

PLANT LAYOUT AND MATERIALS HANDLING

FINAL PROJECT REPORT
MARCH 14, 1977

PRESENTED TO PROFESSOR ELLER

PREPARED BY:

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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 production 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

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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 S. 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

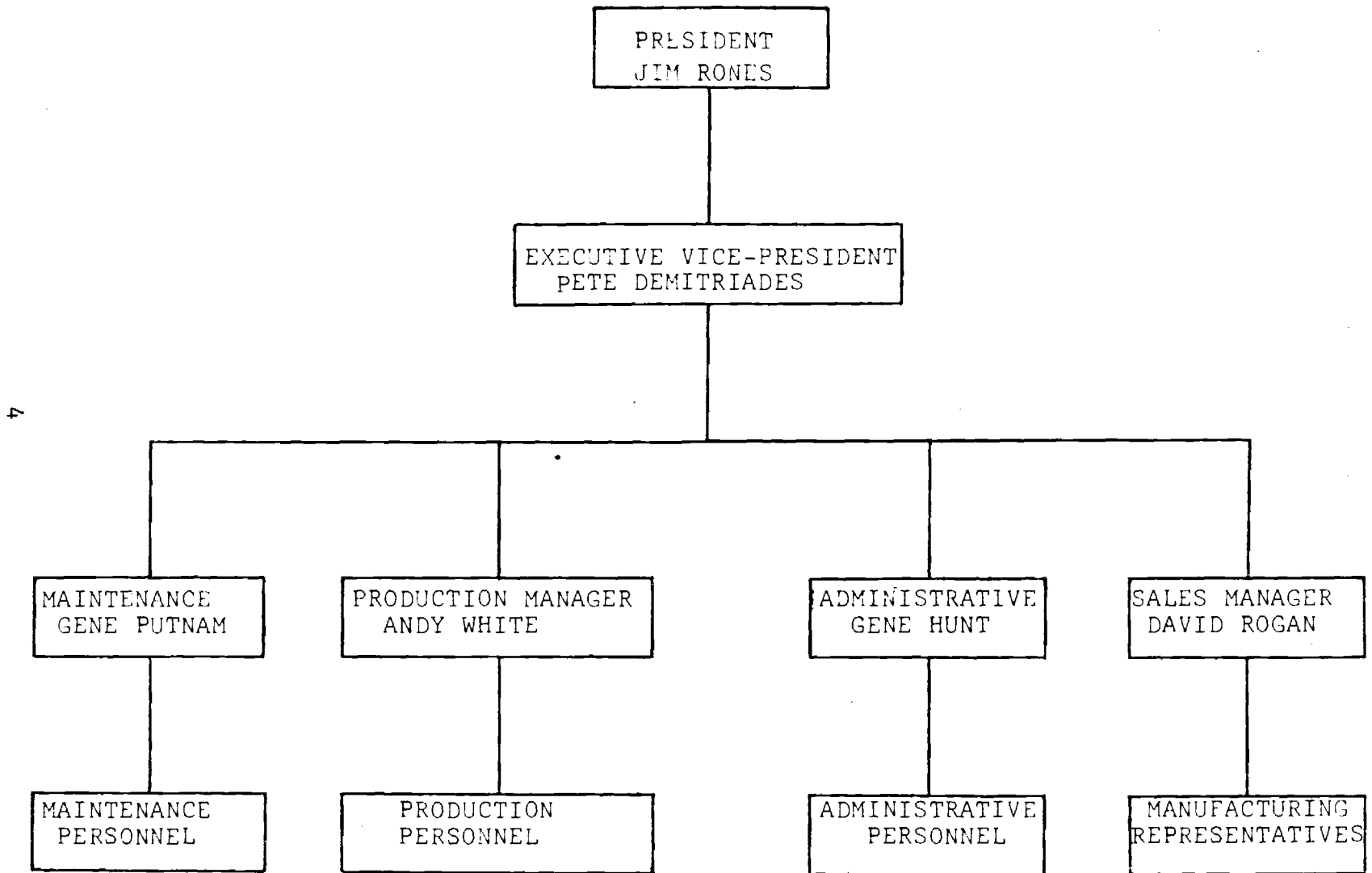
1965-1966: Aladdin Mills, Dalton, Ga. - Production Manager

