GEORGIA INSTITUTE OF TECHNOLOGY
OFFICE OF CONTRACT ADMINISTRATION
SPONSORED PROJECT INITIATION

no action as of 8/

Date: January 4, 1977

Project Title: Provide Management Counseling and Technical Assistance to Small Business Concerns

Project No: N-24-502

Project Director: James W. Bannerman

Sponsor: Small Business Administration

Agreement Period: From 10/1/76 Until 6/30/77

Type Agreement: Contract No. SBA-0526-MA-77

Amount: $1,500

Reports Required: Quarterly Progress Reports; Final Case Reports
Counseling Report

Sponsor Contact Person (s):

Technical Matters

Contractual Matters
(thru OCA)

Contracting Officer -- Room 221
Small Business Administration
1441 L Street, N. W.
Washington, D. C. 20416

Defense Priority Rating: None

Assigned to: Southern Tech (School/Laboratory)

COPIES TO:

- Project Director
- Division Chief (EES)
- School/Laboratory Director
- Dean/Director—EES
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- Project Code (GTRI)
- Other Dan Conner

CA—3 (3/76)

GEORGIA INSTITUTE OF TECHNOLOGY
OFFICE OF CONTRACT ADMINISTRATION

SPONSORED PROJECT TERMINATION

Date: 10/14/77

Project Title: ~~PROVIDE~~ MANAGEMENT COUNSELING AND TECHNICAL ASSISTANCE TO SMALL BUSINESS CONCERNS

Project No: N-24-502

Project Director: JAMES W. BANNERMAN

Sponsor: SMALL BUSINESS ADMINISTRATION

Effective Termination Date: 6/30/77

Clearance of Accounting Charges: ALL CLEAR

Grant/Contract Closeout Actions Remaining: NONE

_ Final Invoice and Closing Documents
_ Final Fiscal Report
_ Final Report of Inventions
_ Govt. Property Inventory & Related Certificate
_ Classified Material Certificate
_ Other _____

Assigned to: SOUTHERN TECHNICAL INSTITUTE (School/Laboratory)

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EES Information Office
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Project Code (GTRI)
Other _____

CA—4 (3/76)

Phase I and Phase II

Management Counseling And Technical Assistance

To

American Manufacturing Company
Norcross, Georgia

Prepared By

Stephen M. Cornwell & Edwin O. Sawyer

Industrial Engineering Technology
Southern Technical Institute - A Division of
Georgia Institute of Technology
Marietta, Georgia 30060
March 10, 1977

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I. PROBLEMS

The following report concerns our study of the area of cutting and packaging abrasive floor pads. This area was presented to us as a bottleneck and high waste operation, was defined as the area in which we should direct our study.

The major problems identified by the student team members, faculty advisor, and company officials include a need for increased material utilization and the elimination of double handling of materials.

The present method of cutting pads involves a placement of dies by the operators according to their judgement based on experience. At present, there is no pattern drawings in the work area to which the operators refer while cutting the pads. With this present method, a reinspection of scrap material from the two primary presses is necessary to determine whether smaller pads may be cut from the material.

Reinspection is performed by a third employee who makes the additional cuts on a small press located approximately fifty feet away (refer to figure 11). Since no reinspection is made by the primary press operators, it is necessary to move the scrap material to the secondary press area.

The reinspection is made by the secondary press operator by physically digging through mounds of scrap material in search of sufficient sizes of scrap to make smaller cuts.

We feel the judgement of the primary operators concerning the optimum number of cuts due to lack of a definite pattern drawing requires unnecessary time between machine cuts. Although the operators are trained, the placement of dies according to operator judgement does not optimize material utilization. This method of placement of dies is also the reason the reinspection is necessary to identify salvage material.

Due to a double handling of material for reinspection, temporary storage of scrap material requires unnecessary use of floor space. Additional requirements of reinspection include floor spaces necessary for the second press area and the labor cost of the secondary operator.

We feel that improved material utilization can eliminate these problems of double handling. Use of pattern drawings can lessen time required for operator judgement and also create a savings in material cost by using a combination of die sizes.

II. SOLUTIONS

Implementation of the use of the proposed die patterns will enable the company to save approximately $19,000 per year. The amount of savings is based on 68,000 linear yards of material used per year in production. This figure is also based on an average cost of material per linear yard.

The amount of projected savings primarily reflect savings based on production and cost figures supplied to us by the company. Since we did not receive separate direct labor costs, the amount of savings is direct labor cost is not included in the above figure. This additional saving will occur due to no need for inspection of scrap material which is necessary with the present method.

We propose that American Manufacturing Company implement the pattern diagrams represented in figure one through figure nine. Operators should be supplied with proposed diagrams of the suggested patterns and required to use them as a normal routine in pad production.

According to the information obtained from American Manufacturing Company our calculations show they are getting a material utilization of 70.4%. By implementing our proposed patterns the material utilization will be increased to 74.57% for the pattern range we studied (12 in. - 20 in.). For a size breakdown of material utilization refer to figure 10. Since our study of material utilization only covered the range of sizes which constituted approximately 89% of total pad sales, other cost reductions may be obtained by a further study of the remaining pad sizes.

