AN ANALYSIS OF

WILSHIRE FOAM PRODUCTS

END OF THE MONTH PRODUCTION

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SENIOR DESIGN PROJECT

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PREPARED FOR

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SUMMARY

Wilshire Foam Products is a job shop operation which specializes in large volume orders of foam products. To keep their clients happy, such products must be produced properly and in a timely manner. The company is faced with the end of the month problem which is essentially producing a large percentage of their orders the last week of the month.

This report analyzes this problem through the study of the overall scheduling process. Because this process lacks a proper technical procedure, a general scheduling system utilizing PERT/CPM methods is recommended. Moreover, this study will show that before this procedure can be implemented, the company should analyze better ways to utilize their work order forms and develop a sense of discipline between the actual and perceivable production capabilities.

The end of the month (EOM) problem is one which faces many companies. In this particular case, Wilshire Foam Products (from now on referred to as WFP) was producing about 80% of their products during the last week of the month. This problem created a large amount of unused inventory and low cash flow. At first glance, it would seem like the problem lies on one particular factor, but surprisingly enough the solution is a combination of many factors that all contribute to the problem.

After a short summary of the constraints, I will try to provide certain factors which influence these constraints, and finally present the recommended solutions. The report follows this pattern and tries to keep the following questions in mind:

How is work scheduled?

What is the forecasting procedure?

How is the material movement tracked?

How does information flow throughout the plant?

In a job shop such as Wilshire Foam Products, the operation handles a variety of products, most of the equipment is time-shared, and different jobs are governed by different priorities. One third of the jobs control about 75% of the revenue, and about 10% of jobs are going to be late because of the nature of the large volume orders and the small batch orders.

The company's philosophy is geared towards sales. From the top brass down to the field reps, sales are the number one priority. It is up to the Sales Department to get the clients which in turn generates cash flow. A company is at a standstill without its sales force, and therefore, sales have a big influence in the operation.

WFP, like many companies that deal with large volume orders, usually has to ship their products at the end of the month. These large orders start to accumulate in the warehouse and soon take up vital production space. The sight of large boxes alone gives the feeling of being closed up in a small space. These large orders are called 'blanket orders' or 12/31/99 orders. The date refers to the largest future date the computer system can handle. The blanket orders consist of a goal of, for example, 1 million pieces of a certain product to be produced ten different times at two week intervals. This type of order usually puts WFP at a disadvantage since, due to the lack of a binding contract, the client can change his mind about the quantity to be produced at a certain date, and scheduling of these products is thrown off its due date.

Small orders are a significant part of WFP; there is a flat fee of two hundred dollars. These types of orders can be scheduled in at any particular time and they are produced very quickly.

ANALYSIS OF THE SITUATION

The best way to solve any type of problem is to break it down to its simplest form and build up. The first step of this process is the gathering of information. Approximately ten people ranging from top management to plant employees were interviewed. The next section includes the factors that influence the EOM problem.

The organization chart (Fig. 1) is a typical functional form chart. It is very simple yet there are two problems which disrupt the easy and smooth flow; the Quality Assurance (Q.A.) Manager and Production Control (P.C.) positions are vacant. The lack of quality assurance has hurt the company's ability to detect any defects in the arriving materials and the outgoing products. The raw materials that arrive are cut or transformed into the finished goods without changing the actual foam into something else; therefore, there is an important need to monitor the materials. Production Control is now run by the Materials Manager, who, because of new responsibilities, has leaned towards production control and let purchasing and shipping/receiving fall behind.

The paperwork flow is an ordered, calculated process that begins with a client calling in an order or an outside salesman placing an order (Fig. 2). The request is passed on to the Estimating Department where the cost of production is calculated. The estimator gives the package to the inside salesman who tags on the mark-up, and Order Entry enters the

information into the computer and it is printed out on the Work Order Form (Fig. 3). This form goes to Production Control and describes how much to produce and when a certain product must be completed. Production Control translates this information into plain English onto the Shop Work Order Form (Fig. 4) so that the plant employees know what machine to run and how many batches to produce. The Production Control Supervisor fills out the start date, the finish date, the machine order flow (i.e., what route the material takes from one machine to the next), the quantity required, number of people needed, and estimated time required at each station.

This entire process, beginning with a call and concluding with the scheduling of the production, has a calculated lead time of about three days. Most jobs have a lead of about 7-10 days plus about 1 day margin for safety. The process is an efficient one, however, once it reaches the production control station, the process is very primitive. Once the work orders are filled out, they are filed according to one of three categories: flex, rigid, or tape. These orders are later taken out and put on the shop floor according to the availability of human and material resources, both of which must be checked with the appropriate managers.

The Shop Work Order has been modified and re-modified many times to its present form. The basic idea is that this form serves as a general schedule. The rows and columns were specially chosen to provide all the information that a person needs to know at any particular point in time. Moreover, after the run is completed, there are spaces provided for post-production analysis. The form should be filled out according to use

by the plant employees; such data includes set-up times, start and finish times, problems, runs, and transfers. This, however, is not done. The forms are not adequately filled out, therefore, there is a void in the production and post-production analysis.

Because the Work Order Form does not suffice as a general schedule, Production Control uses the backlog procedure. This process enables Production Control to backcheck the availability of resources and manpower through a computer printout. This system is useful, but there really is no scientific or mathematical formula on how to arrive at an answer. The scheduler relies on his past experience and a small chance factor in order to complete the order according to schedule, or as close to it as possible.