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



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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" x 20'	3.60	2	.0750	562.50	
06	Cradle Rim	1" x 1" x 20'	4.60	1	1.1500	8,625.00	
07	Leg	1" x 1" x 20'	4.60	2	.4600	3,450.00	
08	Brace	1" x 1" x 20'	4.60	2	.3068	2,301.00	
09	Bottom	1" x 1" x 20'	4.60	2	.6900	5,175.00	
10	Cradle Brace	1 1/4" x 3/16" x 20'	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	1001b-Roll 1000	62.75	.65 lb	.4078	3,059.06	
14	9" x 12" Sheets Sandpaper	Sheets/Pk	1.56	.5	.00078	5.85	
15	Paint	10 Gal.	6.50/Gal.	.05 Gal.	.3250	2,437.50	
						\$40,391.16	

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)

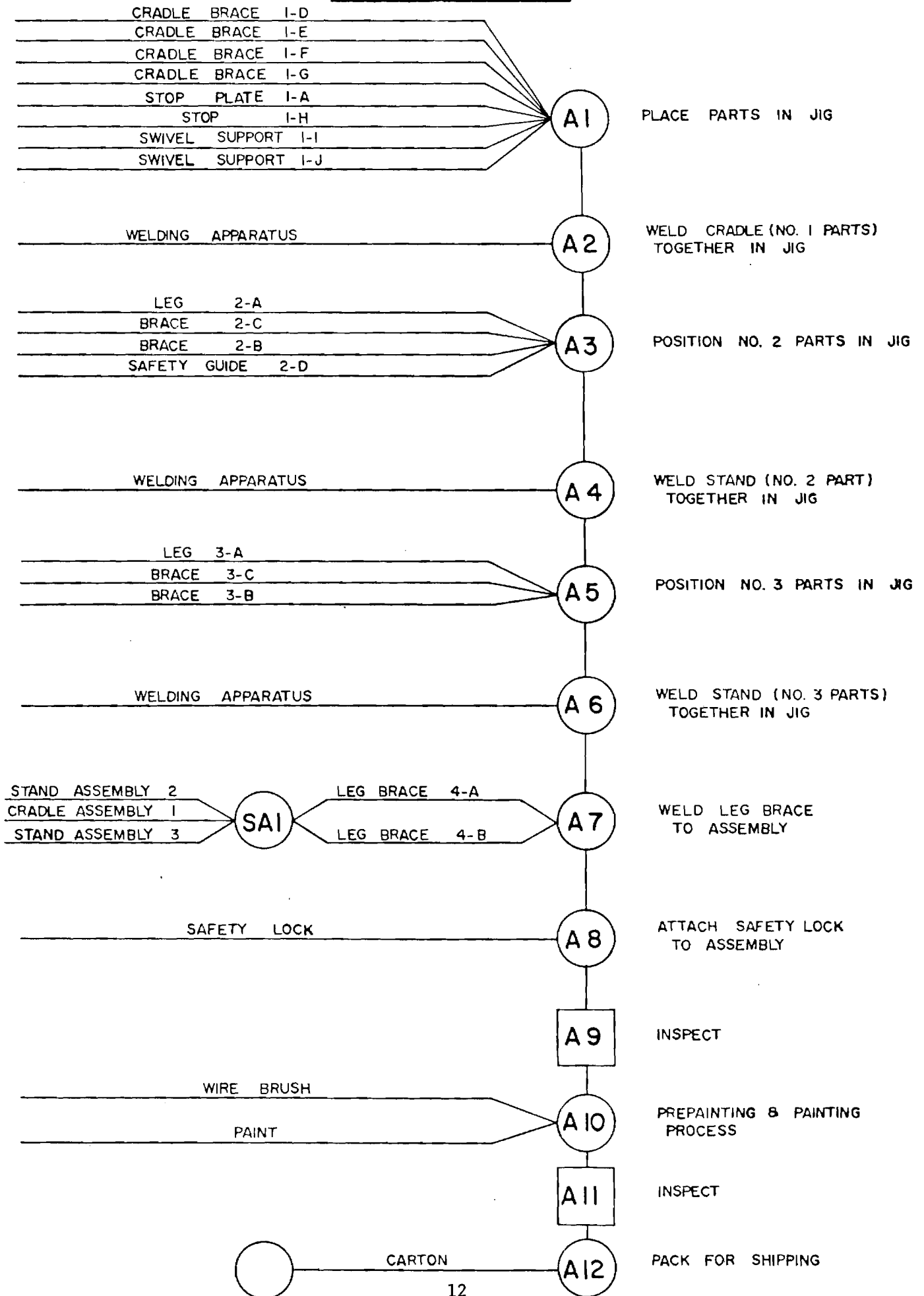
MACHINE REQUIREMENTS CALCULATIONS

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% Efficiency	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