APPENDIX

Organization Chart

American Manufacturing Company

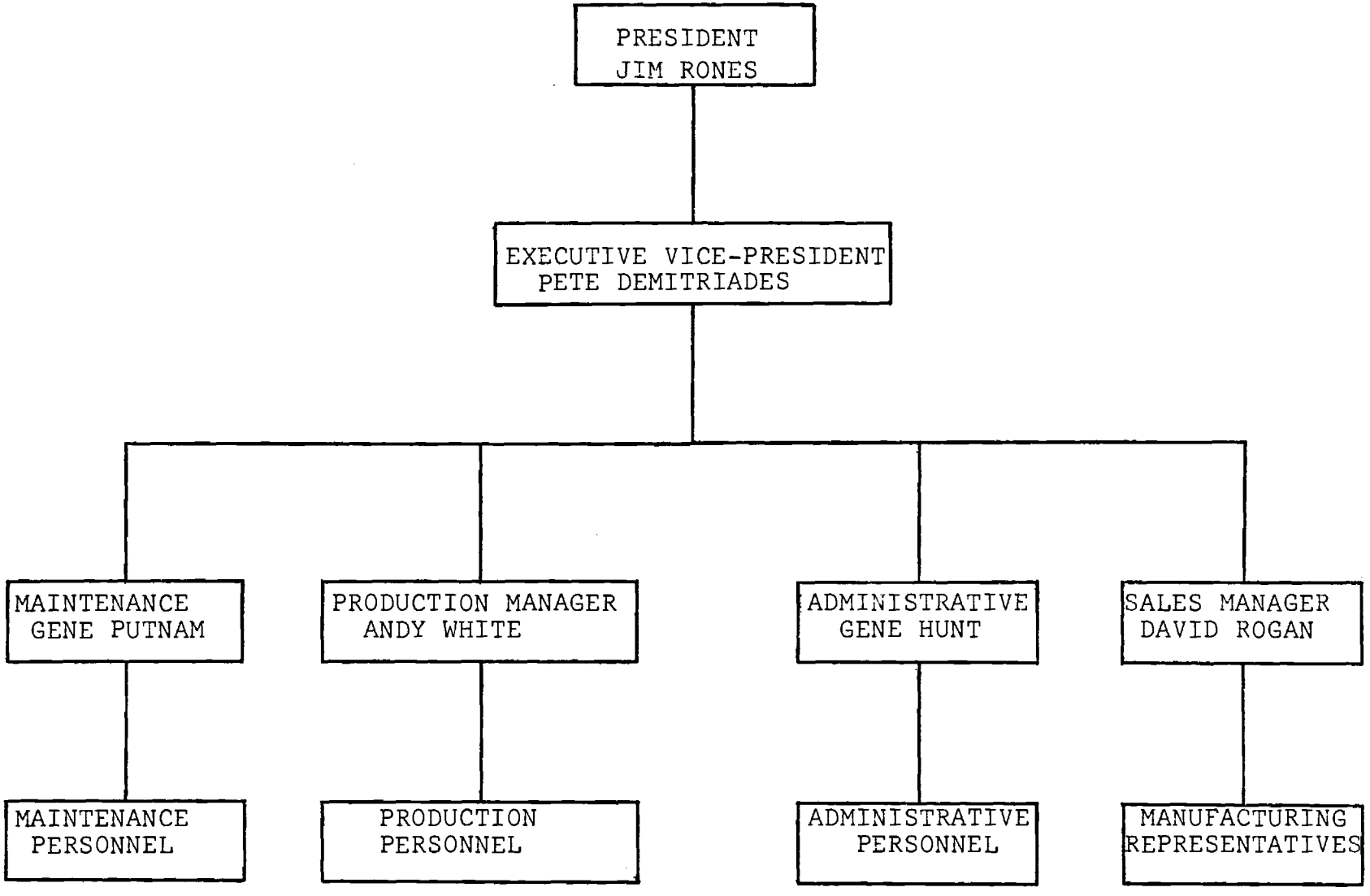


Fig. A

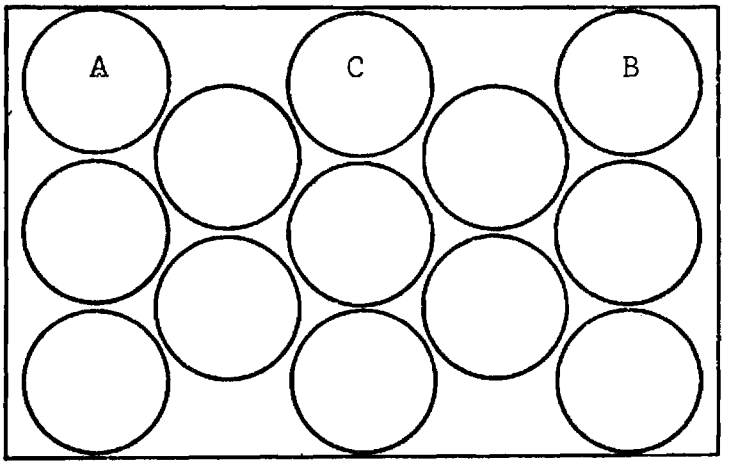


Fig. 1 12-inch Pattern

No. of pads/roll: 360
% Material Utilization: 78.0

CUTTING PROCEDURE

1. Make corner cut of pads A and B with minimum tolerance from edges.

2. Cut pad C with equal distance from cut A and B.

3. Continue cutting according to pattern with minimum tolerance from edges and previous cuts.

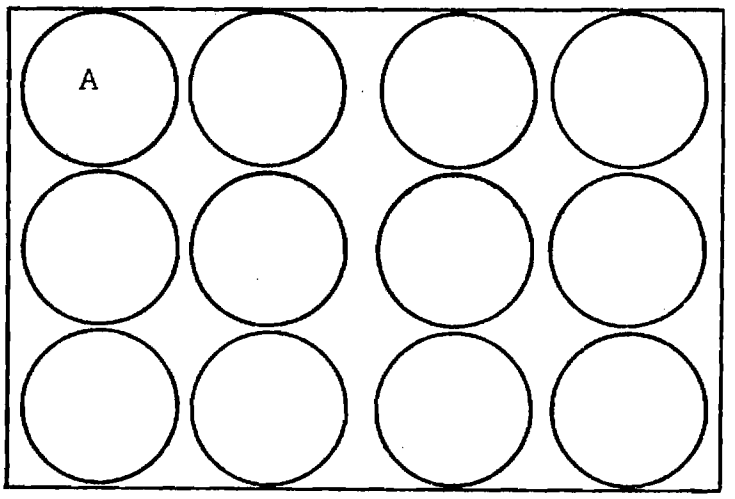


Fig. 2 13-inch Pattern

No. of pads/roll: 266.66
% Material Utilization: 67.8

CUTTING PROCEDURE

1. Make corner cut of pad A with minimum tolerance from edges.

2. Continue cutting pads of first row with minimum tolerance from previous cut and edges.

3. Continue cutting according to pattern with minimum tolerance from previous cuts and edges.

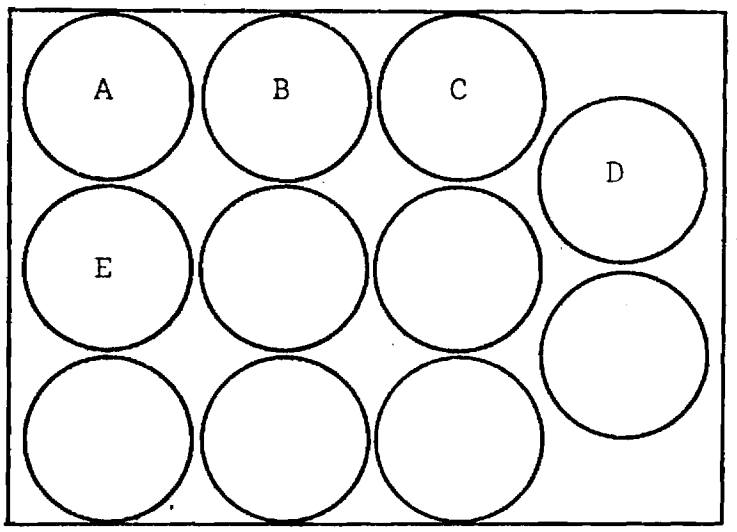


Fig. 3 14-inch Pattern

No. of pads/roll: 247.2
% Material Utilization: 72.9

CUTTING PROCEDURE

1. Make cut A with minimum tolerance from edges.

2. Cut pads B and C with minimum tolerance from previous cut and edge.

3. Cut pad D with minimum tolerance from cut C and edge.

4. Continue cutting according to pattern with minimum tolerance from previous cuts and edges.

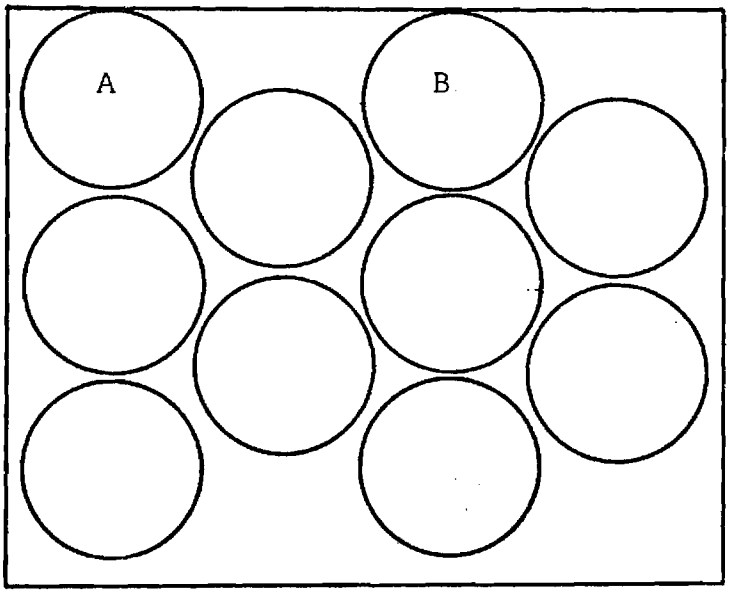


Fig. 4 15-inch Pattern

No. of pads/roll: 231.29
% Material Utilization: 78.3

CUTTING PROCEDURE

1. Make cut A with minimum tolerance from edges.

2. Cut pad B at a distance of 12.5 inches from cut A with minimum tolerance from edge.

3. Continue cutting according to pattern with minimum tolerance from previous cuts and edges.

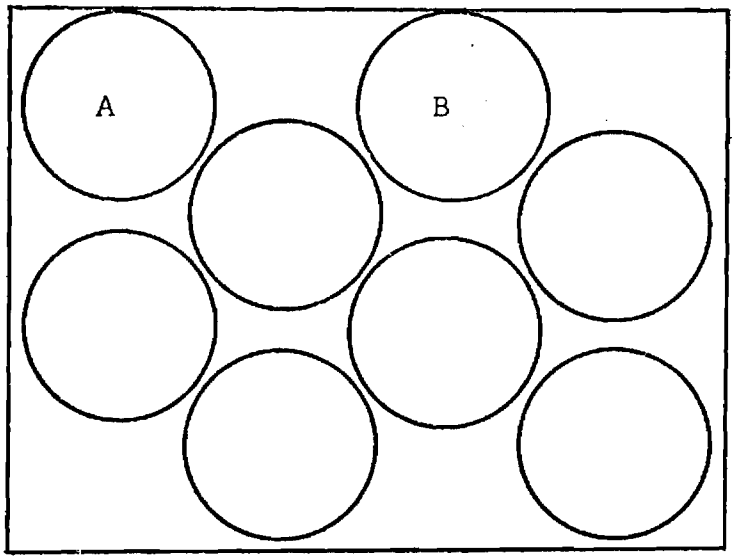


Fig 5 16-inch Pattern

No. of pads/roll: 185
% Material Utilization: 71.3

CUTTING PROCEDURE

1. Make cut A with minimum tolerance from edges.

2. Cut pad B at a distance of 10.5 inches from cut A with minimum tolerance from edge.

3. Continue cutting according to pattern with minimum tolerance from previous cuts and edges.

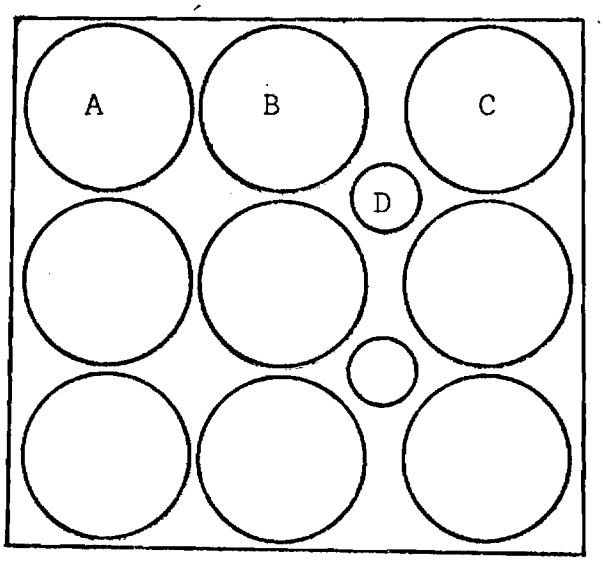


Fig. 6 17-inch Pattern

No. of pad/roll: 154.28 (17-inch pads)
50 (7 3/4-inch pads)
% Material Utilization: 71.6

CUTTING PROCEDURE

1. Make cut A with minimum tolerance from edges.
2. Cut pad B with minimum tolerance from cut A and edge.
3. Cut pad C with minimum tolerance from edges.
4. Cut pad D (7 3/4-inch) with minimum tolerance from cut B and C.
5. Continue cutting according to pattern with minimum tolerance from previous cuts and edges.

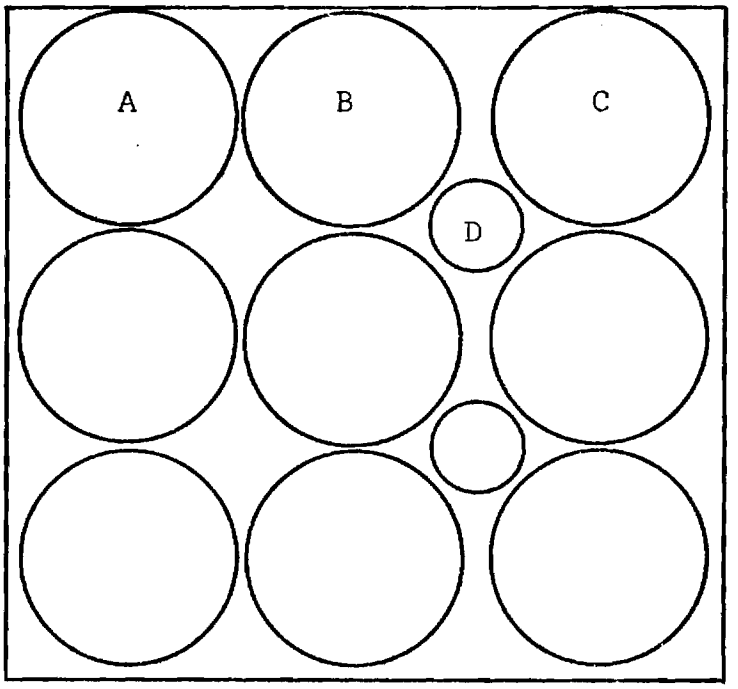


Fig. 7 18-inch Pattern

No. of pads/roll: 145.946 (18-inch pads)
47.648 (7 3/4-inch pads)
% Material Utilization: 75.45

CUTTING PROCEDURE

1. Make cut A with minimum tolerance from edges.
2. Cut pad B with minimum tolerance from cut A and edge.
3. Cut pad C with minimum tolerance from edges.
4. Cut pad D (7 3/4-inch) with minimum tolerance from cuts B and C.
5. Continue cutting according to pattern with minimum tolerance from previous cuts and edges.

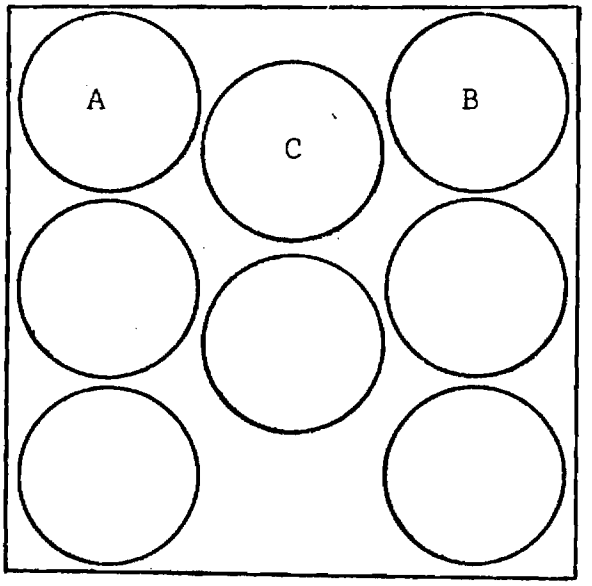


Fig. 8 19-inch Pattern

No. of pads/roll: 137.457
% Material Utilization: 74.66

CUTTING PROCEDURE

1. Make cut A with minimum tolerance from edges.

2. Cut pad B with minimum tolerance from edges.

3. Cut pad C with minimum tolerance from pads A and B.

4. Continue cutting according to pattern with minimum tolerance from previous cuts and edges.

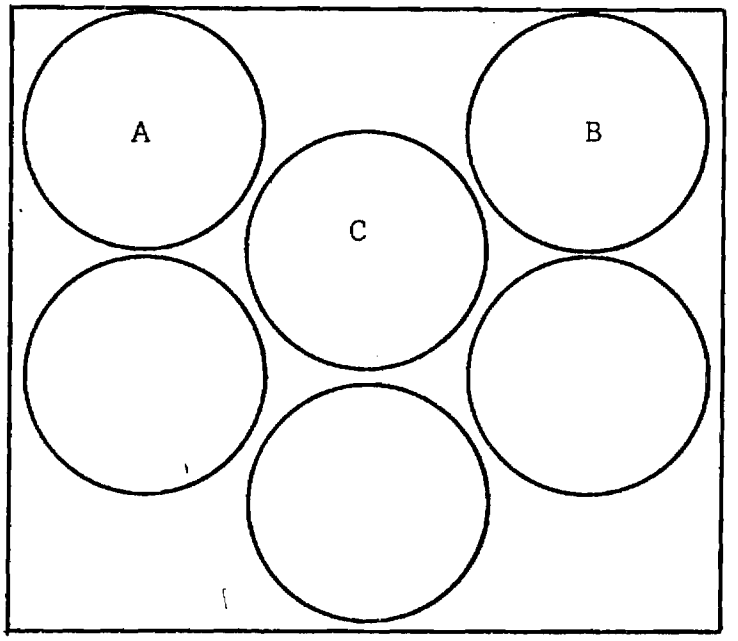


Fig. 9 20-inch Pattern

No. of pads/roll: 131.2
% Material Utilization: 78.96

CUTTING PROCEDURE

1. Make cut A with minimum tolerance from edges.
2. Cut pad B with minimum tolerance from edges.
3. Cut pad C with minimum tolerance from pads A and B.
4. Continue cutting according to pattern with minimum tolerance from previous cuts and edges.

Percentage Material Utilization

Machine Pad Size	% Utilization (Present Method)	% Utlization (Proposed Method)
12	60.18	78.00
13	61.12	67.80
14	63.56	72.90
15	66.12	78.30
16	68.78	71.30
17	70.59	71.60
18	73.42	75.45
19	73.80	74.66
20	75.23	78.96

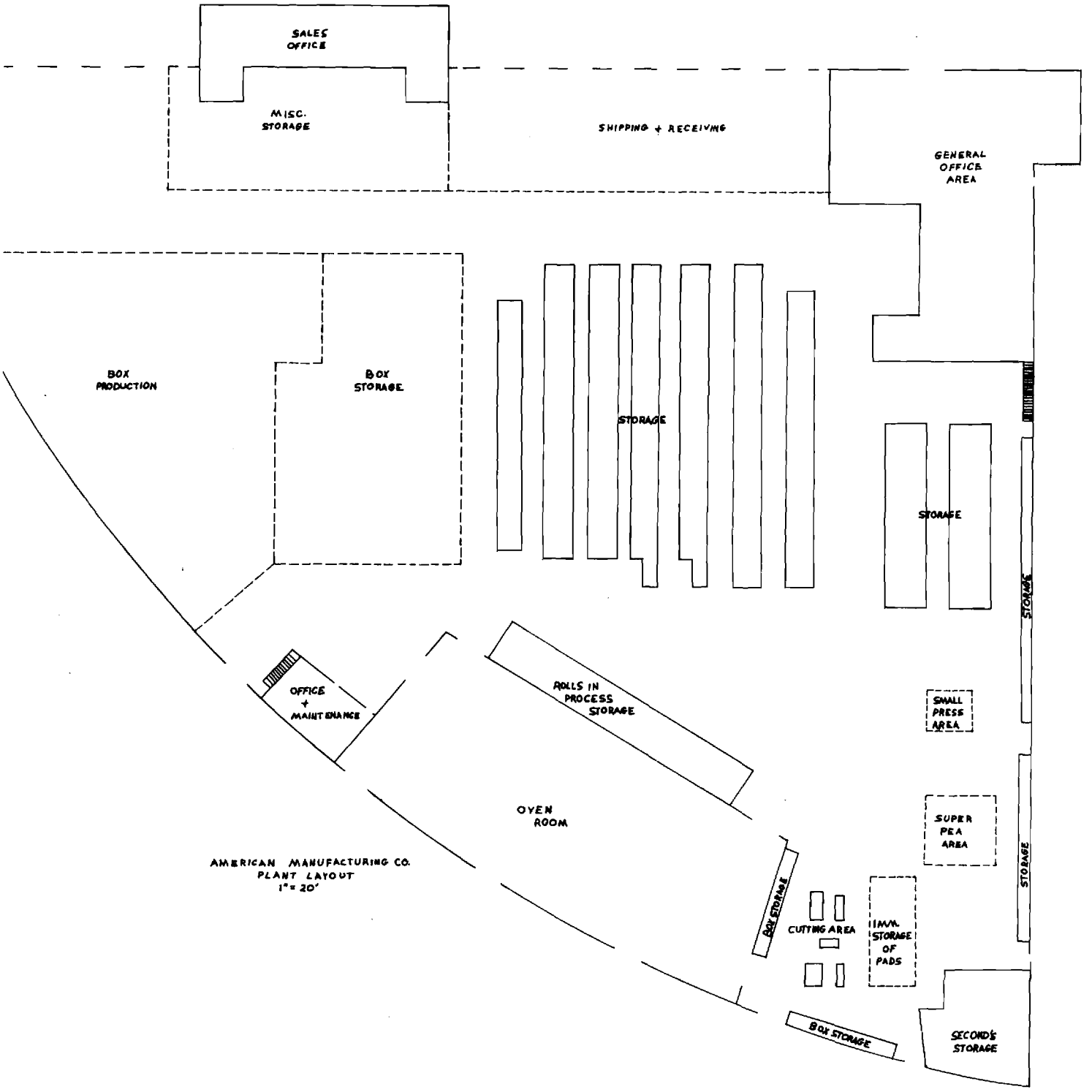
Weighted Average: Present = 70.42% Utilization
Proposed = 74.57% Utilization

Fig. 10

Client Acknowledgement

The preceding report has been presented to me as the representative of American Manufacturing Company. I have reviewed the contents of this report and discussed this information with the student team.

