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PRODUCTION MANAGEMENT [1]

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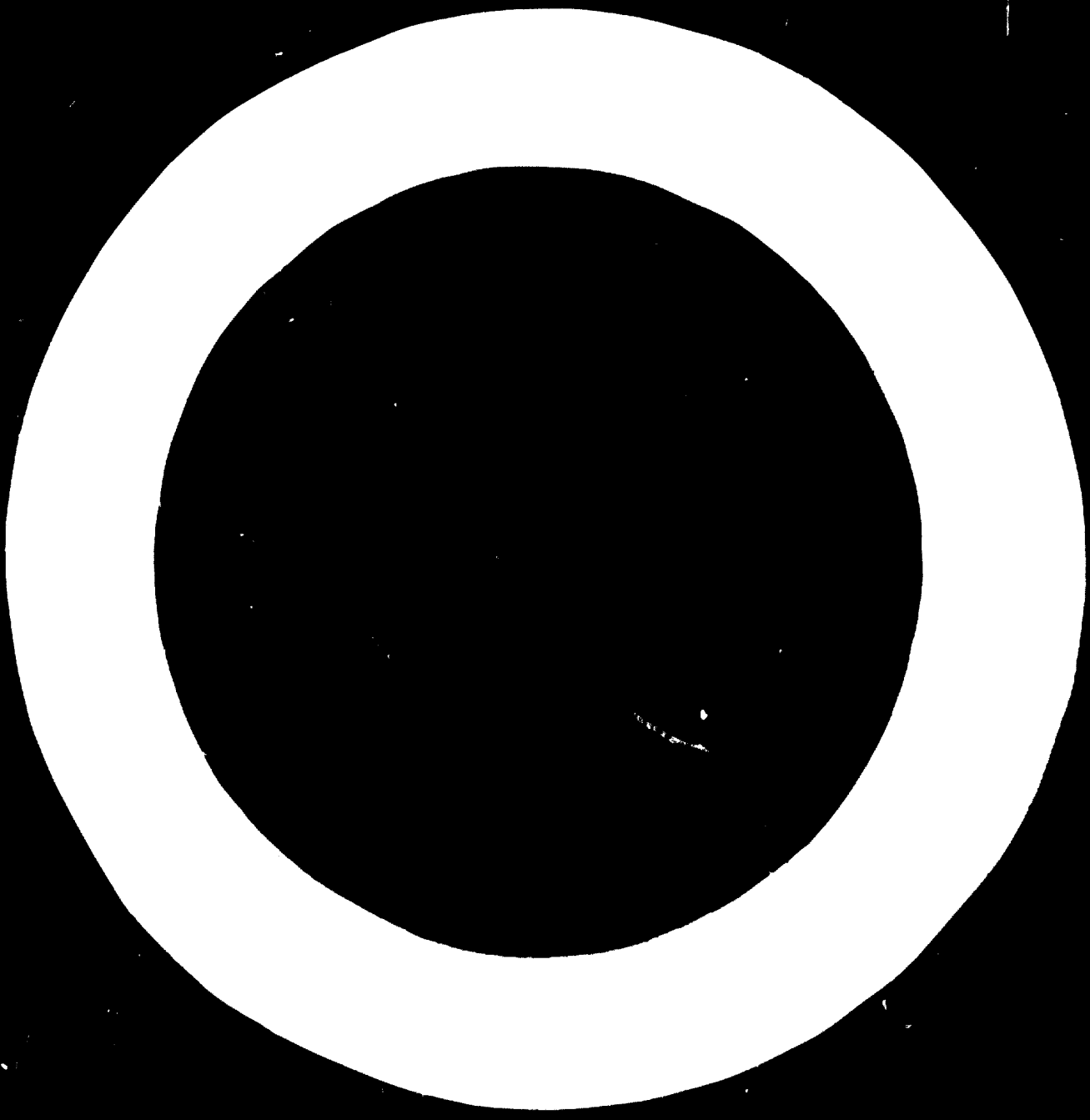


1. The Function and the Objectives of the Production

1.1 The Function of the Production

The production is a transformation process, where we produce or refine products or services (figure 1). The production is usually the most complicated function in a company. The production problems are not only technical, on a large scale, they are economic and organizational as well.

1.2 The Objectives of the Production

The classical task of the production is to make and deliver products which belong to the product collection, the right amount of the right quality at the right time at the lowest cost with a minimum of investment.

The quality is the backbone of a manufacturing company's success. The quality level must be planned in advance so that the quality of the products will not be too poor, but, for economic reasons, neither too good.

The second objective of the production is to produce the right amount. Which is the right amount ? The right amount for manufacturing may not be the right amount at all for sales. The top management has to decide if we shall sell what we produce or if we shall produce what we sell.

The third objective of the production is to produce the product at the right time. Producing the product too early means an excessive investment in inventory. Producing the product too late may mean permanent loss of sales and added costs. It is often extremely difficult to produce the right

amount at the right time.

The fourth objective of the production is to produce the product with a minimum of money. Production efficiency is generally measured with productivity, which is simply output divided with input. We can increase the productivity if we can achieve a bigger production with the same basic capacity or if we can achieve the same production with less basic capacity.

1.3 The Cost Structure of the Company

For development and rationalization of the production we must know, approximately, the cost structure of our company. It is in average for Finnish industries as follows:

Materials (in general purchases)	60 %
Wages	20 %
Capital costs, administration costs etc.	20 %
	100 %

2. What is Production Management ?

2.1 The Necessity to Plan

Production management, in this connection, means principles and procedures for planning and controlling the production both in technological and administrative sense.

Planning is the means of achieving the objectives. Planning nowadays must be more dynamic than ever before, because of the rapid changes around the company. We are always short of something: capital, capacity, time or know-how. Therefore we have to plan the use of the available scarce resources carefully.

2.2 The Procedures of Planning

The planning procedures based on the objectives of production are shown in figure 2. The normal sequence of the planning procedures for a customer order is shown in figure 3.

2.3 Prerequisites for Planning

Production is dependent on many other functions in the company. The production management cannot be efficient if the prerequisites for planning are not good.