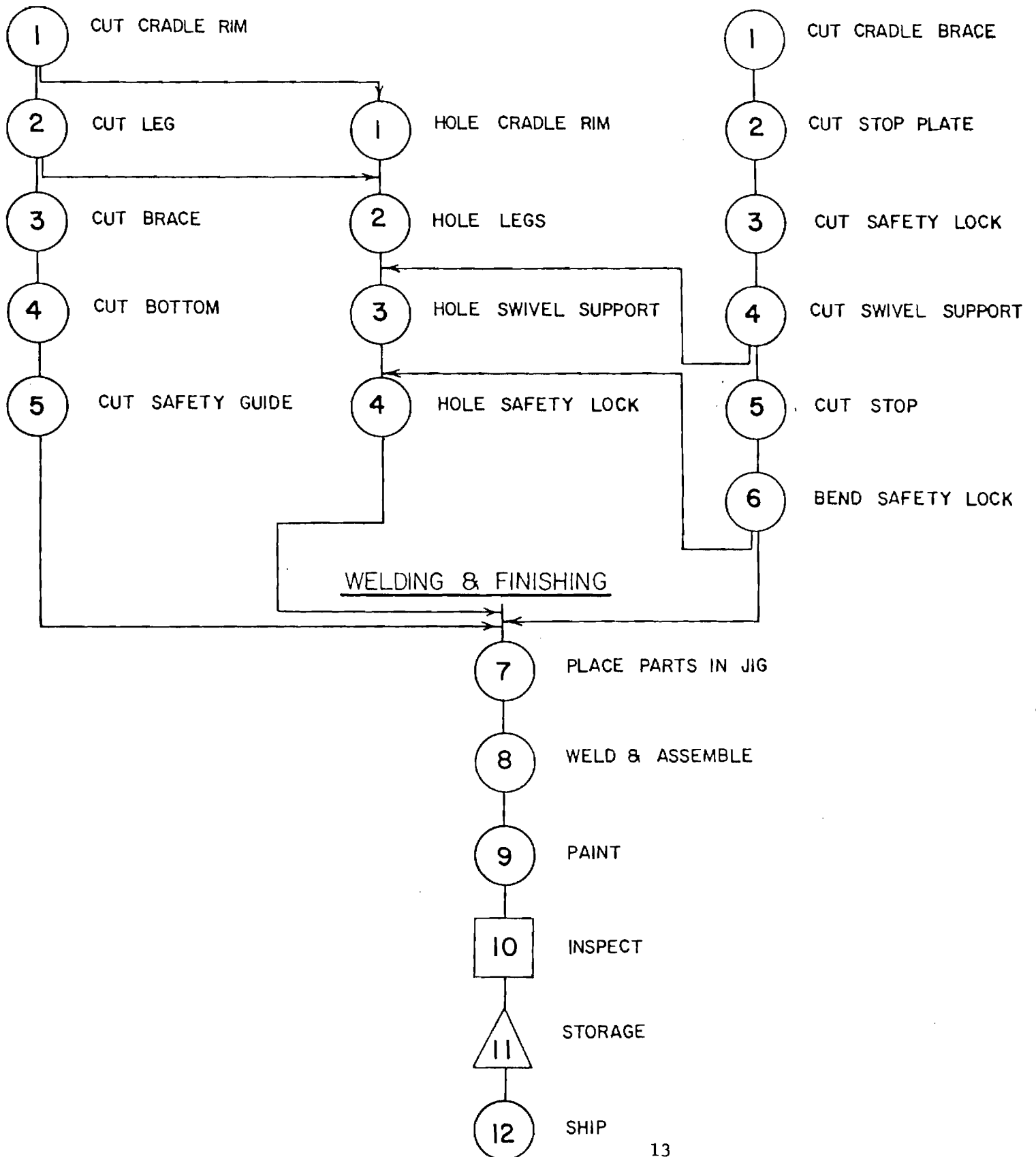


OPERATION PROCESS CHART

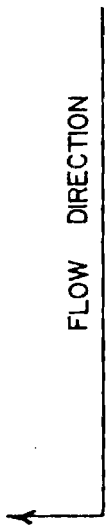
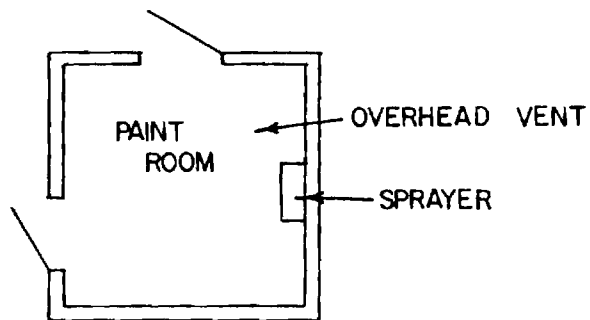
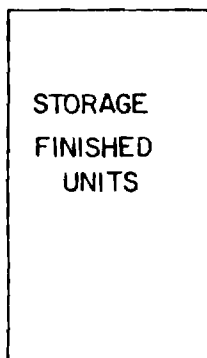
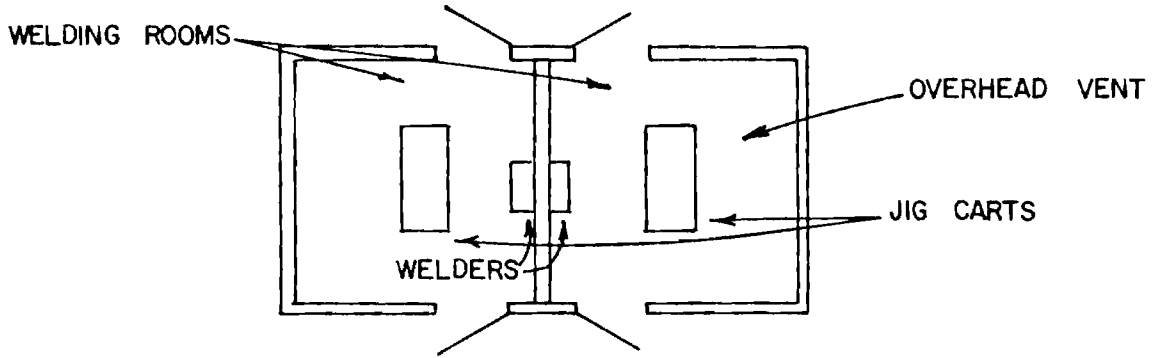
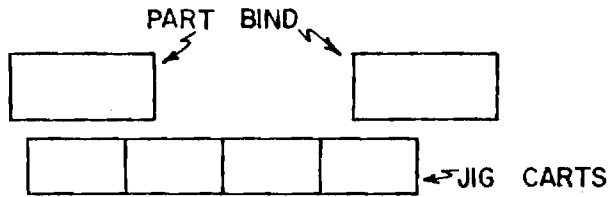
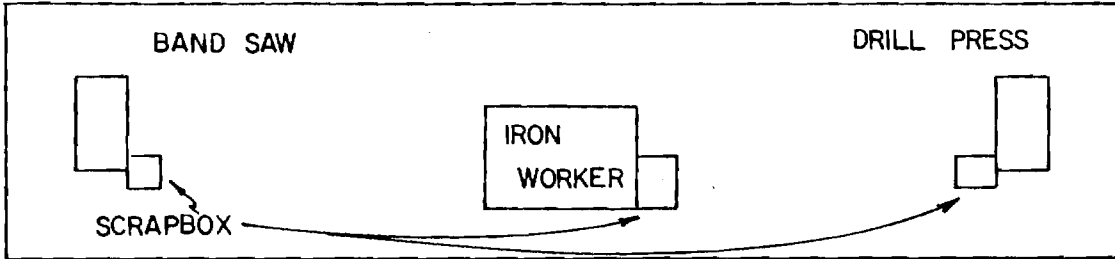
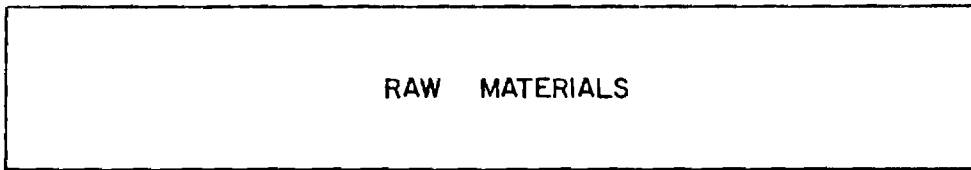
BAND SAW

DRILL PRESS

IRON WORKER



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

<u>Other Projects</u> - - - - -		39.5 percent
<u>Push-Over Balancer</u> - - - - -		<u>60.5 percent</u>
		Total 100 percent
<u>Selling Price</u> - - - - -	\$23.50	
<u>Direct Labor Cost Per Unit</u>		
* (1) Raw Materials - - - - -		
* (2) Labor - - - - -		
* (3) Freight In - - - - -		
<u>Total</u> - - - - -	\$10.25	
<u>Indirect Costs Per Unit</u> - - - - -	2.39	
<u>Selling Expense</u> - - - - -	2.52	
<u>Gross</u> - - - - -	8.34	
<u>Administration & General</u> - - - - -	3.67	
<u>Profit Per Unit</u> - - - - -	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	<u>\$ 350.00</u>

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	<u>\$ 35.00</u>

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	<u>\$ 941.50</u>

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)	<u>\$2,880.00</u>

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.

