conforming to the EEC law, should be obtained as soon as they have been issued in final form. The EEC is <u>not</u> responsible for disseminating this information. Its publication is to obligation of each Member State government.

APPENDIX I

SUSTAIN Description

The program Sharing U.S. Technology to Aid in the Improvement of Nutrition (SUSTAIN) provides access to U.S. expertise in food processing to help improve nutrition in the developing world. Technical assistance is provided by volunteer professionals from U.S. food companies, universities, and other organizations who donate their time and expertise.

SUSTAIN was granted a five-year renewal from the U.S. Agency for International Development (USAID) on September 30, 1991. SUSTAIN is an activity in the Global Bureau, Office of Nutrition under the Food Technology and Enterprise Project. The program is managed under a cooperative agreement with the National Cooperative Business Association (NCBA) and receives advice from a Steering Committee made up of private sector representatives.

NCBA was founded in 1916 and is a membership association representing America's 45,000 cooperative businesses. Known overseas as CLUSA, NCBA works overseas with its own member co-ops, USAID, World Bank, UNDP, and other donor agencies to promote development and joint ventures in the third world.

Many benefits can accrue to the developing world through improvements in food processing. From the standpoint of alleviating hunger and improving nutrition, food processing has much to offer. It helps meet food and nutritional requirements and reduce post-harvest food losses. From the economic standpoint, food processing provides a means for increasing foreign exchange earnings through exporting value-added processed foods rather than commodities. It helps generate employment and stimulates technological development and the growth of allied industries.

SUSTAIN helps improve food quality, expand production, and lower operating costs of locally grown and processed foods by providing technical assistance in post-harvest food systems, including: (a) food safety, quality, and sanitation (b) food preservation and storage (c) food processing (d) food fortification (e) packaging (f) marketing (g) weaning foods and (h) environmental technologies.

How the Program Works

SUSTAIN receives requests for assistance from individual food companies, research institutions, and USAID. Short-term technical assistance is provided by experienced U.S. professionals who donate their time and expertise to the project. Missions are typically one to three weeks in duration. SUSTAIN covers international travel costs. Companies or host organizations requesting SUSTAIN assistance are asked to contribute towards in-country expenses. Due to budget constraints, priority is given to requests that can demonstrate an ability to improve the nutritional quality, safety, and availability of food in the local community. To the extent possible, SUSTAIN coordinates its overseas activities through a local organization. This not only enhances opportunities for technology transfer, but also facilitates coordination of activities and contributes to long-term sustainable development.

SUSTAIN is able to solve many problems by providing information that exists either in technical literature or in the "memory" of a company. If the problem cannot be solved through correspondence, then SUSTAIN volunteers may be sent to provide short-term technical assistance. Workshops and seminars can also be organized to help address food technology issues. The program does not fund product or equipment acquisitions.

The program publishes a quarterly newsletter (*SUSTAIN Notes*) on food technology issues. It is provided gratis to over 1900 recipients in more than 50 countries.

For more information, please write to:

SUSTAIN
National Cooperative Business Association
1401 New York Avenue, NW, Suite 1100
Washington, DC 20005-2160
Phone: (202) 638-6222
Fax: (202) 628-6726

APPENDIX II

Biography of SUSTAIN Volunteer

Donald Lindemann (B.S., Packaging Engineering, University of Wisconsin, 1982) is Senior Packaging Engineer at Land O'Lakes, Inc., where he manages the development and implementation of new packaging designs, new machinery purchases, and machinery modifications. Previously he was a Packaging Instructor at Wisconsin Indianhead Technical College, Packaging Engineer, Project/Process Engineer-Packaging at Kimberly-Clark Corporation, and Packaging Engineer at R.J. Reynolds. Mr. Lindemann has co-authored five U.S. Patents. He is an officer of the Minnesota Chapter of the Institute of Packaging Professionals. As a SUSTAIN volunteer, Mr. Lindemann taught a packaging workshop in Uganda.