Product collection increases easily exponentially. This makes production more expensive and the planning more difficult. Everybody who suggests starting of a new product should name two old products to be left out.

The product is of course the core of the production. No production can be rationalized further than the product itself. Therefore the product must be production-minded. The processing must start already at the drawing-board, because the production cost is mainly determined at this stage.

No production planning can be better than sales programs. Production planning is the faithful servant of sales. But in order to serve sales well we must have sales programs or forecasts which must be as detailed as possible and made up on a long-term basis.

When we look at the order books of many companies we often notice astonishing things. Even some larger companies still perform operations which they did years ago when they started their activity in a back yard garage. These often small individual services to old clients are in most cases inprofitable and cause disturbancies in production. We should check our product and job policy now and then and make clear to ourselves if we want to remain a custom shop or grow to an industry.

3. The Procedures of Production Management

3.1 General

The need for and the procedures of planning varies in different kinds of industries. The situation is most complicated in job shop production with single custom-made products. In batch production of e.g. consumer goods the competition is often hard. In this case work study and inventory control are very important. In mass production, e.g. process industries, the plant and the whole production process may be planned in detail already before building the plant and no further planning on a larger scale is needed.

3.2 Production Planning

The main objectives of production planning are as follows:

1) To keep the output capacity as high as possible. This means: Keep promised times of delivery and make the through times as short as possible.

2) To keep the inventories (stocks and jobs in process) as low as possible.

3) To utilize the production capacity to the largest possible extent and to try to keep an even employment.

4) To inform management, sales, purchase and production supervisors regarding the delivery and the loading situation so, that it is possible to make the right decisions and arrangements in time.

Gross planning is based on sales programs or on customer orders. It must include all main phases of the time of delivery. Rough capacity reservation or gross loading is made at the same time.

Material planning can be carried out when the preliminary or definite drawings are available. It is important to make the material orders or reservations as early as possible and to control the times of delivery carefully.

Detail planning consists of scheduling and detail loading. It is often favorable to make planning models. Figure 4 shows a schematic model of a product including product structure, scheduling, capacity and material needs per operation.

The scheduling is always more or less unsafe in job shop production, because the waiting times make up about 3/4 of the through time (figure 5).

For the loading procedure we must know the capacity. In production planning we are interested in the net capacity, which we get from the theoretical gross capacity by subtracting all losses (figure 6). It is best to determine the capacity losses separately in every company.

If we can produce repetitively some products and parts in batches we can have forced or cyclical schedules. The production periods (cycles) are not depending on calendar time, but on working hours. At the beginning of every cycle a new batch of a part starts. An example is shown in figure 7. Similar cyclical time tables are used in many areas, e.g. in traffic connections, schools etc.

Dispatching is the stage when plans are put in action. Here we have to regulate the work order flow to the shop very carefully.

Figure 8 shows 2 alternative ways to regulate the material flow.

In the left part of the figure (broad and slow) the production planning dispatches all work orders to the shop foremen as soon as they are ready. The jobs are badly prepared, but the shop people are satisfied, because they get plenty of work and they can themselves determine the sequence of jobs. But the shop will soon be full of uncompleted jobs and the assembly department is short of parts. The result is that the through times are long and the output is small.

In the right part of the figure (narrow and fast) the production planning dispatches work orders to the shop well prepared, in the right sequence and only as little at a time as the shop is able to cope with. In this case the shop people are forced to do the jobs in the right, planned sequence. The result is short through times and an even, broad output flow.

We can generally say that it is no use to give an order if we don't control its performance. We must always have feedback from the shop. Figure 9 shows the feedback procedure in general and figure 10 shows it applied to production of a single taylor-made product.

Control must exist on all levels. Figures 11 and 12 show how the progress of a single order and the whole production can be roughly controlled by curves.

3.3 The Production Technique

The development of the production techniques in processing, methods planning , layout planning, tool design, work study and work measurement has been rather slow. These techniques are trained and practiced nearly all over the world.

Some extreme results of systematic development work are e.g. division of work, assembly belts and thorough time and motion studies with predetermined time standards (like MTM and Work Factor).

Has the development in this form gone too far ? There are in industrialised countries some signs which indicate that:

1) The education of young people is on the average much higher than before

2) The shortage of labor is increasing

3) Young people work rather in the service business than on the assembly line.

4) The turnover of labor is in many industries very high

5) Many labor unions demand monthly salaries instead of incentives

6) Labor demands participation and more democracy in many work places

All these signs are a challenge for production management.

It seems as if the pendulum of rationalization has reached its extreme position and is on its way back to the middle. Job enlargement, job enrichment, participation, motivation, ergonomics and human engineering are not only slogans, but realities in more and more companies. Industrial engineering techniques are needed more than ever. The question is only who uses them and how.

3.4 The Selectivity in Production Management

It is not always suitable to plan everything with the same accuracy. It is often worthwhile to use Pareto's minority principle according to which in every group always a small part corresponds to a big part of the result. The applications of the principle bear often the names of stratification, volume value, ABC-grouping, 80/20-rule, Lorenz-diagram.

In this way we can choose the most important things from the whole amount, plan and control selectively and save much work by leaving less important things to less attention.

In materials management, work studies and all control it is often possible to receive fantastic results e.g. by giving priority to different products and different orders.

Figures 13 and 14 show an application of ABC-grouping in a manufacturing for stock system.

4. The Development of Production

One of the most central problems in all planning is: How far and how detailed is it profitable to plan in advance ? It is obvious that there is usually no risk of overplanning in the production field. The question is only how far to the left are we from the optimum (figure 15).

Planning takes also time and the manufacturing can correspondingly start later. Anyway, through time for the whole order should be shorter (figure 16). The planning part of the total amount of work has to increase in accordance with the development (figure 17).

No development occurs automatically, but purposeful and effectively guided development work is needed.

The first thing is to determine the level where we stand today. It is of course good if we can compare our level with e.g. the competitors' level. We can often get good ideas outside our own branch.