SIGNATURE _____ Date _____


SALES OFFICE
MISC. STORAGE
SHIPPING + RECEIVING
GENERAL OFFICE AREA
BOX PRODUCTION
BOX STORAGE
STORAGE
STORAGE
STORAGE
OFFICE + MAINTENANCE
ROLLS IN PROCESS STORAGE
SMALL PRESS AREA
OVEN ROOM
SUPER PEA AREA
STORAGE
BOX STORAGE
CUTTING AREA
IMM. STORAGE OF PADS
BOX STORAGE
SECOND'S STORAGE
AMERICAN MANUFACTURING CO.
PLANT LAYOUT
1" = 20'

March 15, 1977

Professor Herbert Eller
IET Department
Southern Technical Institute

Dear Professor Eller:

We enclose herewith our report for the American Manfuacturing Company. This report includes an analysis of problems and proposed solutions for the abrasive pad cutting operation.

Due to questionable accuracy of statistical data obtained from the company, the projected savings of our solutions can only be stated as estimated.

It has been a pleasure working with you on this project. We respectfully submit our proposal with the hopes that the information included will be both practical and useful to the company.

Sincerely yours,

Stephen M. Cornwell

Edwin Langley

Phase I and Phase II

Management Counseling and Technical Assistance

TO

American Manufacturing Company
Norcross, Georgia

Prepared By

Stephen M. Cornwell and Edwin O. Sawyer

Industrial Engineering Technology
Southern Technical Institute - A Division of
Georgia Institute of Technology
Marietta, Georgia 30060
March 15, 1977

TABLE OF CONTENTS

SUMMARY

The American Manufacturing Company produces various janitorial supplies for sale to wholesale supply companies.

A team of Southern Tech students and a faculty coordinator has worked closely with the factory management in a research project on ways to improve productivity.

The company worked with the Southern Tech team in the selection of the areas of activity to be studied. The company has a number of areas of activity in which substantial improvement is desired. They include materials handling and storage, bottlenecks in the production process, a lack of diversification, and a high rate of waste of raw material in the cutting of machine cleaning pads.

The company's sales have grown from $175,000 in 1969 to $3,000,000 in 1976. Major production processes studied include the manufacture of pad sheeting, die cutting of pads, and packaging of pads.

These items generate about fifty per cent of the company's sales revenue. This activity was selected for study because significant annual savings that would result from an increase in productivity and material utilization.

The pad cutting operation was selected for study because of the large number of pads produced per year and the large part of total revenue generated by pad sales. It was felt that even small amounts of labor and/or material savings would represent large savings when considered on an annual basis.

As these processes were studied by the college team, the following problem areas became apparent:

1. Space utilization was not maximized
2. Too much time was consumed by operators in placing dies to cut pads
3. The need for a die placement pattern to optimize material utilization
4. Material was being handled more time than necessary
5. Scrap loss was high
6. Reworking of scrap was time consuming
7. Backtracking and long moves of some material was observed.

Based on various analyses of the factory over a period of time by the college team members, a number of recommendations evolved in the areas of facilities and production.

In the facilities area, a suggested new layout and work flow were designed to reduce materials handling and storage space.

In the production process, a number of changes were recommended concerning selection of die sizes and die placement patterns.

The intent of all of the recommendations is to suggest low cost methods for increasing productivity, which would permit the company to increase production, reduce scrap losses, and more effectively utilize existing building and facilities and realize a savings of more than $19,000 per year.

I. Business History. Land Industries, Inc., was started in 1969 by Jim Rones, d/b/a American Manufacturing Company. The company basically started operating by purchasing finished goods and repacking and selling them to the janitorial market through distributors located throughout the United States. Sales were approximately $175,000 during the first year of operation and have grown to approximately $3,000,000 during 1976.

During early 1973 supply problems necessitated the decision to begin partial manufacturing of abrasive floor scrubbing pads and other abrasive products. These products were responsible for approximately 50% of sales. With normal start-up problems solved, American Manufacturers was running smoothly until March of 1975 when the warehouse and corporate offices were destroyed by a devastating tornado. With the help of loyal suppliers and personnel of the company, operations were moved immediately to the present 90,000 sq. ft. location. Shipments began again within two weeks, and with the aid of a SBA Disaster Loan the company re-established operations.

A non-woven air lay production line became necessary when the only supplier of one vital raw material was unable to supply the necessary quality and volume to meet their needs. When other suppliers could not be secured the decision was made to commit for the production line. Equipment began arriving January 1976, and the line was completed by March of this year. Crews have been trained in the operation, and they are now producing on this line. The equipment has allowed American Manufacturers to become one of the seven basic suppliers in the country of non-woven abrasive products (which constitutes 50% of their sales volume).

They have recently designed and are now manufacturing for their industry a new concept in barrel stands - which seem to have great potential. At present they are also having tooling made for a newly-designed mop wringer, which will be in production early in 1977.

Refer to Figure A for a representation of the company's present organizational structure.

II. Objectives. The objectives were to increase production and reduce waste in the fabrication and packaging of abrasive floor pads. This was to be accomplished by eliminating production bottlenecks and cutting more pads per square yard of material.

Mr. Peter Demetriades, Plant Manager, and Mr. Andy White, Plant Supervisor, offered their full cooperation and were very helpful in providing any information desired by the college team members.

III. Problems. The following problem areas or activities were identified:

1. Bottlenecks in the cutting and packaging operations
2. A high rate of waste of pad material
3. Double handling of materials
4. A lack of pattern drawings to optimize the number of pads to be cut from a standard piece of raw material, resulting in rework of scrap material
5. A lack of a pattern to aid operators in placing dies quickly for proper cutting of pads
6. Excessive inspection, handling, and rework of scrap material resutling in excessive labor costs.
7. Excessive use of floor space

IV. Existing Conditions. The present method of cutting pads involves a placement of dies by the operators based on their judgement and experience. At present, there is no pattern drawings in the work area to which the operators refer while cutting the pads. With this present method, a reinspection of scrap material from the two primary presses is necessary to determine whether smaller pads may be cut from the material.

Reinspection is performed by a third employee who makes the additional cuts on a small press located approximately fifty feet away (refer to figure 11). Since no reinspection is made by the primary press operators, it is necessary to move the scrap material to the secondary press area.

The reinspection was made by the secondary press operator by physically digging through mounds of scrap material in search of succificient sizes of scrap to make smaller cuts.

It was felt that the judgement of the primary operators concerning the optimum number of cuts due to lack of a definite pattern drawing required unnecessary time between machine cuts. Although the operators are trained, the placement of dies according to operator judgement did not optimize material utilization. This method of placement of dies was also the reason the reinspection was necessary to identify salvage material.

Due to a double handling of material for reinspection, temporary storage of scrap material required unnecessary use of floor space. Additional requirements of reinspection included floor space necessary for the second press area and the labor cost of the secondary operator.

It was felt that improved material utilization could eliminate these problems of double handling. Use of pattern drawings could lessen time required for operator judgement and also create a savings in material cost by using a combination of die sizes.

V. Solutions. Implementation of the use of the proposed die patterns would enable the company to save approximately $19,000 per year. The amount of savings is based on 68,000 linear yards of material used per year in production. This figure is also based on an average cost of material per linear yard.

The amount of projected savings primarily reflects savings based on production and cost figures supplied to us by the company. Since we did not receive separate direct labor costs, the amount of savings in direct labor costs is not included in the above figure. This additional saving will occur due to not having to inspect scrap material after it has left the large die cutting machines.

It is proposed that American Manufacturing Company implement the pattern diagrams represented in figure one through figure nine. Operators should be supplied with proposed diagrams of the suggested patterns and required to use them as a normal routine in pad production.

According to the information obtained from the American Manufacturing Company, our calculations show they are getting a material utilization of 70.42%. By implementing our proposed patterns the material utilization will be increased to 74.57% for the pattern range studied (12 in. - 20 in.).

For a size breakdown of material utilization refer to figure 10. Since our study of material utilization only covered the range of sizes which constituted approximately 89% of total pad sales, other cost reductions may be obtained by a further study of the remaining pad sizes.

BRIEF PERSONAL HISTORY - PETER G. DEMETRIADES

EDUCATIONAL BACKGROUND

1957:	Graduated Frank L. Ashley High School Gastonia, North Carolina (Pre-college)
1957-1961:	Georgia Institute of Technology, Atlanta, Georgia Graduated - B. S. Industrial Management

TECHNICAL TRAINING

1. Naval Instructors School, Charleston, S.C. - 2 weeks
2. Supervisors School, Lockheed Corporation, Atlanta, Ga. - 2 weeks
3. Sales Seminar, Signode Corp., Chicago, Ill. - 2 weeks
4. Real Estate Broker Course, Atlanta Area Tech, Atlanta, Ga. - 9 weeks
5. Non-woven Fabrics Seminar, Clemson University, Clemson, S. C.- 4 days

EMPLOYMENT AND BUSINESS EXPERIENCE

1961-1962:	Lockheed Corp., Atlanta, Ga.	- Industrial Engineer
1962-1964:	Lockheed Corp., Atlanta, Ga.	- Production Supervisor
1964-1965:	Signode Corp., Chicago, Ill.	- Industrial Salesman
1965-1966:	Aladdin Mills, Dalton, Ga.	- Production Manager
1966-1971:	Atlas Mills, Dalton, Ga.	- President
1972-1973:	Ackerman & Co., Atlanta, Ga.	- Commercial Real Estate Salesman
1973-Present:	Land Industries, Inc.	- Executive Vice President

BRIEF PERSONAL HISTORY - JIM RONES

EDUCATIONAL BACKGROUND

Graduated from High Point High School in High Point, North Carolina in 1943. From 1946 to 1950 attended Duke University and the University of North Carolina.

MILITARY BACKGROUND

After graduation from high school in 1943 enrolled in the Aviation Cadet Training Program of the Army Air Corps. Graduated as pilot. Had extensive training in single-engine, twin-engine, and four-engine bombers. Attended Army Air Force Radar and Navigational Schools. Qualified as Radar Observer.

BUSINESS BACKGROUND

After leaving the military, became an apprentice optician for Wright Optical Company in High Point, North Carolina, in 1951. Became licensed optician in North Carolina. In 1955 became District Sales Supervisor for Selig Chemical Company. Later became General Manager of the Industrial Mop Manufacturing Division of American Associates Company of Atlanta, Georgia. In 1962 formed Jim Rones & Associates, a manufacturing representative firm. In 1969 formed Land Industries, Inc., a privately-held corporation, which does business as American Manufacturing Company.