Because one person is performing two jobs, there is a natural tendency to lean to one over the other. In this case, as mentioned before, Production Control has taken priority over Materials Manager. It is possible to have the same person doing this job, however, it would be a great advantage to get an additional person to work in Production Scheduling. His job would include working under the Production Control Supervisor and his duties would be formulating a complete scheduling procedure. If this need is accomplished, the Materials Manager could now have equal supervision over Shipping/Receiving as well as Purchasing.

Hot orders are those that need to be turned around very quickly. These orders are usually called in by the very big clients and can range in quantity from very few to quite a large number of pieces. These orders

will fly through the paperwork procedure and land on the desk of Production Control. From this point, the normal operation procedures must be interrupted, and new orders take precedence over the old orders. Material in process gets re-routed or put aside until these hot orders are processed.

Weekly meetings are scheduled every Wednesday and are made up of Purchasing, Sales, Operations Manager, Materials Manager, Production Control, Human Resources, Plant Manager, and the General Manager (usually in California). The meetings are held in the conference room, while the manager in California is hooked up via telephone. The purpose of these meetings is to plan and/or discuss the upcoming week. Topics pertain to each and every department but production is the most talked about subject. Sales usually sets the agenda for the next week and everyone tends to agree because of the strong weight that Sales has over the other departments; top management is only interested in getting the product out not matter what. There is no real discussion in these meetings; the different department heads try to figure out instead why there were problems the past week and try to accommodate the production while getting the orders out.

Large blanket orders contribute a high percentage of the company's cash flow. These customers are very valuable to WFP, so the company will try to work around their clients' needs. However, the clients tend to have too much influence over production control and so there is no good method to schedule these large orders.

Sales run WFP; it is as simple as that. The entire company revolves around sales. As mentioned before, cash flow derived from sales is very important. It is also important however, to have interplay between the departments and the facilities as well as communication, coordination and integration of efforts. Sales has the most influence in the meetings and the top managers are sales-oriented. Production Control in this case does not have the clout it deserves in order to stop new orders from coming in and interrupting production.

Materials are essential to production at WFP, and because there is no Quality Assurance Inspector, many times bad material goes unnoticed for some time. Moreover, at times a product might be in the middle of a run and because a defect was not noticed early enough, the whole batch gets scrapped. Inventory Control is sometimes a problem because it is not entered into the computer properly or at all. Many times, the salesperson has to physically walk out to the warehouse and make a visual inspection of the material.

ANALYSIS AND MANAGERIAL INTERPRETATION

Scheduling is important because inefficient scheduling results in poor utilization of available resources, and poor scheduling frequently creates delays in the flow of some orders through the system. Scheduling requires adequate considerations of the interactions that exist with other systems responsible for forecasting.

Production Control should be composed of at least two people: one to handle the technical side and the other to handle the managerial side. The new person would work under the Production Control Manager and his duties will include:

- Forecasting
- Scheduling/Sequencing
- Monitoring/Dispatching
- Optimizing
- Network Planning Methods
  - PERT
  - CPM

The new forecasting method will be a way to determine actual work vs. capacity. The purpose is to provide a general scheduling procedure that will be able to forecast, track material movement, and provide a real and applicable solution to the EOM problem.

The simplest forecasting methods are called Gantt Charts, and they specify the start and finish times for each activity on a horizontal time scale. A special type of Gantt Charts are called the Johnson's Rule of Sequencing (Figs. 5 & 6). The charts determine the percent utilization of a particular machine during a run. The numbers in the lower left boxes are calculated as follows: take the maximum capacity per machine per hour (Figs. 7 & 8) and divide by the amount of units you want to produce. These charts provide the basis for more complex modeling. Since we know which machines are utilized the most, we can quickly spot the critical areas essential to production.

Different networking models provide the breakdown of work into simple events (Figs. 9, 10, & 11). The work breakdown structure displays the objective and work to be accomplished and interrelation of each element of work. This package can be placed on a timetable and it becomes a work package schedule. Placing any of these packages together, one forms a pictorial network of nodes and branches. Critical Path Method (CPM) and Program Evaluative and Review Technique (PERT) are natural frameworks for reporting and control purposes. PERT is defined as all the steps and tasks that must be accomplished to complete a project in the form of a network of events and activities. It also allows one to know:

- what other work must be completed before a job can start.
- what other work can be started as soon as the task is completed.
- what other work can be accomplished while the job is in process.

CPM/PERT have very simple rules: you start from the end objective and work backwards, subject to one beginning node, one ending node, and no event can be completed until previous ones are concluded. Nodes represent events and branches represent tasks to be accomplished (Figs. 12 & 13). Time limits are determined for the branches and thus a critical path is calculated using the longest time it takes to accomplish a job (Fig. 14). Examples for two clients (Figs. 7 & 8) show what a PERT/CPM chart would look like. Combining all the different PERT charts for the different products develops a general scheduling system (Fig. 15). This system can get as complex as the operator needs. Factors such as materials, costs, and labor can be computed as constraints in the system. These types of charts can be computed for any number of products in the plant at one time.

The advantages of PERT/CPM are:

- Organization
- Planning
- Communication
- Control

The Work Order Forms need to be filled out properly. As mentioned previously, these forms are the backbone of any type of scheduling system. The potential for information is available on these forms, and it can be translated into visual aides such as those aforementioned. Workshops should be established where management can talk to the plant employees and instruct them on how to fill out these forms. At that time, feedback should be taken to better understand why the information is not being supplied.