As the second stage we can set objectives for our development work. The objectives should be at least approximately numerical and of course as realistic as possible. The objectives could be short term and long-range and maybe divided ito several steps.

The third step is to determine how and when to reach the objectives. Larger development work should be carried out as projects with clear organization and schedule. The projects are investments and it is important to calculate and follow-up the pay-off time.

Figure 18 shows a general schedule for a development project of a production planning system.

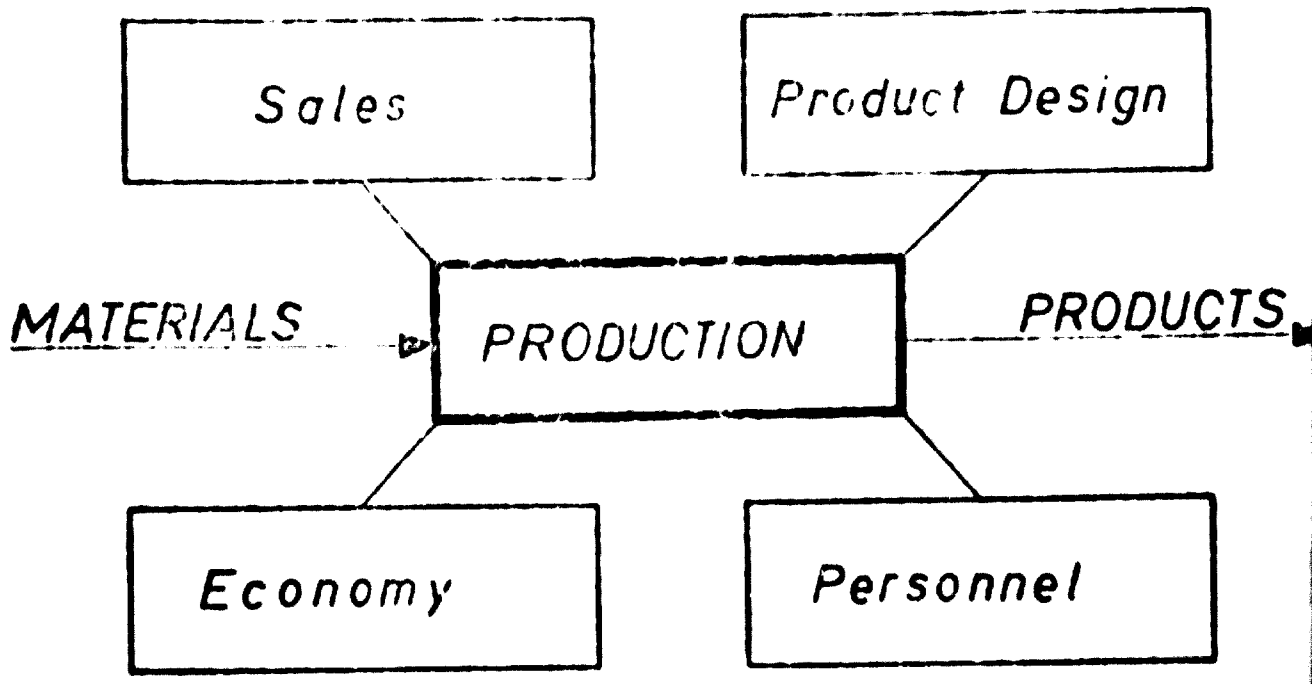


Figure 1.

The transformation process of production.

OBJECTIVE OF PRODUCTION	PROBLEM	PROCEDURE OF PLANNING
Quality	How to achieve ?	Production technique - Processing, routing - Methods planning - Layout planning - Tool design - Work study - Work measurement
conomy	Minimizing of costs - How to produce ? - Where to produce	
Amount	Lot size	Production planning - Scheduling (gross, det - Loading (gross, detail - Materials management (inventory control) - Dispatching - Control, reporting
Point of time	When ?	

Figure 2.

Planning procedures based on the objectives of production.