Organization Chart

American Manufacturing Company

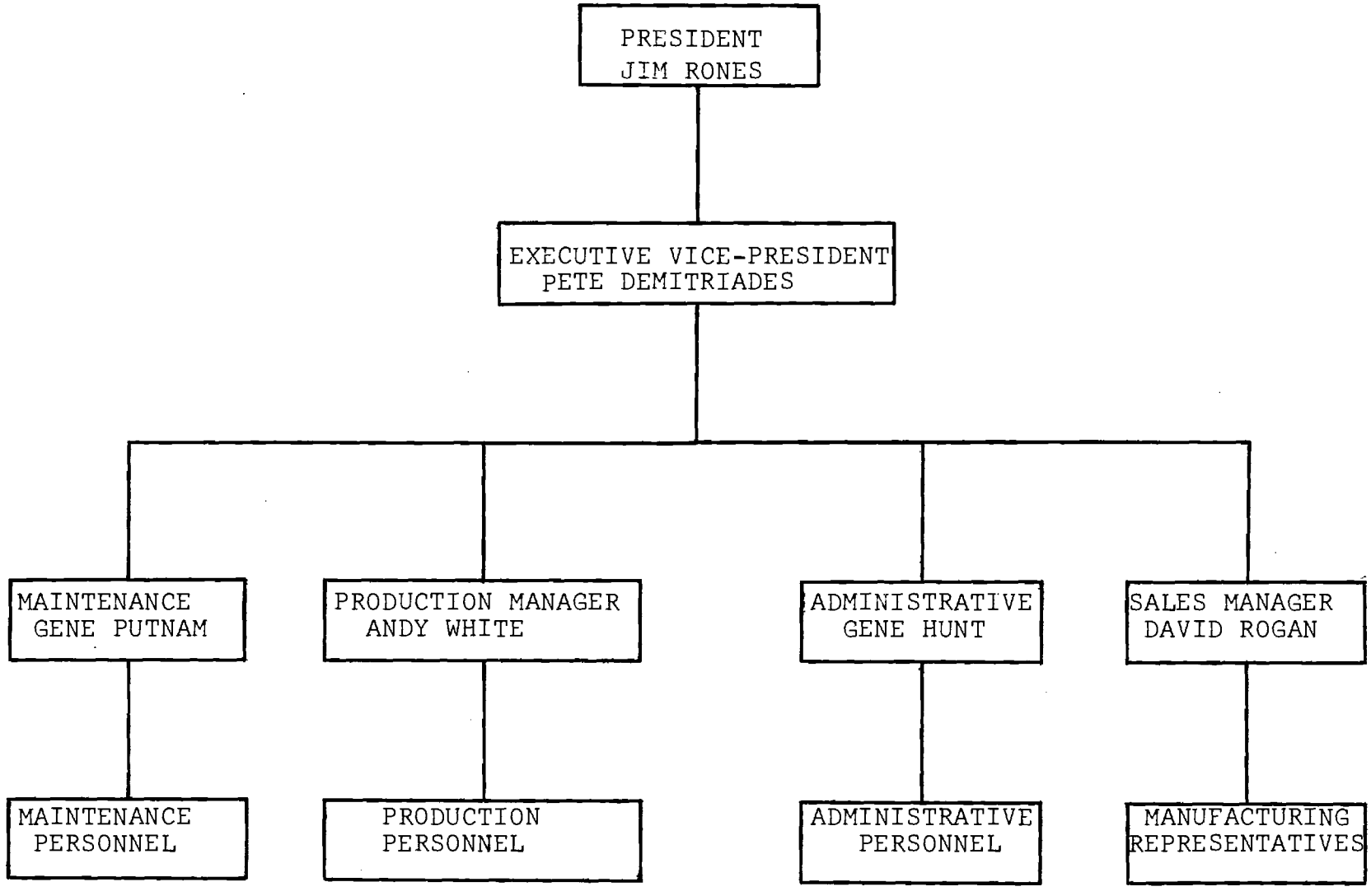


Fig. A

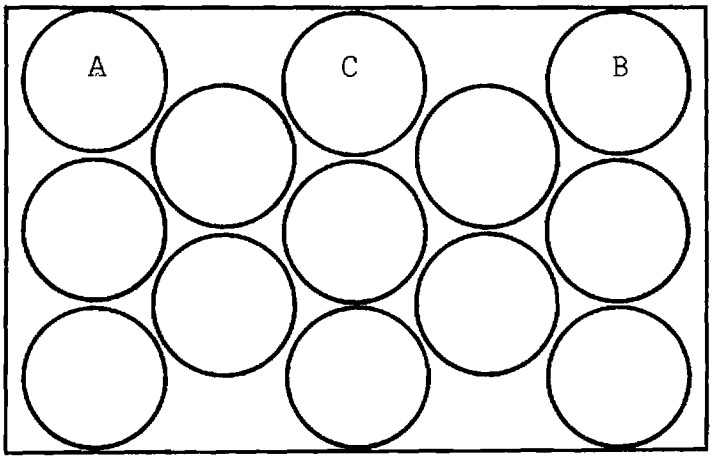


Fig. 1 12-inch Pattern

No. of pads/roll: 360
% Material Utilization: 78.0

CUTTING PROCEDURE

1. Make corner cut of pads A and B with minimum tolerance from edges.

2. Cut pad C with equal distance from cut A and B.

3. Continue cutting according to pattern with minimum tolerance from edges and previous cuts.

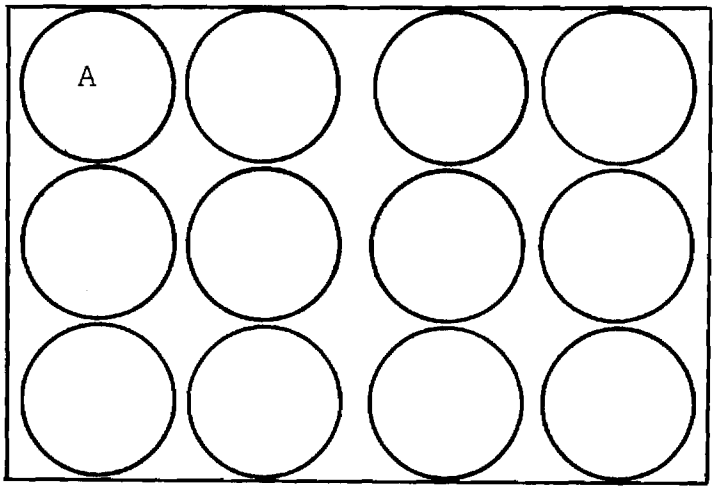


Fig. 2 13-inch Pattern

No. of pads/roll: 266.66
% Material Utilization: 67.8

CUTTING PROCEDURE

1. Make corner cut of pad A with minimum tolerance from edges.

2. Continue cutting pads of first row with minimum tolerance from previous cut and edges.

3. Continue cutting according to pattern with minimum tolerance from previous cuts and edges.

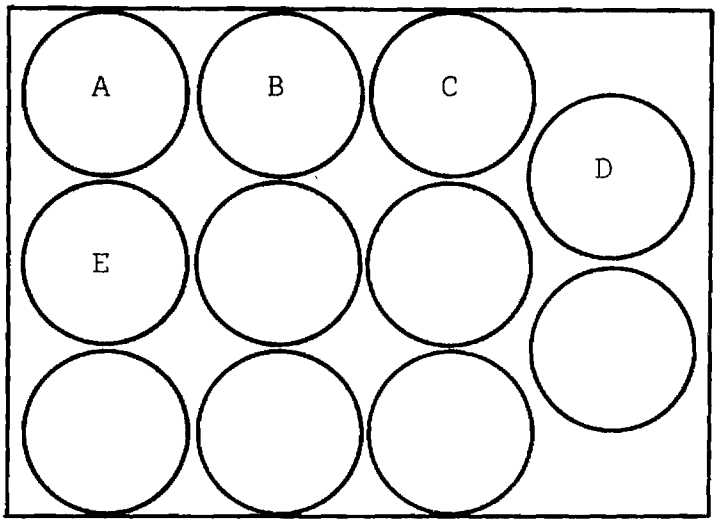


Fig. 3 14-inch Pattern

No. of pads/roll: 247.2
% Material Utilization: 72.9

CUTTING PROCEDURE

1. Make cut A with minimum tolerance from edges.

2. Cut pads B and C with minimum tolerance from previous cut and edge.

3. Cut pad D with minimum tolerance from cut C and edge.

4. Continue cutting according to pattern with minimum tolerance from previous cuts and edges.

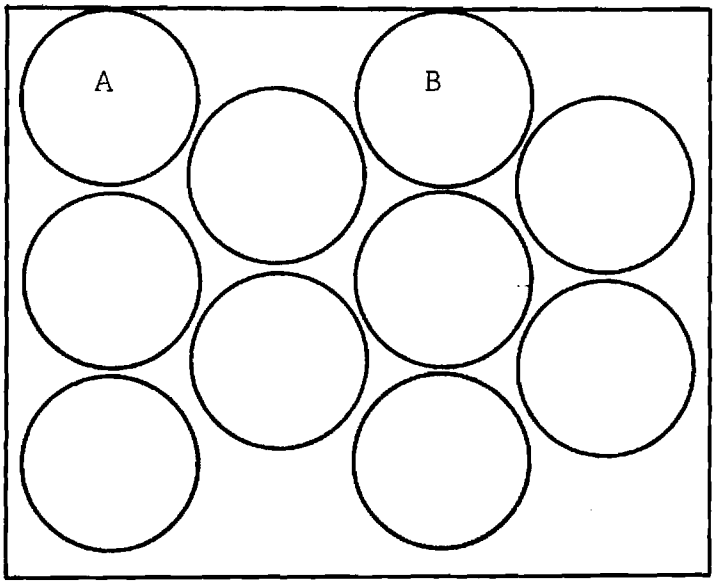


Fig. 4 15-inch Pattern

No. of pads/roll: 231.29
% Material Utilization: 78.3

CUTTING PROCEDURE

1. Make cut A with minimum tolerance from edges.

2. Cut pad B at a distance of 12.5 inches from cut A with minimum tolerance from edge.

3. Continue cutting according to pattern with minimum tolerance from previous cuts and edges.

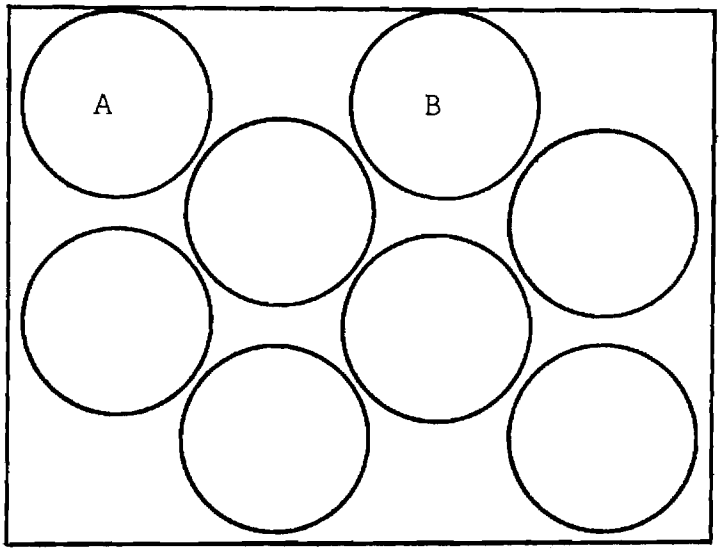


Fig 5 16-inch Pattern

No. of pads/roll: 185
% Material Utilization: 71.3

CUTTING PROCEDURE

1. Make cut A with minimum tolerance from edges.

2. Cut pad B at a distance of 10.5 inches from cut A with minimum tolerance from edge.

3. Continue cutting according to pattern with minimum tolerance from previous cuts and edges.

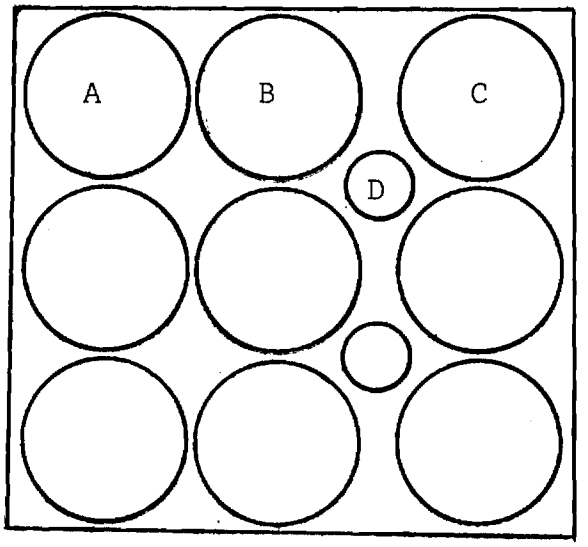


Fig. 6 17-inch Pattern

No. of pad/roll: 154.28 (17-inch pads)
50 (7 3/4-inch pads)
% Material Utilization: 71.6

CUTTING PROCEDURE

1. Make cut A with minimum tolerance from edges.
2. Cut pad B with minimum tolerance from cut A and edge.
3. Cut pad C with minimum tolerance from edges.
4. Cut pad D (7 3/4-inch) with minimum tolerance from cut B and C.
5. Continue cutting according to pattern with minimum tolerance from previous cuts and edges.

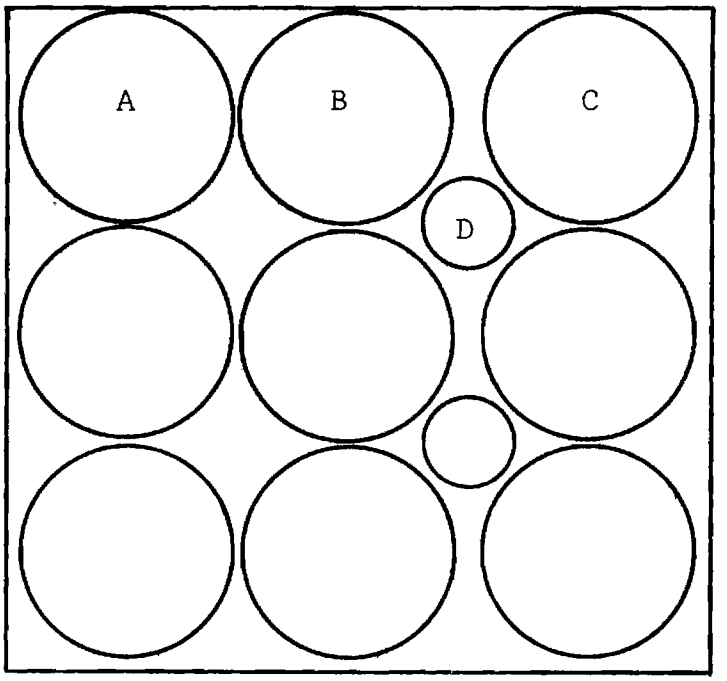


Fig. 7 18-inch Pattern

No. of pads/roll: 145.946 (18-inch pads)
47.648 (7 3/4-inch pads)
% Material Utilization: 75.45

CUTTING PROCEDURE

1. Make cut A with minimum tolerance from edges.
2. Cut pad B with minimum tolerance from cut A and edge.
3. Cut pad C with minimum tolerance from edges.
4. Cut pad D (7 3/4-inch) with minimum tolerance from cuts B and C.
5. Continue cutting according to pattern with minimum tolerance from previous cuts and edges.