Sales and the other departments must integrate their efforts in order to meet production deadlines. Before the weekly meetings, the departments should work out their differences so that once in the meetings, they do not become blaming sessions. Sales is concerned about increasing their quotas and getting the commission, but discipline is needed in order to balance the actual vs. perceived output of the plant.

CONCLUSIONS

The EMO problem at WFP is a combination of factors that have caused many problems. WFP had hired a professional consultant and although he was not

pursuing the same objective, he did come up with similar conclusions. The factors causing the problem are:

- Production Control
- Hot Orders
- Sales
- Materials
- Quality Assurance

Although my first inclination was to develop a sample program using PERT/CPM, I decided it was more important to really determine whether this solution would actually work. The PERT/CPM method has to be researched more. Once this method is implemented, it will benefit the production and provide for a way to detect problems in their early stages, recover from anomalies and failures, and provide rapid communication and visibility of everything that is occurring to all parties involved.

The immediate recommendations are:

- Examine the role of Production Control. Determine whether it would be feasible to hire an extra person to implement the scheduling programs.
- Conduct an in-house analysis of the role that Sales has and should have in the organization. Develop a true set of quotas that can be attained according to normal plant production capacity.
- Create a better relationship with large order customers so that blanket orders place WFP at the advantage, not the disadvantage.

- Educate employees as to the importance of the proper completion of the Work Order Forms (i.e. the filling out of all intermediate due dates according to each machine). These forms can provide important information that can be used by all of the departments.
- Fill the vacancy in Quality Assurance as this relates to the EMO problem.

FIG. 1

Dallas Organization Chart

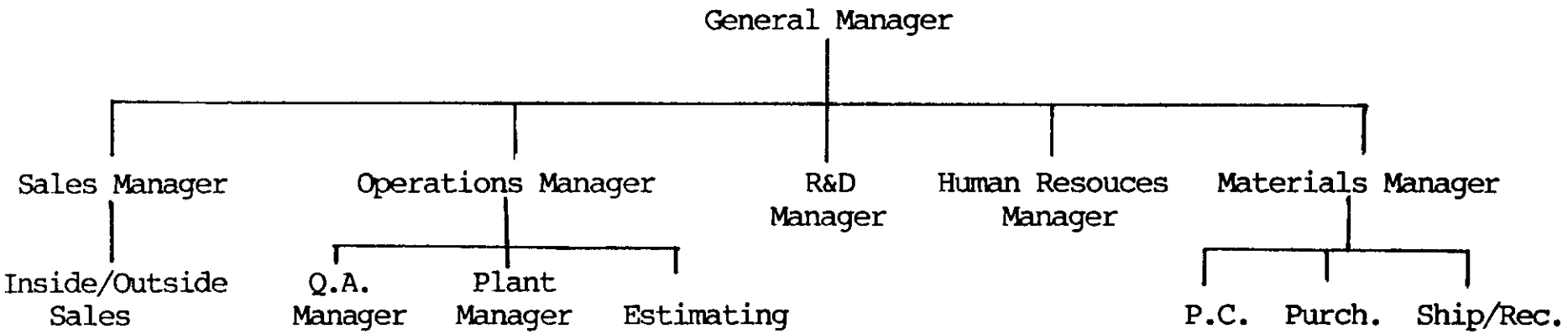


FIG. 2

PHONE ORDER

COD

T. KEN BY:

SOLD TO	SHIP TO

CUSTOMER # NEW >>

DATE	CUSTOMER ORDER #	AREA	SHIP DATE

JOB DALLAS >>		COLLECT >>	
JOB DELIVERED >>		PPD >>	
		PPD & CHARGE >>	
OWNERSHIP OK >>		DROPSHIP >>	
CONTACT ONLY >>		CPU >>	

SHIP VIA:

CALLED BY:

TELEPHONE:

TAXABLE ?	YES >>	
MEDICAL ACCOUNT ?	YES >>	
CERTS REQUIRED ?	YES >>	
PRINTS FOR PART ?	YES >>	

QUANTITY	MATERIAL	DESCRIPTION	UOM	UNIT PRICE
			UC	
			MC	
			FRT	
			UC	
			MC	
			FRT	

SPECIAL INSTRUCTIONS:

WILSHIRE FOAM PRODUCTS INC.

D-U-N-S 00-848-1269 11420 MATHIS P.O. BOX 810217 DALLAS, TEXAS 75381 (214) 869-1727

Part Shipment

FIG. 3

DATE

WORK ORDER NO.

SHIPPING NO.

INVOICE TO	SHIP TO

DATE	CUSTOMER'S ORDER NO.	SALESMAN	FREIGHT			DATE SHIPPED	SHIPPED VIA
			COLL	PPD	PPD & CHG		

QUANTITY ORDERED	QUANTITY SHIPPED	MATERIAL	COLOR	DESCRIPTION	UNIT	UNIT PRICE	AMOUNT

PRIOR W.O. NO.	PRIOR W.O. DATE	QUOTE NO.	QUOTE DATE	TERMS: NET CASH - 10 DAYS

REV 5/86

CREDIT	APPROVED	C.O.D.	HOLD

All claims covering short count, defective goods or packages must be made in writing within 10 days of receipt of goods.
No merchandise can be accepted for credit without our authorization for its return.