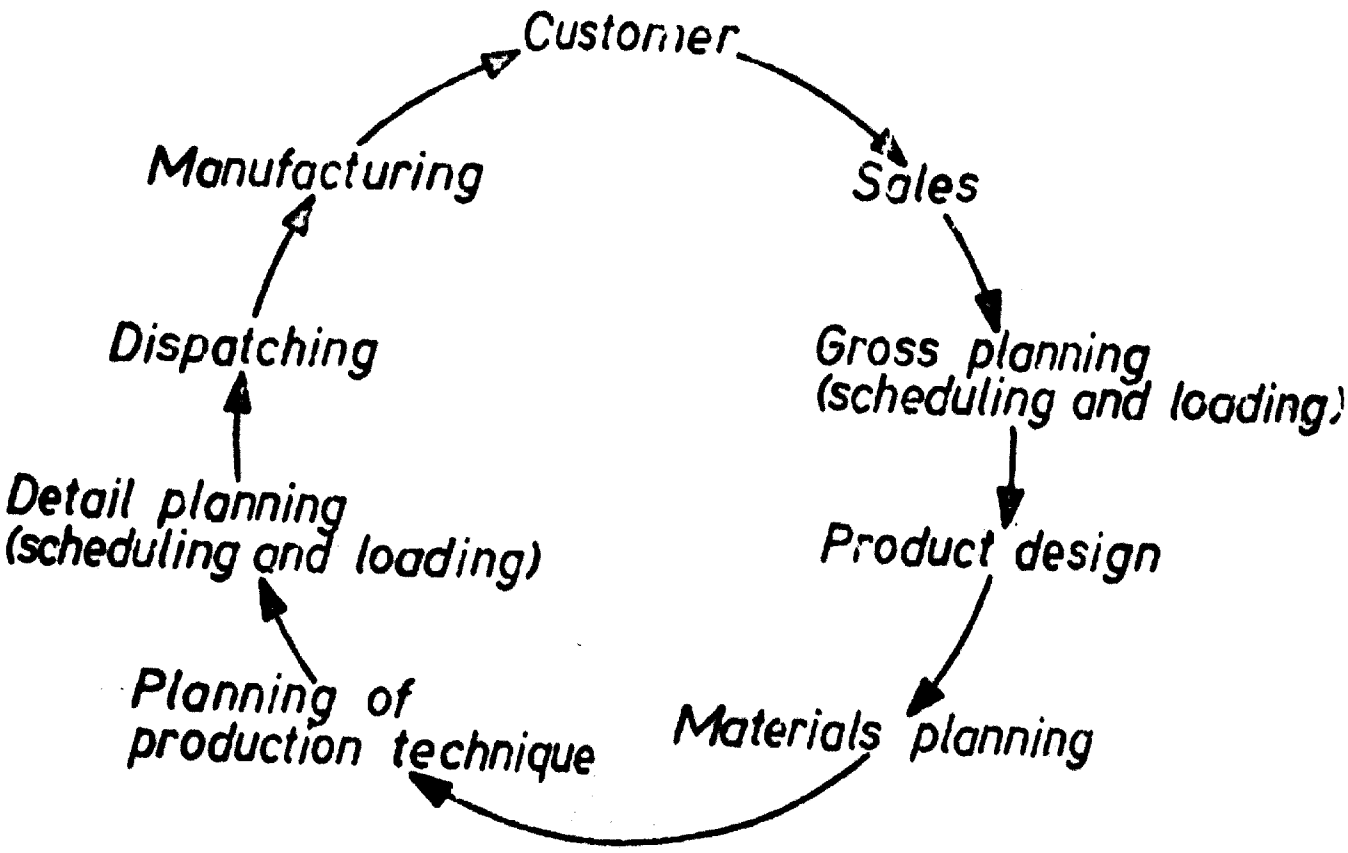


Figure 3.

Planning procedures for a customer order.

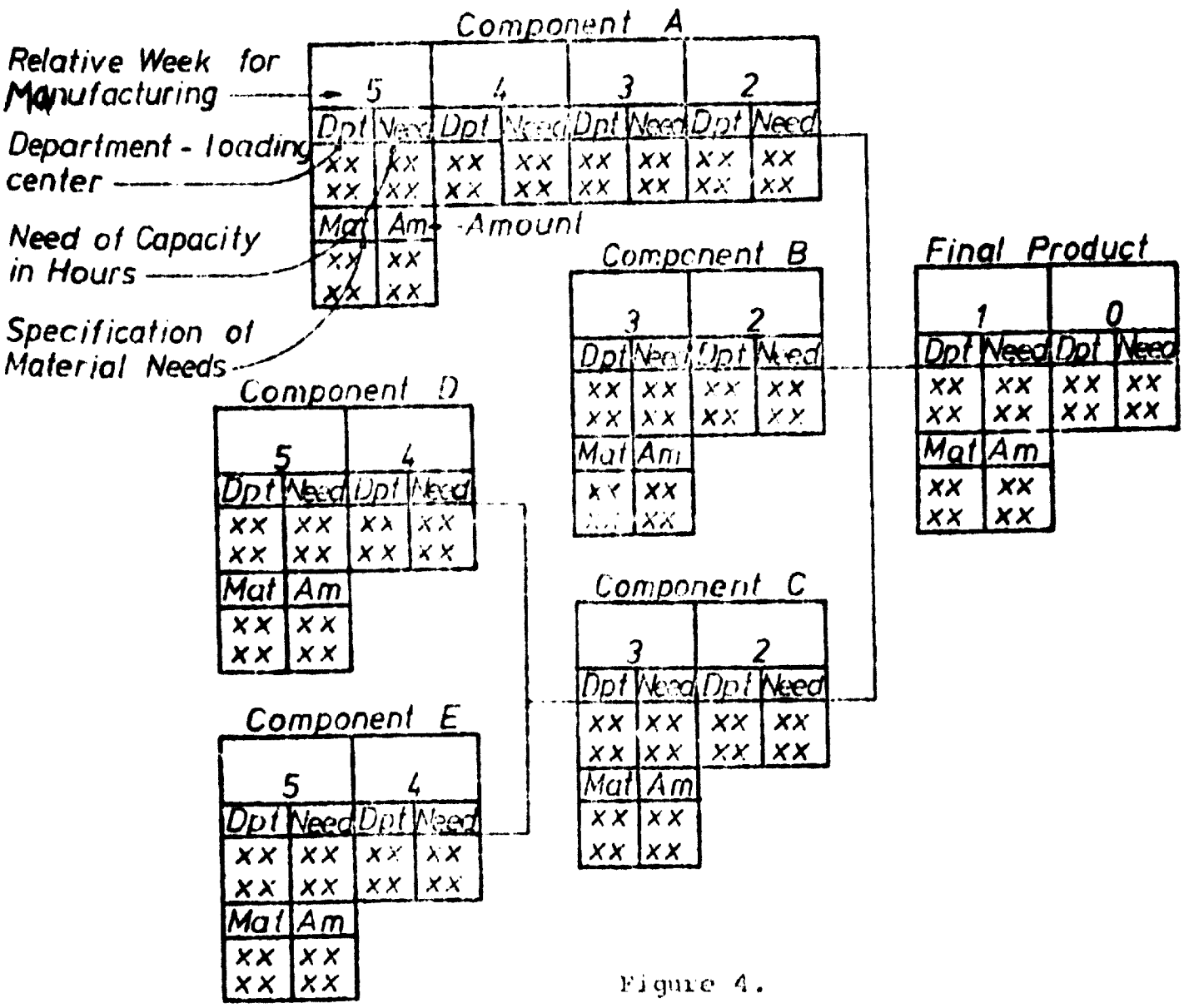


Figure 4.

A schematic planning model.