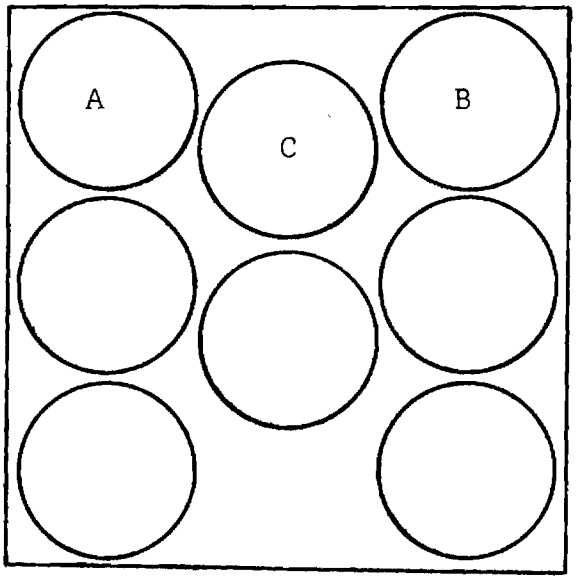


Fig. 8 19-inch Pattern

No. of pads/roll: 137.457
% Material Utilization: 74.66

CUTTING PROCEDURE

1. Make cut A with minimum tolerance from edges.

2. Cut pad B with minimum tolerance from edges.

3. Cut pad C with minimum tolerance from pads A and B.

4. Continue cutting according to pattern with minimum tolerance from previous cuts and edges.

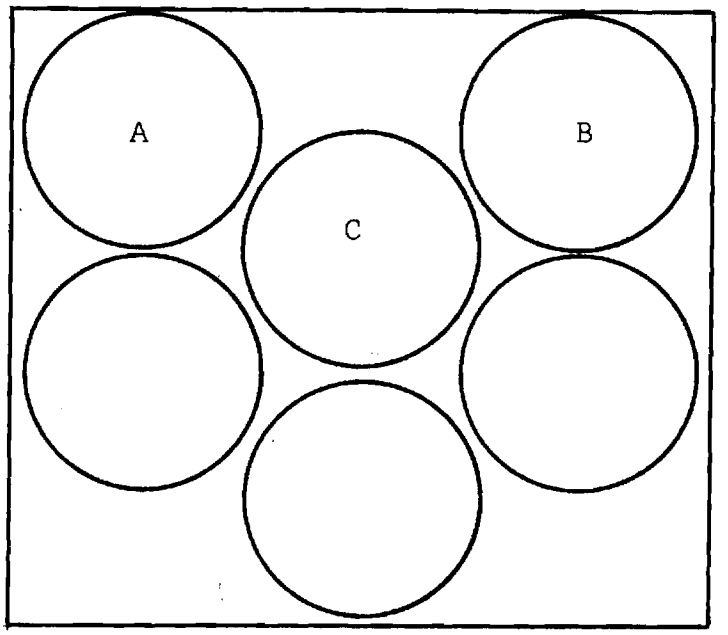


Fig. 9 20-inch Pattern

No. of pads/roll: 131.2
% Material Utilization: 78.96

CUTTING PROCEDURE

1. Make cut A with minimum tolerance from edges.

2. Cut pad B with minimum tolerance from edges.

3. Cut pad C with minimum tolerance from pads A and B.

4. Continue cutting according to pattern with minimum tolerance from previous cuts and edges.

Percentage Material Utilization

Machine Pad Size	% Utilization (Present Method)	% Utlization (Proposed Method)
12	60.18	78.00
13	61.12	67.80
14	63.56	72.90
15	66.12	78.30
16	68.78	71.30
17	70.59	71.60
18	73.42	75.45
19	73.80	74.66
20	75.23	78.96

Weighted Average: Present = 70.42% Utilization
Proposed = 74.57% Utilization

Fig. 10

Client Acknowledgement

The preceding report has been presented to me as the representative of American Manufacturing Company. I have reviewed the contents of this report and discussed this information with the student team.

SIGNATURE _____ Date _____

Figure 1. Monthly Log 20

Client Company: American Manufacturing

1. Client Meetings:

Date	Time Start	Time Finish	Team Members Present	Client Members Present
11-10-76	3:00	5:30	Sawyer, Cornwell, Eller	Demetriades
11-20-76	9:25	4:20	Sawyer, Cornwell	White
12-8-76	9:15	4:20	Sawyer, Cornwell	White
12-20-76	4:00	5:00	Sawyer, Cornwell	Demetriades

2. Telephone Contacts:

Date	Time Start	Time Finish	Team Member(s)	Client Member(s)
12-21	11:00	11:00	Cornwell	Demetriades

3. Team Meetings:

Date	Time Start	Time Finish	Team Members
12-21	9:30	4:00	Sawyer, Cornwell
1-6-77	3:00	4:20	Sawyer, Cornwell, Eller

Figure 1. Monthly Log 27.75

Client Company: American Manufacturing

1. Client Meetings:

Date 1-77	Time Start	Time Finish	Team Members Present	Client Members Present
1-13	1:30	5:00	Cornwell, Sawyer, Eller	Demetriades
1-28	2:15	4:30	Cornwell, Sawyer	Demetriades

2. Telephone Contacts:

Date 1-77	Time Start	Time Finish	Team Member(s)	Client Member(s)

3. Team Meetings:

Date	Time Start	Time Finish	Team Members
1-12	3:00	4:00	Sawyer, Cornwell, with Ron Young
1-11	1:30	3:00	Sawyer, Cornwell
1-10	3:00	4:30	Sawyer, Cornwell, Eller
1-17	2:00	5:00	Sawyer, Cornwell, with Prof. Haddock, Eller
1-18	1:00	4:00	Sawyer, Cornwell
1-19	2:00	5:00	Sawyer, Cornwell, Eller
1-24	2:00	5:00	Sawyer, Cornwell, Eller
1-25	1:00	2:00	Sawyer, Cornwell
1-26	2:00	5:00	Sawyer, Cornwell, Eller
1-31	2:00	5:00	Sawyer, Cornwell, Eller

Figure 1. Monthly Log 60.5

Client Company: American Manufacturing

1. Client Meetings:

Date	Time Start	Time Finish	Team Members Present	Client Members Present
2-3	2:00	4:00	Sawyer, Cornwell	White
2-17	1:00	4:00	Sawyer, Cornwell	Demetriades

2. Telephone Contacts:

Date	Time Start	Time Finish	Team Member(s)	Client Member(s)

3. Team Meetings:

Date	Time Start	Time Finish	Team Members
2-2	2:00	5:00	Sawyer, Cornwell, Eller with Profs. Young and Haddock
2-7	2:00	5:00	Cornwell, Sawyer, Eller
2-8	10:00	2:00	Cornwell, Sawyer
2-9	2:00	5:00	Cornwell, Sawyer, Eller
2-10	5:00	7:00	Cornwell, Sawyer, Eller
2-11	9:00	4:30	Cornwell, Sawyer
2-14	1:00	5:00	Cornwell, Sawyer
2-15	1:00	5:00	Cornwell, Sawyer
2-16	2:00	5:00	Cornwell, Sawyer, Eller
2-21	2:00	5:00	Cornwell, Sawyer, Eller
2-23	2:00	5:00	Cornwell, Sawyer, Eller
2-24	2:00	10:00	Cornwell, Sawyer
2-28	2:00	10:00	Cornwell, Sawyer, Eller

Figure 1. Monthly Log

Client Company: American Manufacturing

1. Client Meetings:

Date	Time Start	Time Finish	Team Members Present	Client Members Present

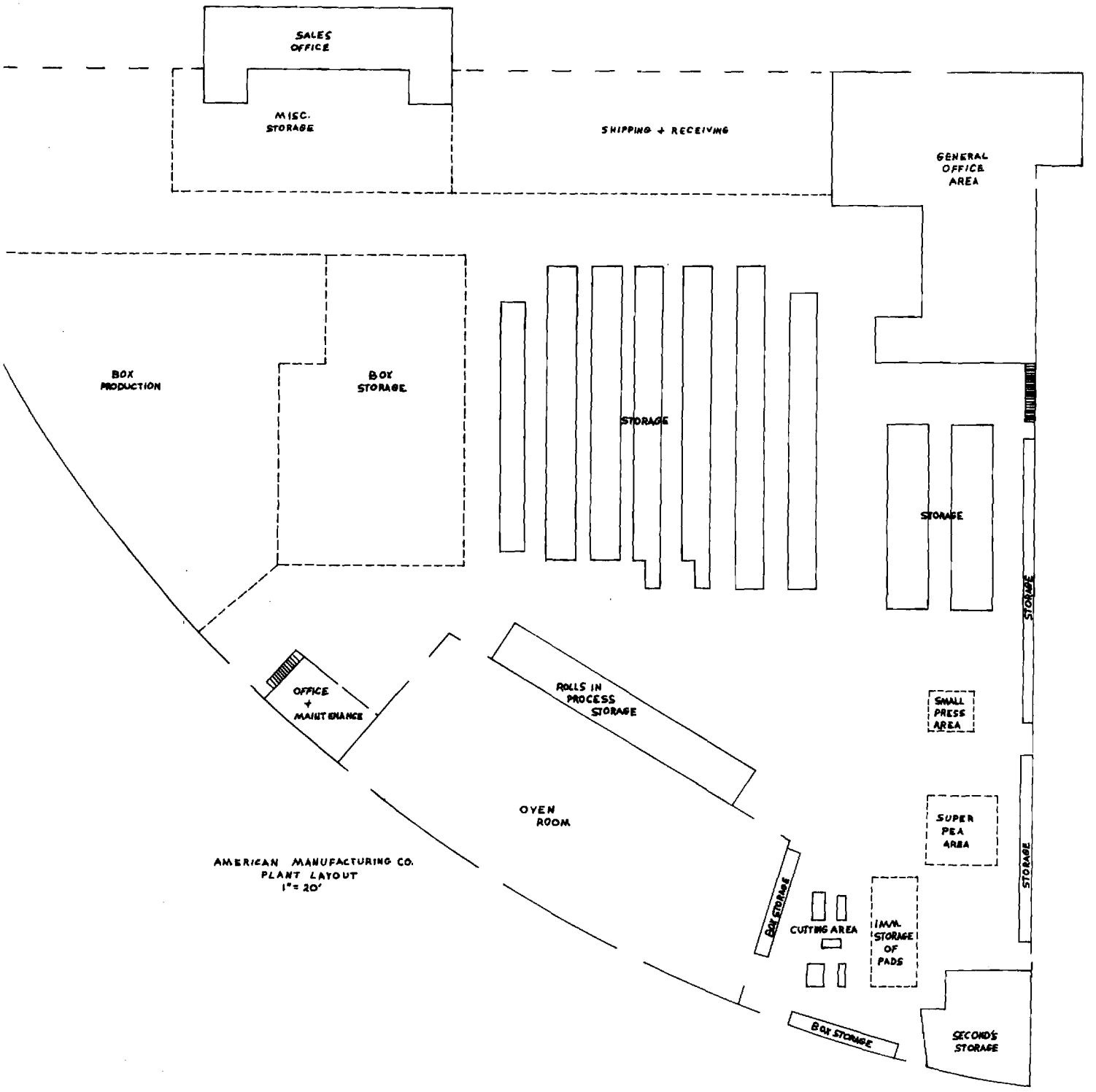
2. Telephone Contacts:

Date	Time Start	Time Finish	Team Member(s)	Client Member(s)

3. Team Meetings:

Date	Time Start	Time Finish	Team Members
3-1	11:30	4:30	Sawyer, Cornwell, Eller
3-2	2:00	5:30	Sawyer, Cornwell, Eller
3-5	11:00	4:00	Sawyer, Cornwell

APPENDIX


SALES OFFICE
MISC. STORAGE
SHIPPING + RECEIVING
GENERAL OFFICE AREA
BOX PRODUCTION
BOX STORAGE
STORAGE
STORAGE
STORAGE
OFFICE + MAINTENANCE
ROLLS IN PROCESS STORAGE
SMALL PRESS AREA
OVEN ROOM
SUPER PEA AREA
STORAGE
BOX STORAGE
CUTTING AREA
IMM. STORAGE OF PADS
BOX STORAGE
SECOND'S STORAGE
AMERICAN MANUFACTURING CO.
PLANT LAYOUT
1"= 20'

PLANT LAYOUT AND MATERIALS HANDLING

FINAL PROJECT REPORT
MARCH 14, 1977

PRESENTED TO PROFESSOR ELLER

PREPARED BY:

WILLIAM B. BLADEN

RONALD E. JONES

JAMES F. HARRIS

Southern Technical Institute
Marietta, Georgia 30060

Professor Eller
Industrial Engineering Department
Southern Technical Institute
Marietta, Georgia 30060

Reference: Plant Layout and Materials Handling for
American Manufacturing Company

Dear Professor Eller:

In January, 1977, you requested a proposed materials handling and assembly procedure for "Pushover Balancers" to facilitate a prodution level of 7,500 Pushover Balancers per year for the American Manufacturing Company of Atlanta, Georgia. This report consists of recommendations that would, if adopted, direct the American Manufacturing Company about layout procedures and materials handling to manufacture the requested amount.