ORIGINAL

FIG. 4

SHOP WORK ORDER

WILSHIRE FOAM PRODUCTS, INC.

LOT # / SALES ORDER # _____

MEDICAL APPLICATION
MEDICAL DEVICE

CUSTOMER _____ SALESMAN _____ DUE DATE _____ TOLERANCES-THICK _____ WIDTH _____ LENGTH _____

PART NUMBER / REVISION	FOAM MATERIAL / MATERIAL NO	P S MATERIAL / MATERIAL NO	OTHER MATERIAL / MATERIAL NO

START DATE	MACHINE MATERIAL	SPECIFICATION	QTY. REQD.	EST. TOTAL TIME	PROD RATE PER HR	QUOTED # PEOPLE	START DATE	COMPLETION DATE	MACHINE	# PEOPLE USED	TOTAL SETUP TIME	START TIME	STOP TIME	QTY. RUN	SUPV INITIALS	ESTIMATING EXT SETUP	ESTIMATING LABOR	ESTIMATING MAT'L

SPECIAL INSTRUCTIONS TO SHOP

PACKING INST. _____

SHIP VIA— _____

MATERIAL TRANSFERS BETWEEN PRODUCTION DEPARTMENTS

DATE OF TRANSFER	DEPARTMENT SENDING MATERIAL	DEPARTMENT MATERIAL SENT TO	QUANTITY TRANSFERRED	UNIT	SUPERVISOR'S SIGNATURE (DEPT. SENDING MATERIAL)
	WAREHOUSE				

	ESTIMATING EXT SETUP	ESTIMATING LABOR	ESTIMATING MAT'L
ACTUAL TOTAL			
QUOTED TOTAL			
VARIANCE			

TO BE FILLED IN BY PRODUCTION DEPARTMENT SUPERVISOR
NOTICE OF DISCREPANCY BETWEEN ACTUAL REQUIRED PRODUCTION TIME AND ESTIMATED TIME
REASONS FOR DISCREPANCY _____