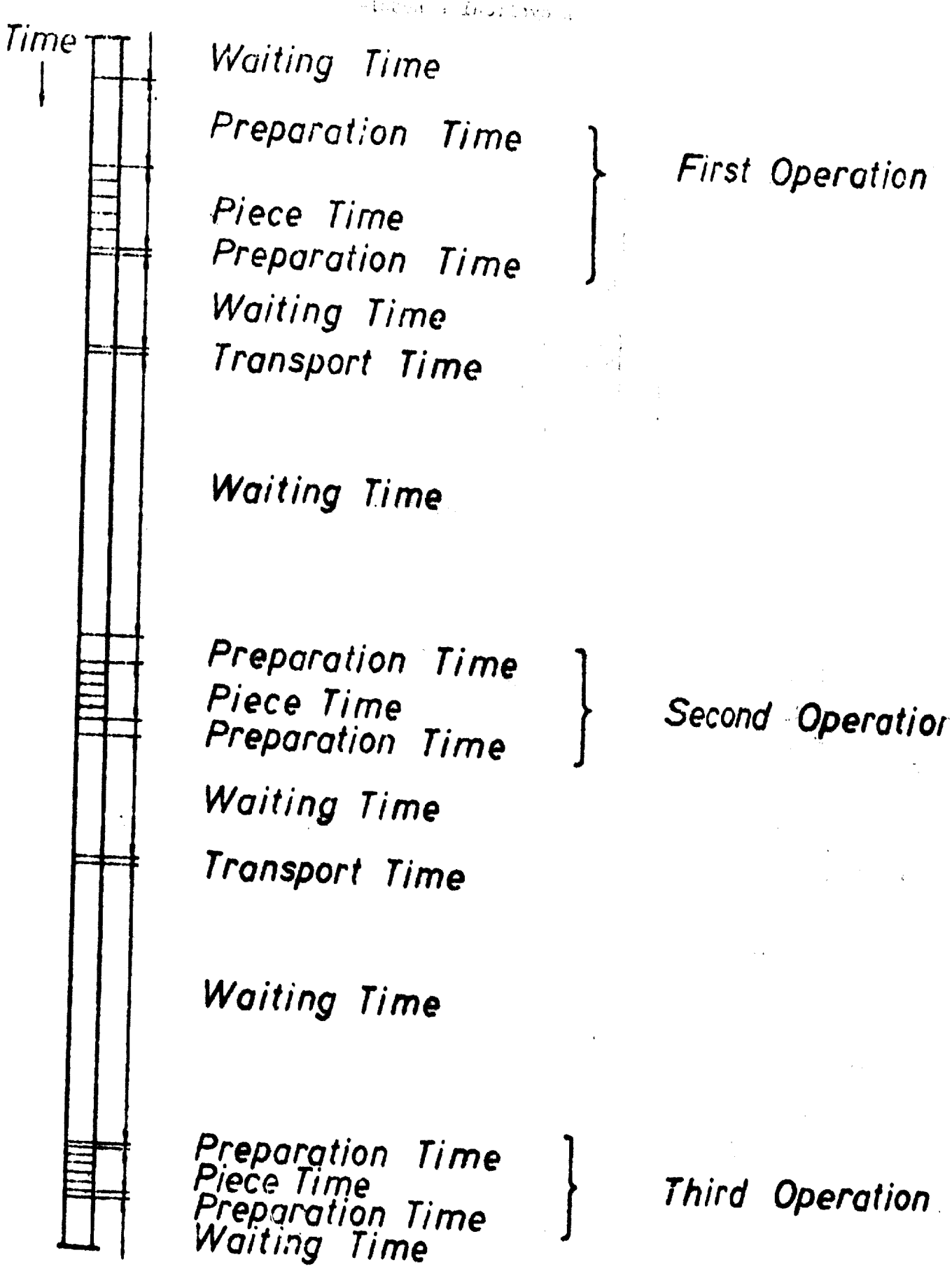


Figure 5.

Schedule for manufacturing a batch of 5 pieces in 3 operations.