Sincerely,
William B Bladen
Ronald E. Jones
James F. Harris

TABLE OF CONTENTS

APPENDIX

COMPANY AND PERSONNEL

BACKGROUND

BRIEF HISTORY OF LAND INDUSTRIES

d/b/a AMERICAN MANUFACTURING COMPANY

Land Industries, Inc., was started in 1969 by Jim Rones, d/b/a American Manufacturing Company. The Company basically started by purchasing finished goods and repacking and selling them to the janitorial market through distributors located throughout the United States. Sales were approximately $175,000 during the first year of operation and have grown to approximately $3,000,000 during 1976.

During early 1973 supply problems necessitated the decision to begin partial manufacturing of abrasive floor scrubbing pads and other abrasive products. These products were responsible for approximately 50% of sales. With normal start-up problems solved, the American Manufacturing Company was running smoothly until March of 1975 when the warehouse and corporate offices were destroyed by a devastating tornado. With the help of loyal suppliers and personnel of the Company, operations were moved immediately to the present 90,000 sq. ft. location. Shipments began again within two weeks, and with the aid of a SBA Disaster Loan the Company reestablished operations.

A non-woven air lay production line became necessary when the only supplier of one vital raw material was unable to supply the necessary quality and volume to meet their needs. When other suppliers could not be secured the decision was made to commit for the production line. Equipment began arriving January, 1976, and the line was completed by March of this year. Crews have been trained in the operation, and they are now producing on this line. The equipment has allowed American Manufacturing Company to become one of the seven basic suppliers in the county of non-woven abrasive products (which constitutes 50% of their sales volume).

They have recently designed and are now manufacturing for their industry a new concept in barrel stands which seem to have great potential. At present they are also having tooling made for a newly-designed mop wringer which will be in production early in 1977.

Refer to Page 4 for a representation of the Company's present organizational structure.

BRIEF PERSONAL HISTORY - JIM RONES

EDUCATIONAL BACKGROUND

Graduated from High Point High School in High Point, North Carolina in 1943. From 1946 to 1950 attended Duke University and the University of North Carolina.

MILITARY BACKGROUND

After graduation from high school in 1943 enrolled in the Aviation Cadet Training Program of the Army Air Corps. Graduated as pilot. Had extensive training in single-engine, twin-engine, and four-engine bombers. Attended Army Air Force Radar and Navigational Schools. Qualified as Radar Observer.

BUSINESS BACKGROUND

After leaving the military, became an apprentice optician for Wright Optical Company in High Point, North Carolina, in 1951. became licensed optician in North Carolina. In 1955 became District Sales Supervisor for Selig Chemical Company. Later became General Manager of the Industrial Mop Manufacturing Division of American Associates Company of Atlanta, Georgia. In 1962 formed Jim Rones & Associates, a manufacturing representative firm. In 1969 formed Land Industries, Inc., a privately-held corporation, which does business as American Manufacturing Company.

BRIEF PERSONAL HISTORY - PETER G. DEMETRIADES

EDUCATIONAL BACKGROUND

1957:	Graduated Frank L. Ashley High School Gastonia, North Carolina (Pre-college)
1957-1961:	Georgia Institute of Technology, Atlanta, Georgia Graduated - B. S. Industrial Management

TECHNICAL TRAINING

1. Naval Instructors School, Charleston, S.C. - 2 weeks
2. Supervisors School, Lockheed Corporation, Atlanta, Ga. - 2 weeks
3. Sales Seminar, Signode Corp., Chicago, Ill. - 2 weeks
4. Real Estate Broker Course, Atlanta Area Tech, Atlanta, Ga. - 9 weeks
5. Non-woven Fabrics Seminar, Clemson University, Clemson, S. C.- 4 days

EMPLOYMENT AND BUSINESS EXPERIENCE

1961-1962:	Lockheed Corp., Atlanta, Ga.	- Industrial Engineer
1962-1964:	Lockheed Corp., Atlanta, Ga.	- Production Supervisor
1964-1965:	Signode Corp., Chicago, Ill.	- Industrial Salesman
1965-1966:	Aladdin Mills, Dalton, Ga.	- Production Manager
1966-1971:	Atlas Mills, Dalton, Ga.	- President
1972-1973:	Ackerman & Co., Atlanta, Ga.	- Commercial Real Estate Salesman
1973-Present:	Land Industries, Inc.	- Executive Vice President

American Manufacturing Company

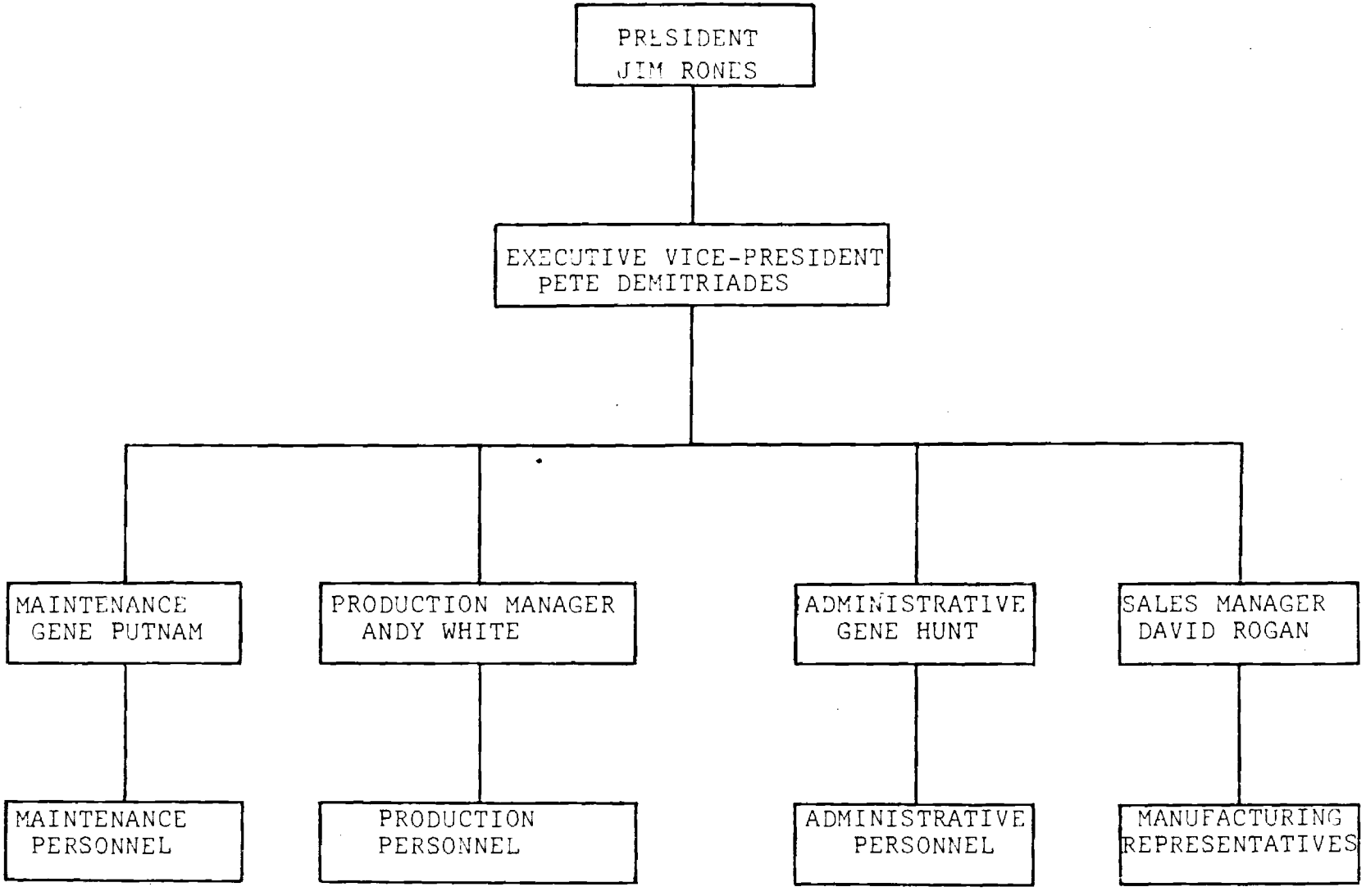


Fig. A

DISCUSSION

STATEMENT OF OWNER'S OBJECTIVES

Previous to this time, production of the Pushover Balancer was limited to maintenance shop production and marketing of the product was limited to single order sales; however, due to the increased popularity of the machine, the American Manufacturing Company is considering preparation for a manufacturing process to quench the current demand by better producing the product.

PROBLEM

The Analysis Team, made up of three IET students from Southern Technical Institute, and headed up by Professor Herbert Eller, confronted the problem with the Company objective of producing 7,500 Pushover Balancers yearly.

RECOMMENDED SOLUTION

The most critical consideration relating to the set-up procedure was the welding time per unit. Utilizing a "jig cart" to convey sub-assemblies, and including a 65% efficiency factor for the operator, the welding time was timed at 33 minutes per unit. With this in mind, and a requested quota of 30 units per 8-hour period, the team designed a straight line assembly set-up, requiring approximately 1,700 sq. ft. of ventilated floor space.

Three workers would be required to operate the set-up: two full-time welders and a machinist. According to the "Machine Requirements Calculations," the team expects the machinist to prepare enough parts in three 8-hour periods to supply two or more welders for five, 8-hour periods--one work week. The team therefore suggests that the American Manufacturing Company consider the possibility of setting up a third welding stall--the third to be made use of by the machinist, and also to offset a breakdown or the loading time for the other wire-fed welders. The utilization of a third welding stall certainly increases the production to more than the requested thirty units per 8-hour period.

The "jig cart" is basically a table on wheels designed to align the prepared parts to be welded, and to transport the aligned parts from the parts bin area into the welding stalls so that the welder has only to position the jig cart and begin welding. The team concluded that ten jig carts would be necessary for the operation. The brief time that it would take the machinist to load ten jig carts would allow him sufficient time for other necessary activities. The loaded jig carts would then be a type of "in-line storage" in the assembly line set-up.

APPENDIX

AMERICAN MANUFACTURING CO.
BILL OF MATERIALS

FOR: Push-Over DRAWING NO: 1

MODEL NO: "A" DATE: March 11, 1977

Part No.	Part Name	Dwg No.	Quant. Per Unit	Material Specific	Remarks
1	Safety Lock	1	1	Steel	
2	Stop	1	1	Steel	
3	Stop Plate	1	1	Steel	
4	Safety Guide	1	1	Steel	
5	Swivel Support	1	2	Steel	
6	Cradle Rim	1	2	Steel	
7	Leg	1	2	Steel	
8	Brace	1	2	Steel	
9	Bottom	1	2	Steel	
10	Cradle Brace	1	4	Steel	
11	2" x 5/16" Bolt & Nut	1	2	Steel	Purchased
12	1 1/2" x 5/6" Bolt & Nut	1	1	Steel	Purchased
	Carbon-Wire		4 ft.		
	Sandpaper: 9" x 12" Sheets		.25 Shts.		
	Paint		.05 Gal.		

☒ DIRECT

☐ INDIRECT

MATERIALS REQUIREMENT SCHEDULE

PRODUCT PUSHOVER - BALANCER PRODUCTION QUANTITY 7500 UNITS/YEAR

Part No.	Material description	Purchase unit	Cost per purchase unit	Quantity per product	Cost per product	Total cost per Year	Remarks
01	Safety Lock	1/8" x 1" x 20'	2.00	1	.1000	750.00	
02	Stop	1/4" x 1/4" x 20'	2.60	1	.0108	81.00	
03	Stop Plate	3" x 1/8" x 20'	6.00	1	.4500	3,375.00	
04	Safety Guide	1 1/2"x 1/2" x 20'	6.00	1	.0093	69.75	
05	Swivel Support	1 1/4" x 3/16"x20'	3.60	2	.0750	562.50	
06	Cradle Rim	1"x1"x20'	4.60	1	1.1500	8,625.00	
07	Leg	1"x1"x20'	4.60	2	.4600	3,450.00	
08	Brace	1"x1"x20'	4.60	2	.3068	2,301.00	
09	Bottom	1"x1"x20'	4.60	2	.6900	5,175.00	
10	Cradle Brace	1 1/4"x 3/16"x20'	3.60	4	1.0800	8,100.00	
11	2" x 5/16" Bolts & Nuts	400/Box	38.00	1	.2200	1,650.00	
12	1 1/2" x 5/16" Bolts & Nuts	200/Box	20.00	2	.1000	750.00	
13	Carbon Wire	100lb-Roll	62.75	.65 lb	.4078	3,059.06	
14	9" x 12" Sheets Sandpaper	1000 Sheets/Pk	1.56	.5	.00078	5.85	
15	Paint	10 Gal.	6.50/Gal.	.05 Gal.	.3250	2,437.50	
						$40,391.16	

Problem Manual for Plant Layout, 2nd Ed., ©1963, by The Ronald Press Co., N.Y.