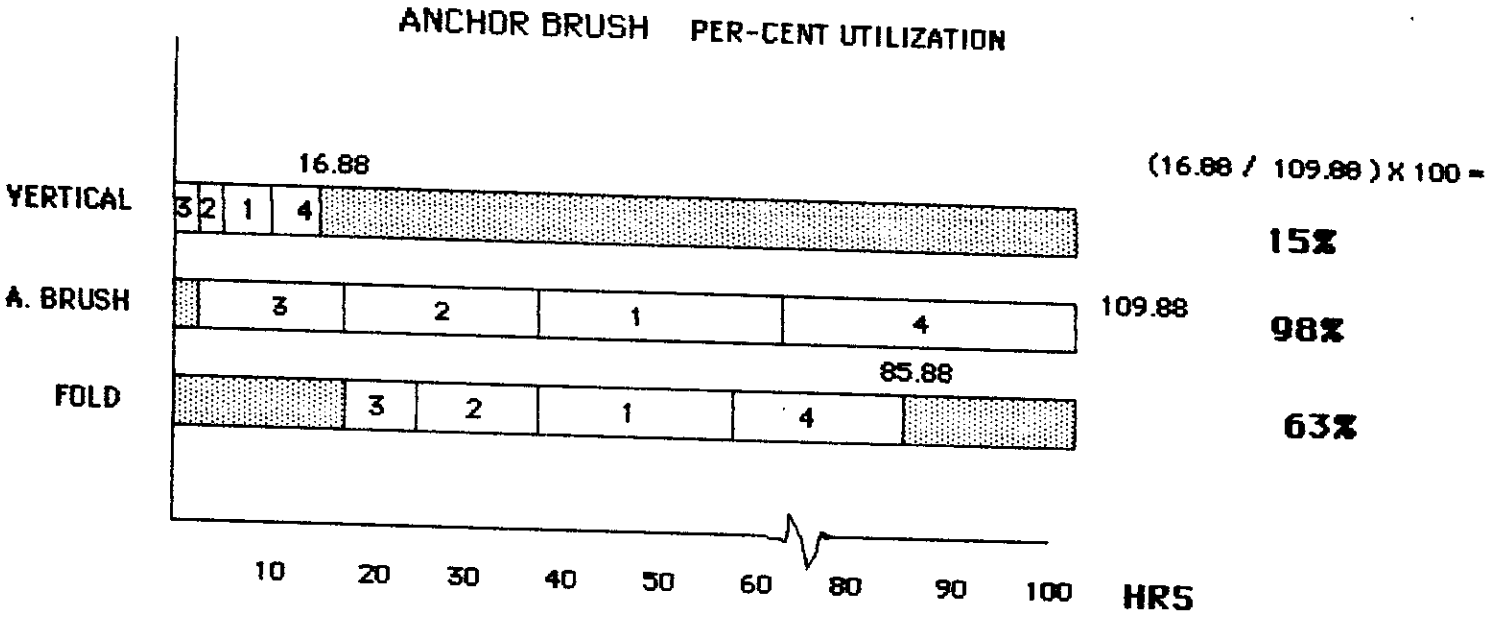
SUGGESTED CORRECTIVE ACTION _____

DO YOU FEEL DISCREPANCY WILL EXIST FOR FUTURE ORDERS? _____ YES _____ NO _____
DEPARTMENT SUPERVISOR'S SIGNATURE _____

CORRECTIVE ACTION TAKEN

ESTIMATOR'S SIGNATURE _____ DATE _____

FIG. 5



NUMBER OF FT. / ORDER

CAPACITY

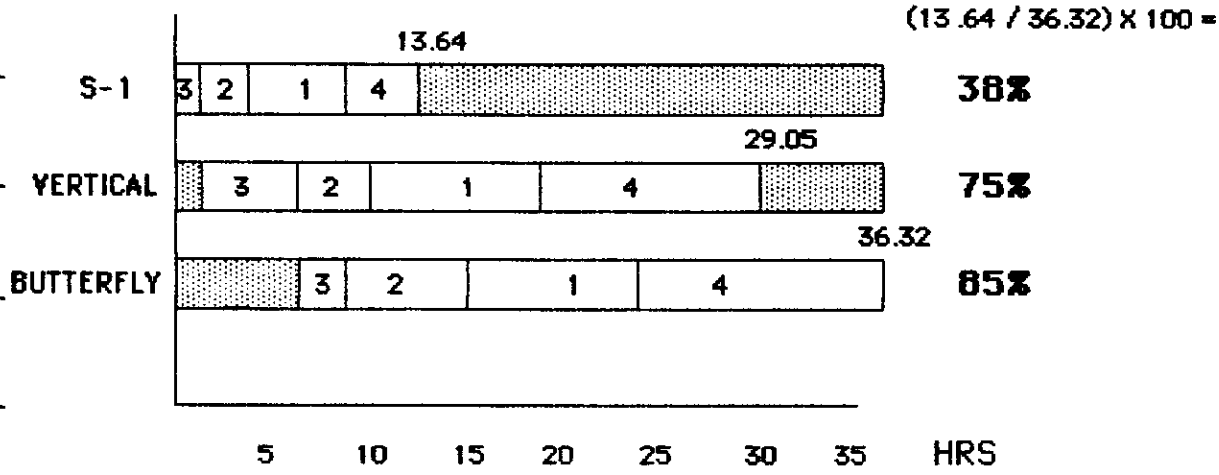
	1	2	3	4
VERTICAL	4.50	3.38	2.25	6.75
A BRUSH	28.50	21.38	14.25	42.75
FOLD	18.50	13.38	9.25	27.75