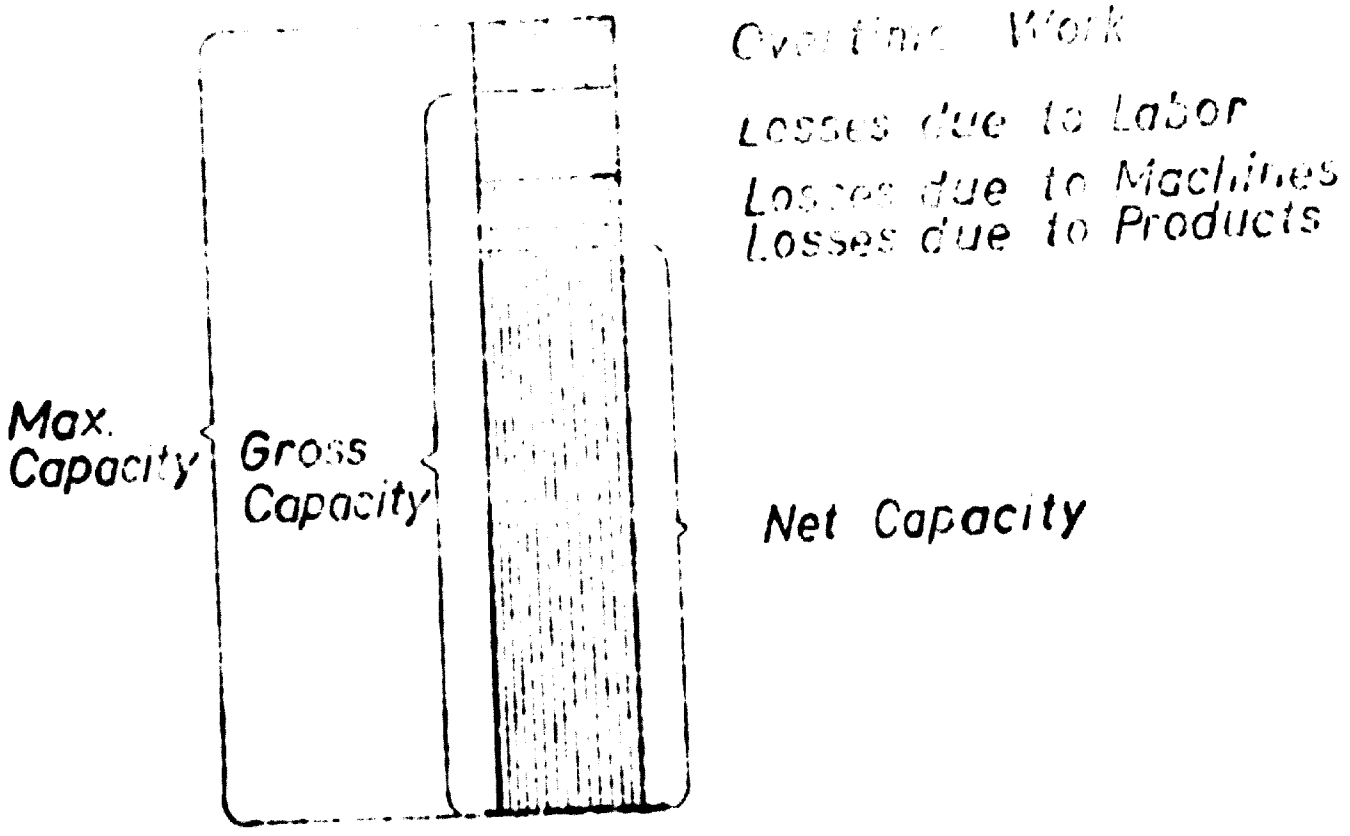


Figure 6.
Capacities

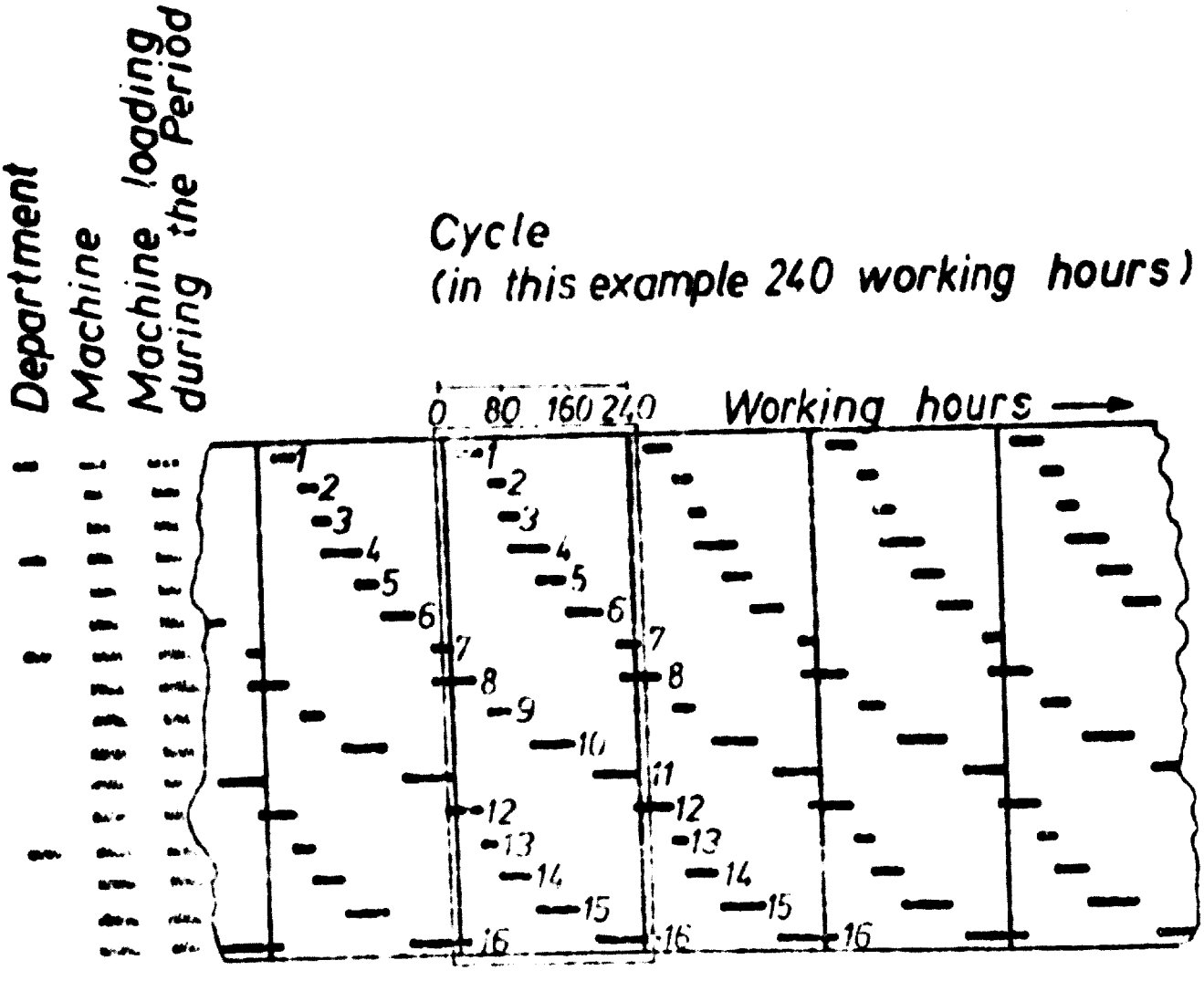


Figure 7.