DATA ON RECEIVING AND SHIPPING

A. Material Received:

Part No. Or Item	Description	Unit Received
1	Safety Lock	1/8" x 1" x 20' Steel Stripping
2	Stop	1/4" x 1/4" x 20' Square Steel Rod
3	Stop Plate	3" x 1/8" x 20' Steel Stripping
4	Safety Guide	1 1/2" x 1/2" x 20' Steel Channeling
5	Swivel Support	1 1/4" x 3/16" x 20' Steel Stripping
6	Cradle Rim	1" x 1" x 20' Square Steel Tubing
7	Leg	1" x 1" x 20' Square Steel Tubing
8	Brace	1" x 1" x 20' Square Steel Tubing
9	Bottom	1" x 1" x 20' Square Steel Tubing
10	Cradle Brace	1 1/4" x 3/16" x 20' Steel Stripping
11	2"x5/16" B&N	2" x 5/16" Bolts & Nuts @ 400 pieces
12	1 1/2" x 5/16" B&N	1 1/2" x 5/16" Bolts & Nuts @ 200 pieces
13	Carbon Wire	(36 in-Dia.) 2-25 lb Rolls
14	9"x12" Sheets Sandpaper	9" x 12" Sheets
15	Paint (1 gal.)	Blue Enamel Paint (10 Gallons)

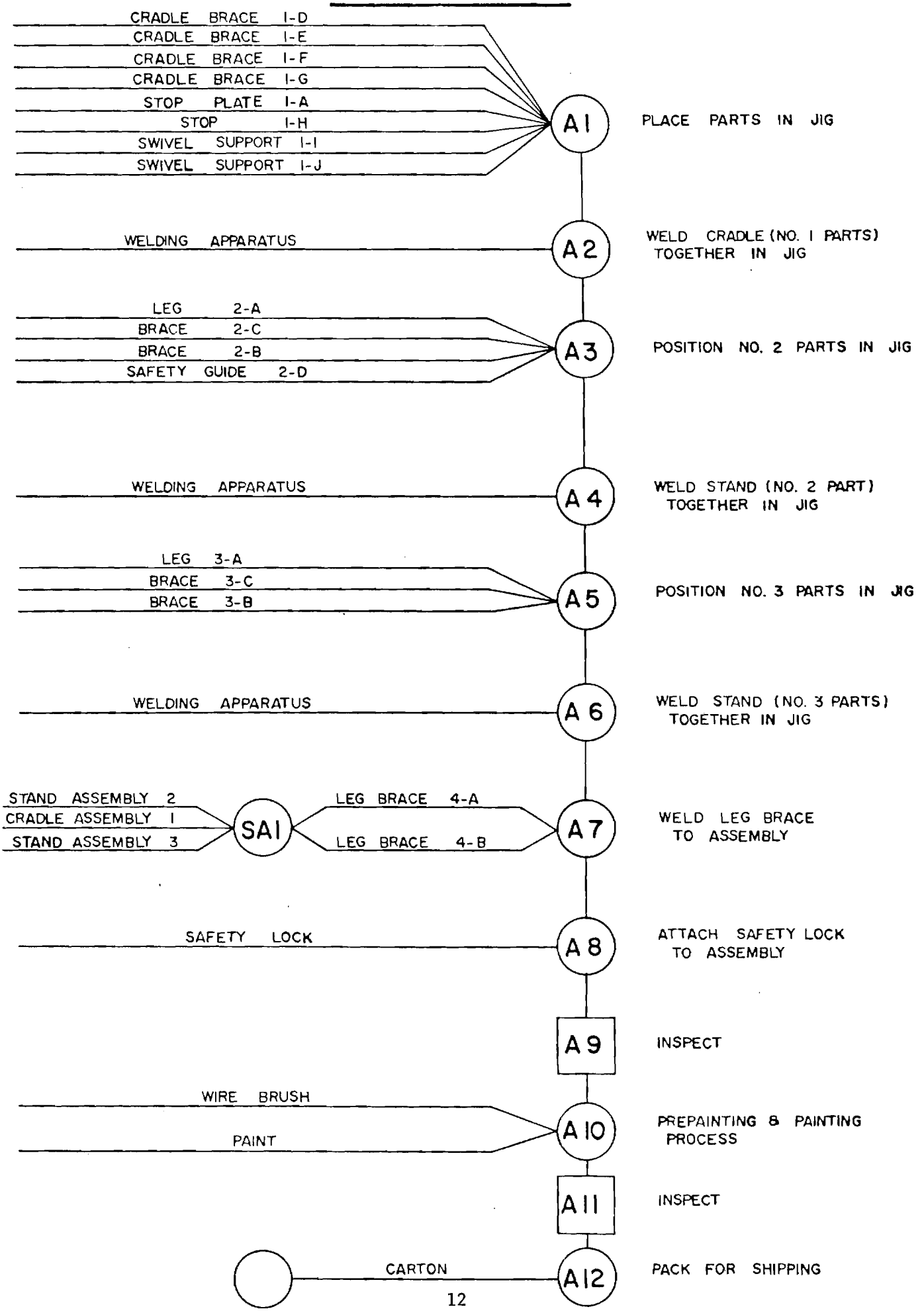
MACHINE REQUIREMENTS CALCULATIONS

Calculation are for 30 good Push-Overs at end of final assembly per 8 hour day			Man & Mach Prod'n Per Hour Based On 65% Efficiency	Percent Scrap Loss Per Oper.	Req'd PC Per 30 P.O. @ 100% Effi-ciency	Actual Number Of Mach. To Purch.
Part 1 - Safety Lock						
Op No		Equipment				
10	Cut to length	Iron Worker	450	--	30.0	1
20	Safety Lock Notch	Iron Worker	450	--	30.3	1
30	Bend	Iron Worker	450	--	30.3	1
40	Drill 1 Hole	D.P.	175	2	30.3	1
Part 2 - Stop				30		
10	Cut to length	Iron Worker	450	--	30	1
Part 3 - Stop Plate				30		
10	Cut to length	Iron Worker	450	--	30	1
Part 4 - Safety-Guide				30		
10	Cut to length	Band Saw	230	--	30	1
Part 5 - Swivel Support				30		
10	Cut to length	Iron Worker	450	--	30.6	1
20	Drill 1 Hole	D.P.	175	2	30.6	1
Part 6 - Cradle Rim						
10	Cut Double Size	Band Saw	230	--	30.9	1
20	45° Cut to length	Band Saw	200	2	30.9	1
30	Drill 1 Hole	D.P.	55	1	30.3	1
Part 7 - Leg				30		
10	Cut to length	Band Saw	230	--	30.3	1
20	Drill 1 Hole	D.P.	55	1	30.3	1
Part 8 - Brace						
10	45° Cut to length	Band Saw	200	2	30.6	1
Part 9 - Bottom				30		
10	Cut to length	Band Saw	230	--	30	1
Part 10 - Cradle Brace				30		
10	Cut to length	Iron Worker	450	--	30	1
Assembly				30		
10	Parts 1-10 In Jig	Jig Table	40	--	30	10
20	Weld Together	Welder Rm	2	--	30	2
30	Prep. For And Paint	Paint Room	10	--	30	
40	Inspect	Storage	120	--		
50	Paint	Storage	40	--		

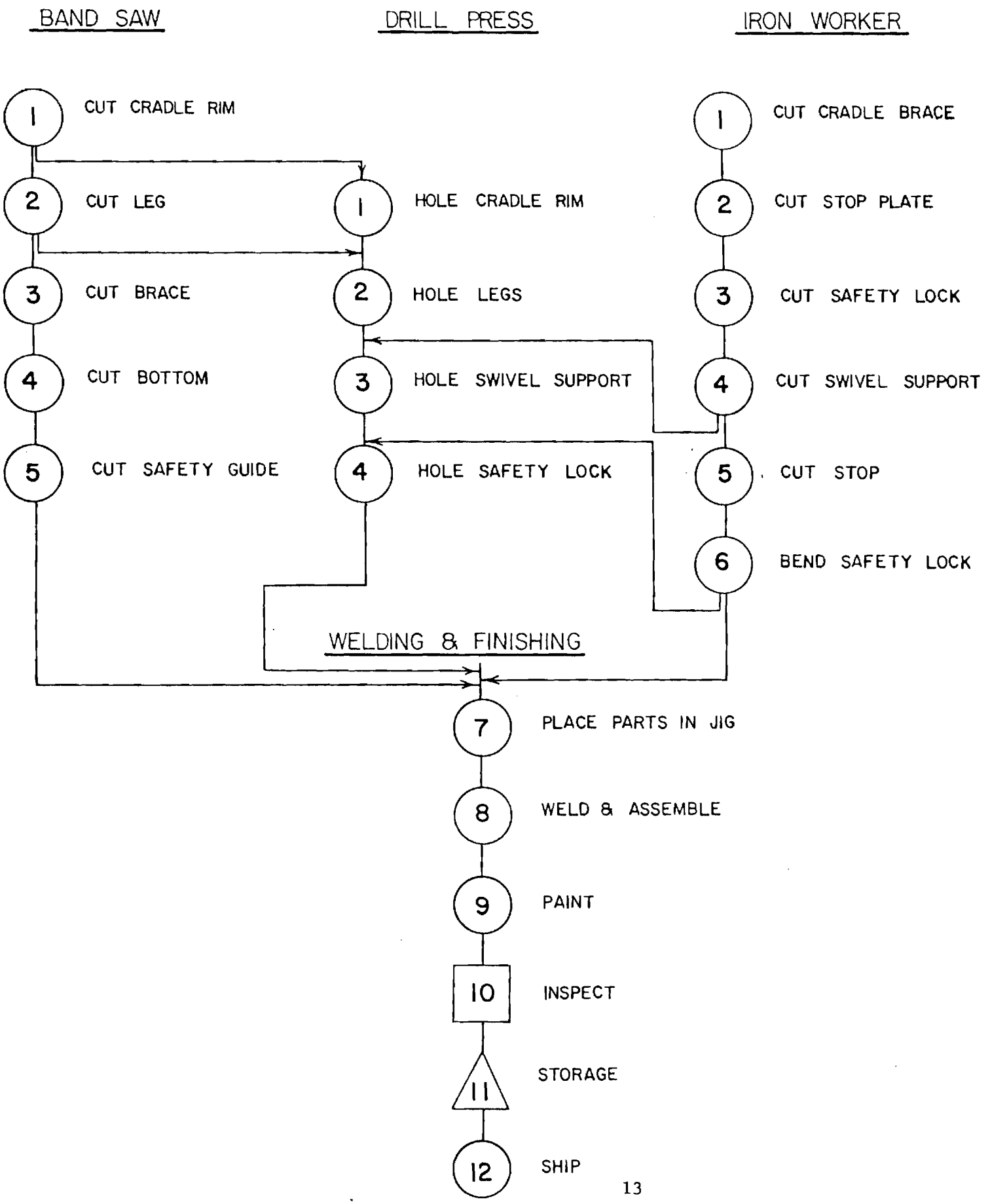
LAYOUT PLANNING CHART

St. No.	OTIDS	Description	No.	Time Per Piece	Piece Per Hour	TOTAL LOAD HOURS	OPER PER MACH.	TOTAL MAN-POWER	Machine	
1	●	Cut Cradle Brace	1	8 Sec	450	1	1	1	Iron Worker	1
2	●	Cut Stop Plate	2	8 Sec	450	1	1	1	Iron Worker	1
3	●	Cut Safety Lock	3	8 Sec	450	1	1	1	Iron Worker	1
4	●	Cut Swivel Support	4	8 Sec	450	1	1	1	Iron Worker	1
5	●	Cut Stop	5	8 Sec	450	1	1	1	Iron Worker	1
6	●	Bend Safety Lock	6	8 Sec	450	1	1	1	Iron Worker	1
7	●	Cut Cradle Rim (Double)	1	15.7Sec	230	2	1	1	Band Saw	1
8	●	45° Cut Cradle Rim	1A	18 Sec	200	2 1/2	1	1	Band Saw	1
9	●	Cut Leg	2	15.7Sec	230	2	1	1	Band Saw	1
10	●	Cut Brace	3	18 Sec	200	2 1/2	1	1	Band Saw	1
11	●	Cut Bottom	4	15.7Sec	230	2	1	1	Band Saw	1
12	●	Cut Safety Guide	5	15.7Sec	230	1	1	1	Band Saw	1
13	●	Drill Hole Cradle Rim	1	65.5Sec	55	8	1	1	Drill Press	1
14	●	Drill Hole Legs	2	65.5Sec	55	8	1	1	Drill Press	1
15	●	Drill Hole Swivel Support	3	20.6	175	4	1	1	Drill Press	1
16	●	Drill Hole Safety Lock	4	20.6	175	4	1	1	Drill Press	1
17	➡	Parts To Jig	2	-	-	-	-	-	--	-
18	●	Part In Jig	1	-	-	-	-	1/2	Jig	-
19	➡	Jig To Welder	1	-	-	-	-	-	--	-
20	●	Weld & Assemble	1	30 Min	2	Cont	1	Cont		2
21	➡	Push-Over To Paint	1	-	-	-	-	-	--	-
22	●	Prep. For And Paint	1	6 Min	10	3	1	1	Sprayer	1
23	➡	To Storage	1	-	-	-	-	-	--	-
24	■	Inspect	1	1 Min	60	-	-	-	--	-