1 - 200,000 feet
2 - 150,000
3 - 100,000
4 - 300,000

JOHNSON'S RULE - SEQUENCING - GANTT CHARTS

FIG. 6

PHARMASEAL PER-CENT UTILIZATION

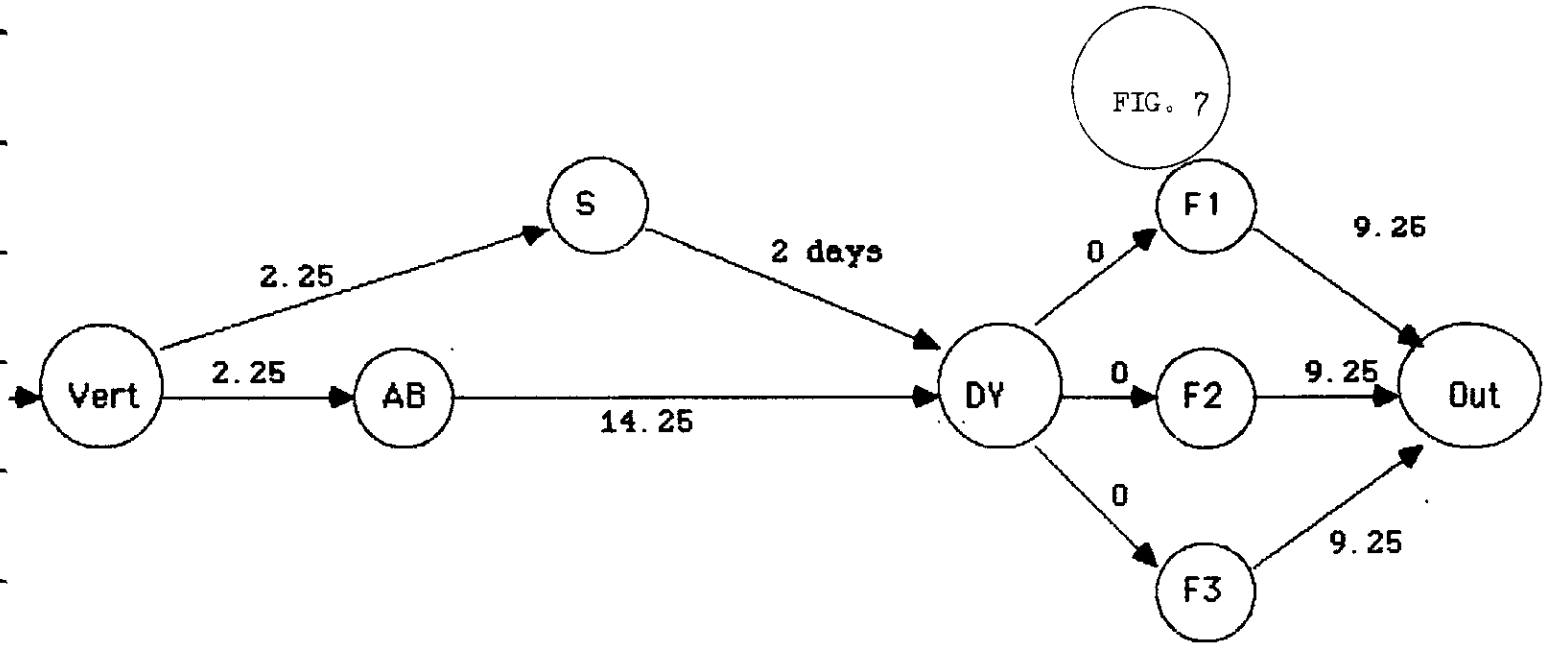


NUMBER OF PIECES / ORDER

CAPACITY	1	2	3	4
S-1	3.63	2.73	1.82	5.46
VERTICAL	7.26	5.45	3.63	10.89
BUTTERFLY	8.23	6.17	4.12	12.35

1 - 200,000 pieces
2 - 150,000
3 - 100,000
4 - 300,000

JOHNSON'S RULE - SEQUENCING- GANTT CHARTS

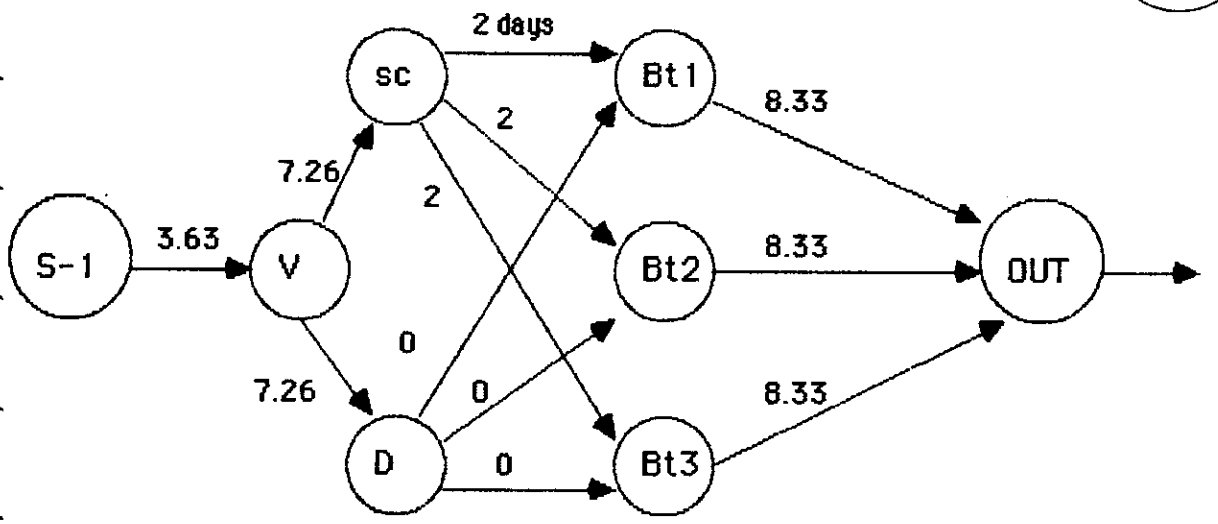


ANCHOR BRUSH

- Vertical 47,520 / Hr.
- Anchor Brush 7,000 / Hr.
- Fold & Pack 3,600 / Hr.

This chart uses 100,000 ft. as basis

FIG. 8



PHARMASEAL

S-1	55,080 / Hr.
Vertical	27,540 / Hr.
Butterfly	8,000 / Hr. x 3 Machines 24,000 / Hr.

This chart uses 200,000 units as the basis

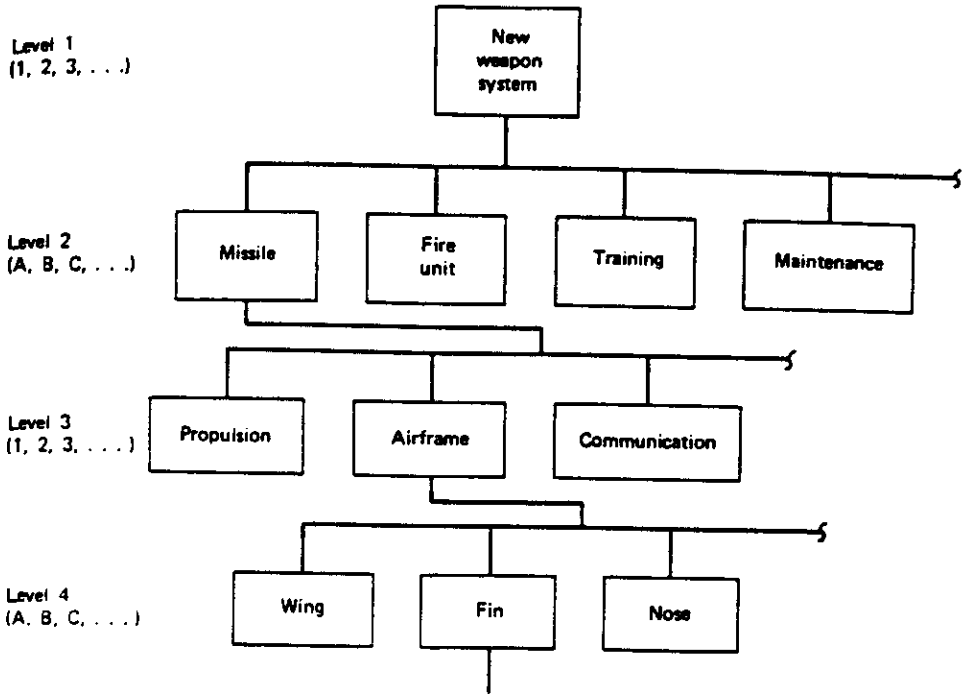


FIG. 9

Work breakdown structure (WBS).