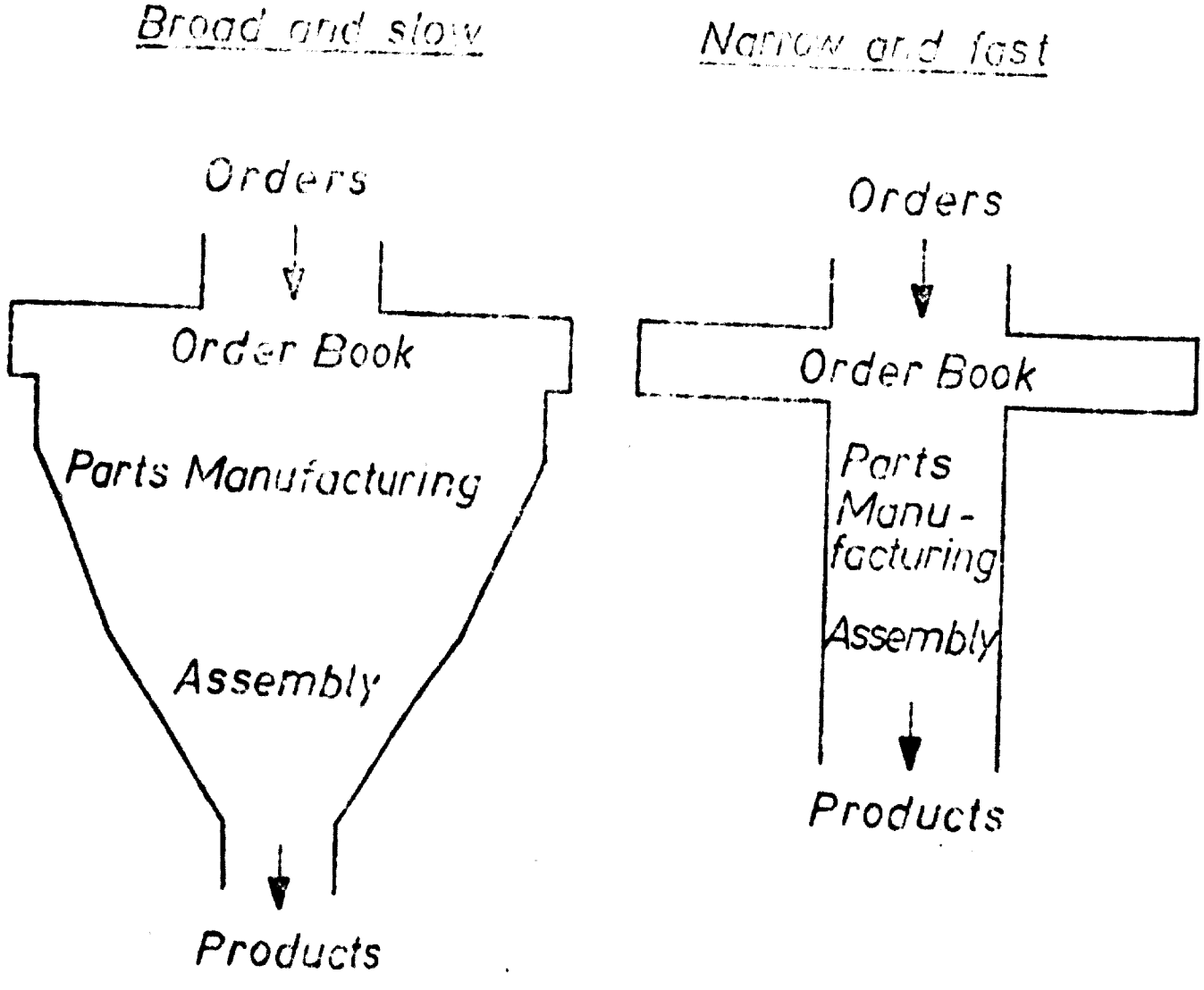


Figure 8.

Material flow

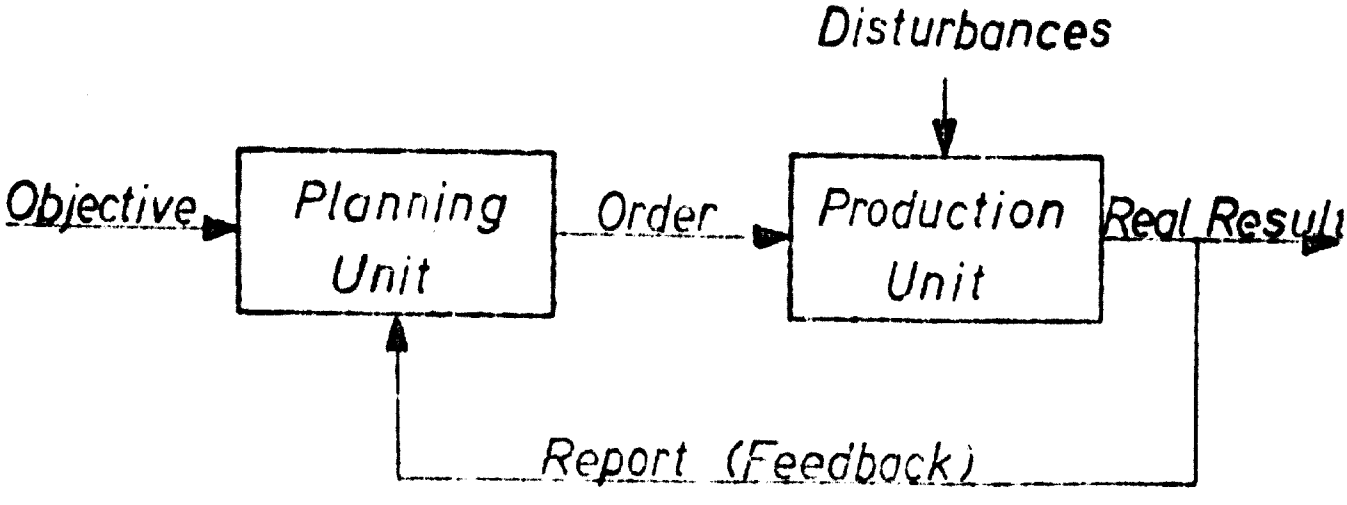


Figure 9.