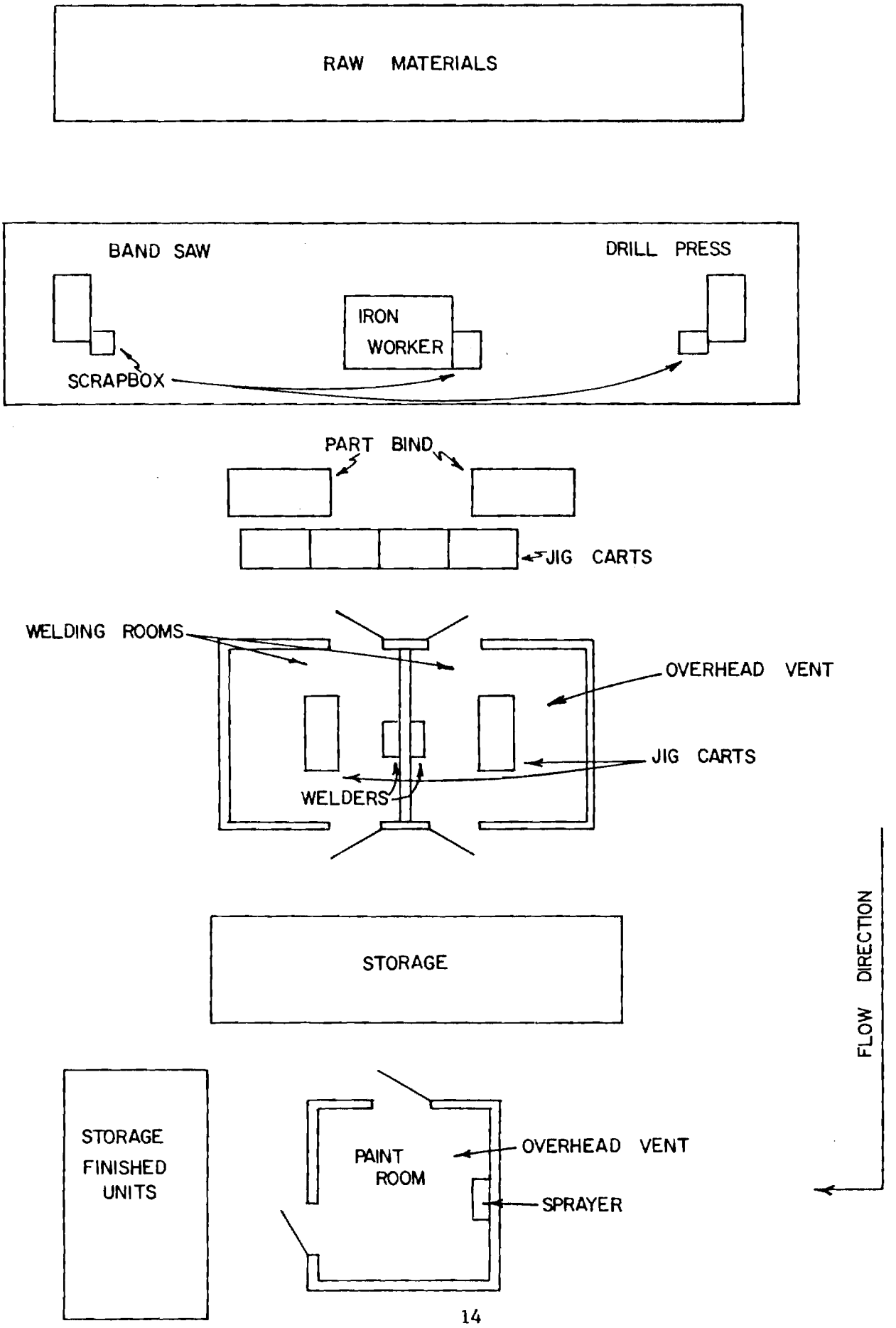
ASSEMBLY CHART



OPERATION PROCESS CHART



FINAL LAYOUT



COST DATA

COST PER UNIT ANALYSIS SHEET

Company Cost Centers:

1) Pad Center
2) Cargated Box Center
3) Other Center

OTHER COST CENTER

Other Projects			39.5 percent
Push-Over Balancer			60.5 percent
			Total 100 percent
Selling Price		$23.50	
Direct Labor Cost Per Unit			
* (1) Raw Materials			
* (2) Labor			
* (3) Freight In			
Total	$10.25		
Indirect Costs Per Unit	2.39		
Selling Expense	2.52		
Gross		8.34	
Administration & General	3.67		
Profit Per Unit		4.67	

* Breakdown of Direct Labor Costs could not be established at this time, due to variation in man-power.

COST SCHEDULES

A. Capital Investment Schedule

Equipment:

a)	Machinery	$6,920.00
b)	Material Handling	$ 130.00
c)	Auxiliary	$ 350.00
Equipment Total		$7,400.00
+ 3% Sales Tax on Equipment		$ 222.00
TOTAL CAPITAL INVESTMENT		$7,622.00

Note: The land, building and building components are already in existence. The push-over assembly is only a portion of the Company's activities.

B. Amortization Schedule

1)	Production Equipment	$ 692.00
2)	Material Handling	$ 13.00
3)	Auxiliary Equipment	$ 35.00
ANNUAL DEPRECIATION		$ 740.00

Note: The Depreciation has a span of 10 years. This is based on the life expectancy of the production equipment.

C. Inventory Value

1)	Raw Materials	$1,820.74
2)	Purchased Parts	$ 84.00
3)	Finished Goods	$ 941.50
TOTAL INVENTORY VALUE		$2,846.24

Note: The Company orders 200 units worth of raw materials and purchased parts, per order. They have in stock 50 units at anytime prior to shipment.

D. Required Investment

a)	Total Inventory Value (2 wks)	$4,066.06
b)	Wages (2 mos)	$2,880.00
TOTAL WORKING CAPITAL		$6,946.06
TOTAL REQUIRED INVESTMENT		$6,946.06

Note: Capital Investments have already been accounted for in the Company's other operations.

Production Equipment

There are three machines to be purchased for the working of parts.

1) Band Saw $1,100.00 Powermatic 1143
2) Drill Press $ 625.00 Powermatic 1150
3) Iron Worker $1,200.00 Trojan

The welding of 30 Push-Overs a day will require two machines.

1) Wire Fed Welder $1,200.00 T.C. = $2,400.00

The painting room will have a Blizzard spraying outfit.

1) Spray Painter $1,595.00

Materials Handling Equipment

There are to be two hand push carts.

1) Hand push carts $65.00 T.C. = $130.00

Auxiliary Equipment

There are to be ten Jig carts.

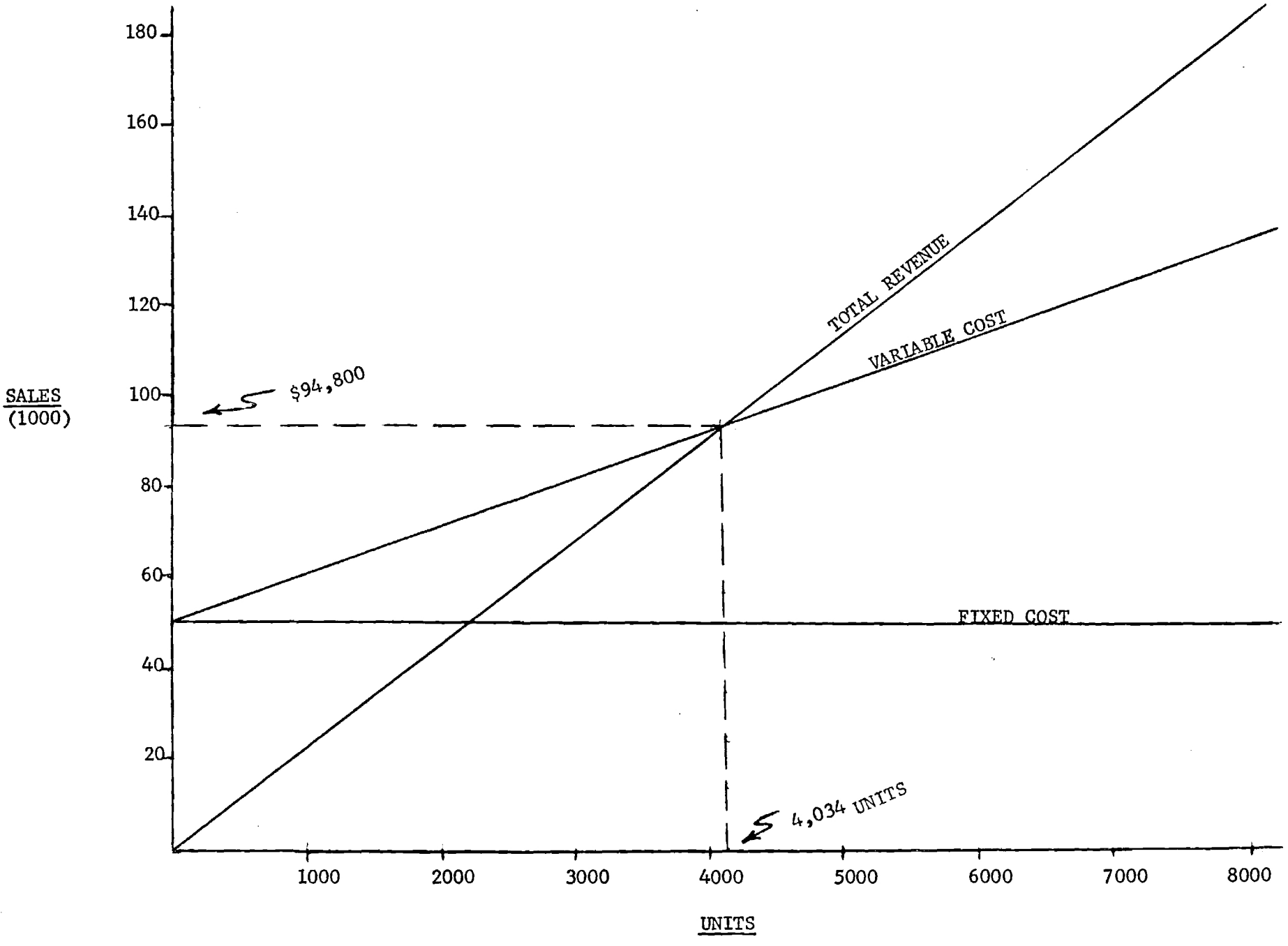
2) Jig Carts $35.00 T.C. = $350.00

Office Equipment

This is already in existance.

Building and Installed Equipment

This has already been accounted for within the operations of the company.


180
160
140
120
100
80
60
40
20
SALES
(1000)
$94,800
TOTAL REVENUE
VARIABLE COST
FIXED COST
4,034 UNITS
1000
2000
3000
4000
5000
6000
7000
8000
UNITS

MONTHLY LOG

Client Company: AMERICAN MANUFACTURING COMPANY

1. Client Meetings:

Date	Time		Team Members Present	Client Members Present
	Start	Finish		
Jan 5	2 P.M.	5 P.M.	All members present incl. Prof. Eller	Peter G. Demetriades
Feb 2	2 P.M.	5 P.M.	All members present incl. Prof. Eller	Peter G. Demetriades
Feb 21	2 P.M.	6 P.M.	All members present	Peter G. Demetriades

2. Telephone Contacts:

Date	Time		Team Member(s)	Client Member(s)
	Start	Finish		

3. Team Meetings:

Date	Time		Team Members
	Start	Finish	
Jan 10	2 P.M.	5 P.M.	All members present, including Prof. Eller
Jan 12	2 P.M.	6 P.M.	All members present
Jan 17	2 P.M.	5 P.M.	All members present
Jan 19	2 P.M.	5 P.M.	All members present
Jan 24	2 P.M.	5 P.M.	All members present
Jan 26	2 P.M.	5 P.M.	All members present
Jan 31	2 P.M.	5 P.M.	All members present, including Prof. Eller
Feb 7	2 P.M.	5 P.M.	All members present
Feb 9	2 P.M.	5 P.M.	All members present

Client Company: AMERICAN MANUFACTURING COMPANY

1. Client Meetings:

Date	Time Start	Time Finish	Team Members Present	Client Members Present

2. Telephone Contacts:

Date	Time Start	Time Finish	Team Member(s)	Client Member(s)

3. Team Meetings:

Date	Time Start	Time Finish	Team Members
Feb 14	2 P.M.	5 P.M.	All members present
Feb 16	2 P.M.	6:30 P.M.	All members present
Feb 23	2 P.M.	6 P.M.	All members present, including Prof. Eller
Feb 28	2 P.M.	5 P.M.	All members present
Mar 2	2 P.M.	6 P.M.	All members present
Mar 7	1 P.M.	6 P.M.	All members present
Mar 8	1 P.M.	6 P.M.	All members present
Mar 9	12 P.M.	6 P.M.	All members present, including Prof. Eller
Mar 10	12 P.M.	6 P.M.	All members present

Client Company: AMERICAN MANUFACTURING COMPANY

1. Client Meetings:

Date	Time Start	Time Finish	Team Members Present	Client Members Present

2. Telephone Contacts:

Date	Time Start	Time Finish	Team Member(s)	Client Member(s)

3. Team Meetings:

Date	Time Start	Time Finish	Team Members
Mar 11	1 P.M.	5 P.M.	All members present, including Prof. Eller

Travel Date	Hours	Total	Miles	
Jan 11	2-5:30	3-1/2	44	Professor Eller
Jan 27	2-6	4	44	
Mar 1	2-5	3	44	
		10-1/2 Total	132	