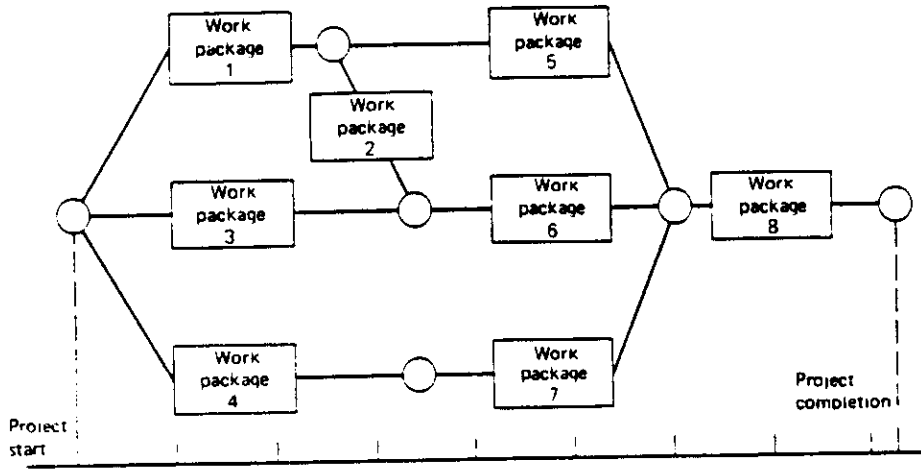


FIG. 10

Work package scheduling.

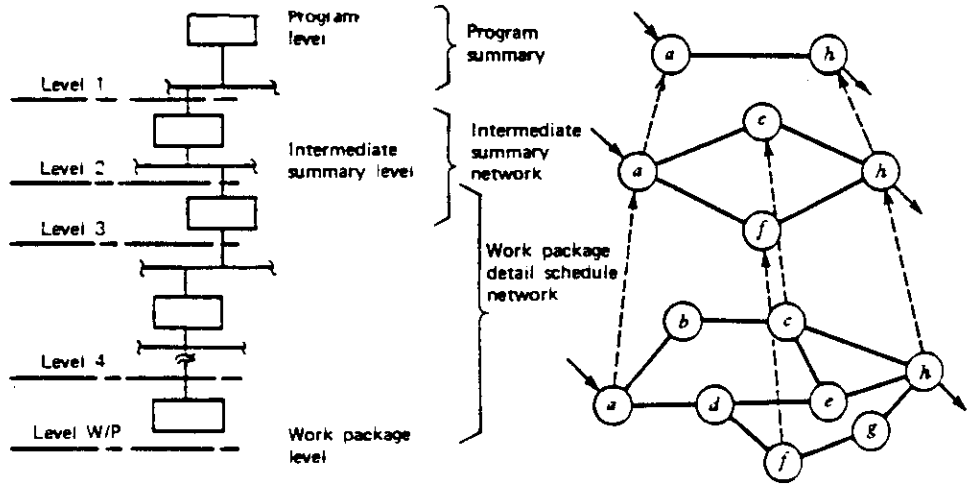


FIG. 11

Relationship between network levels resulting from event compression.

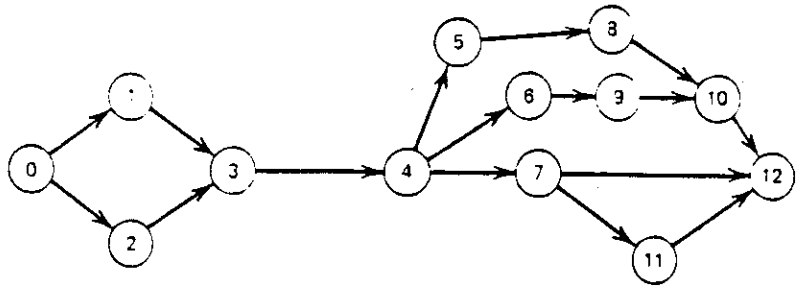


FIG. 12

Sample PERT network.

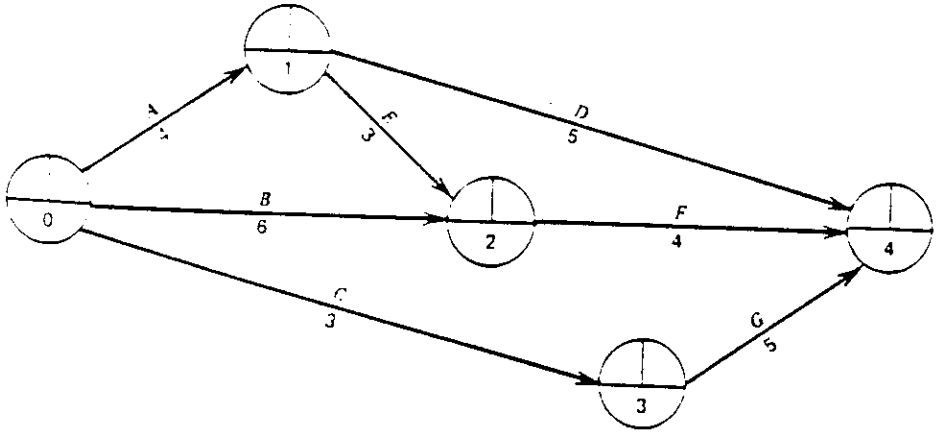


FIG. 13

PERT/CPM network.