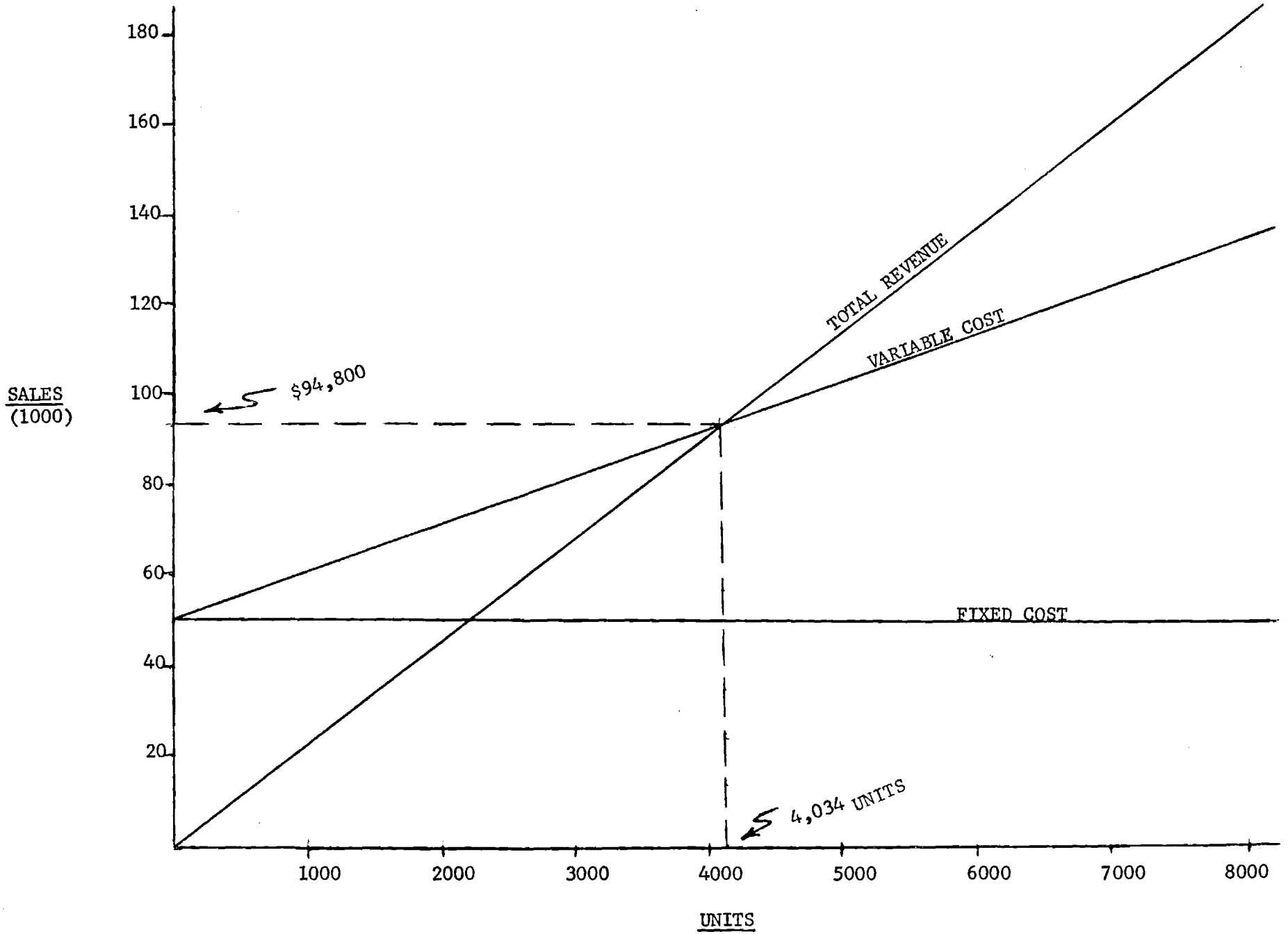
- 2) Jig Carts \$35.00 T.C. = \$350.00

Office Equipment

This is already in existence.

Building and Installed Equipment

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



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		Team Members Present	Client Members Present
	Start	Finish		
	:	:		
	:	:		
	:	:		
	:	:		

2. Telephone Contacts:

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

3. Team Meetings:

Date	Time		Team Members
	Start	Finish	
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

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