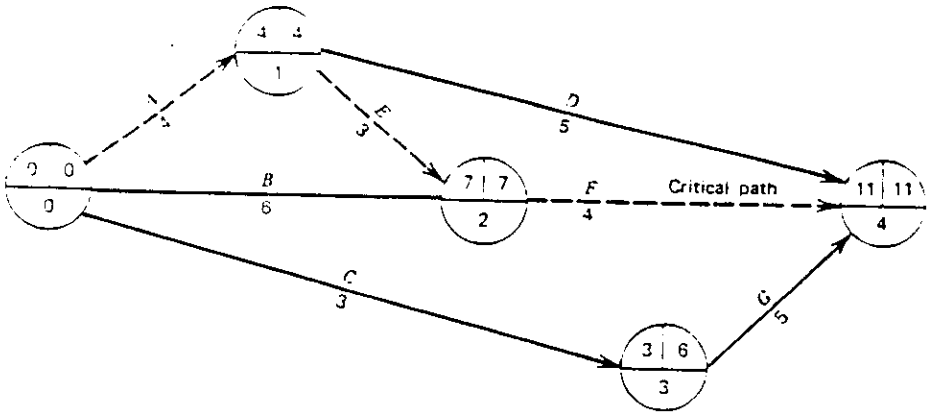
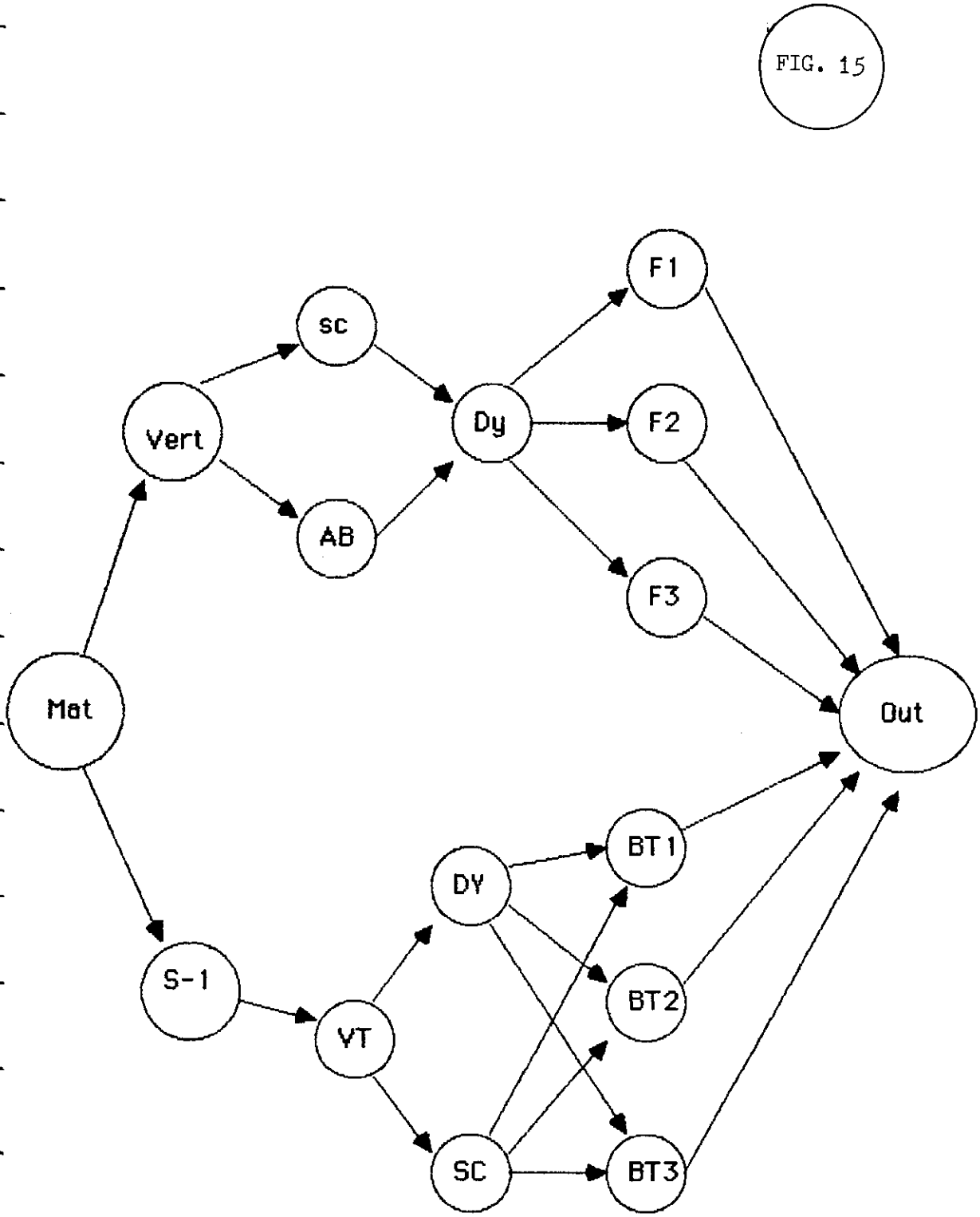


FIG. 14

Critical path.

FIG. 15



SAMPLE INTEGRATED SCHEDULING SYSTEM

PERT / CPM