Circle of planning and feedback

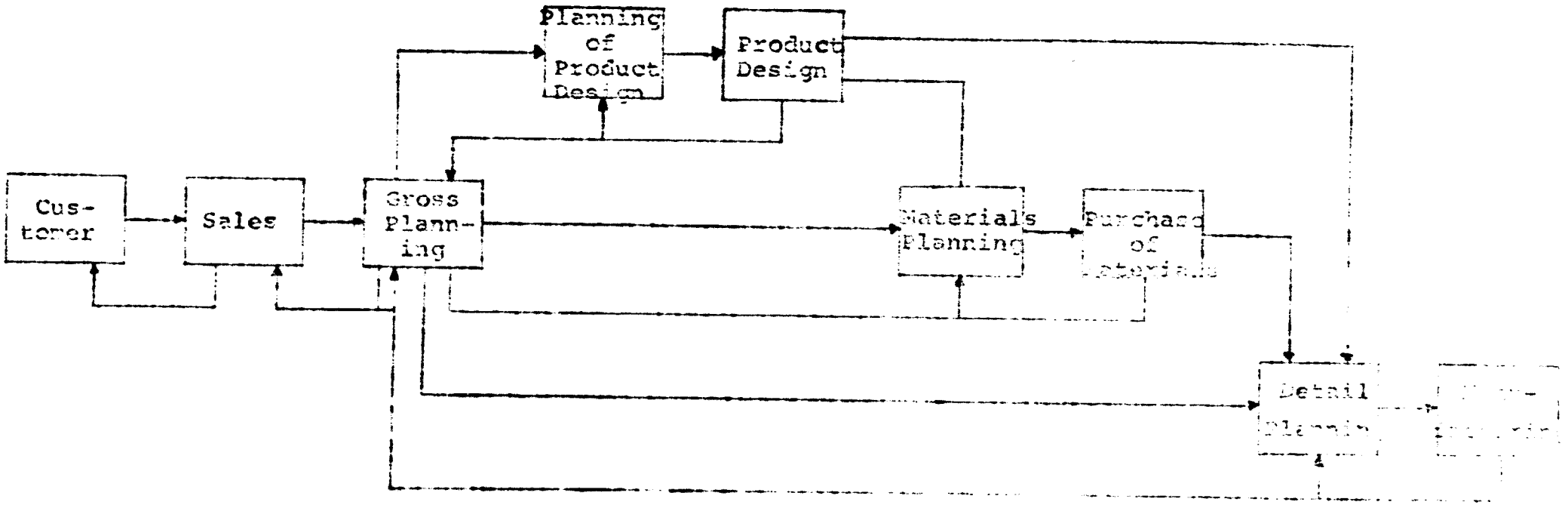


Figure 10.

Planning and feedback of a single custom made product

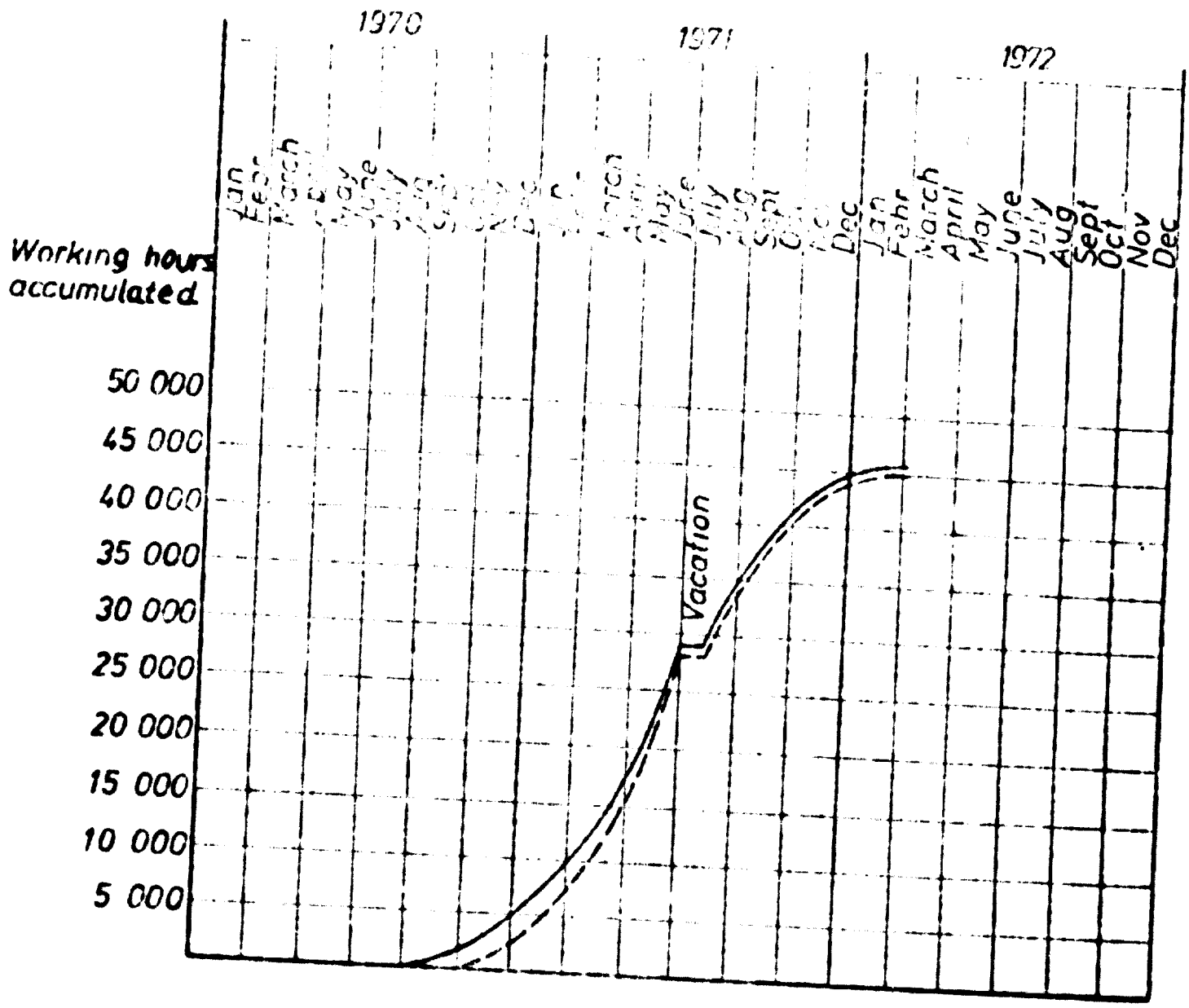


Figure 11.

Control curve for an order

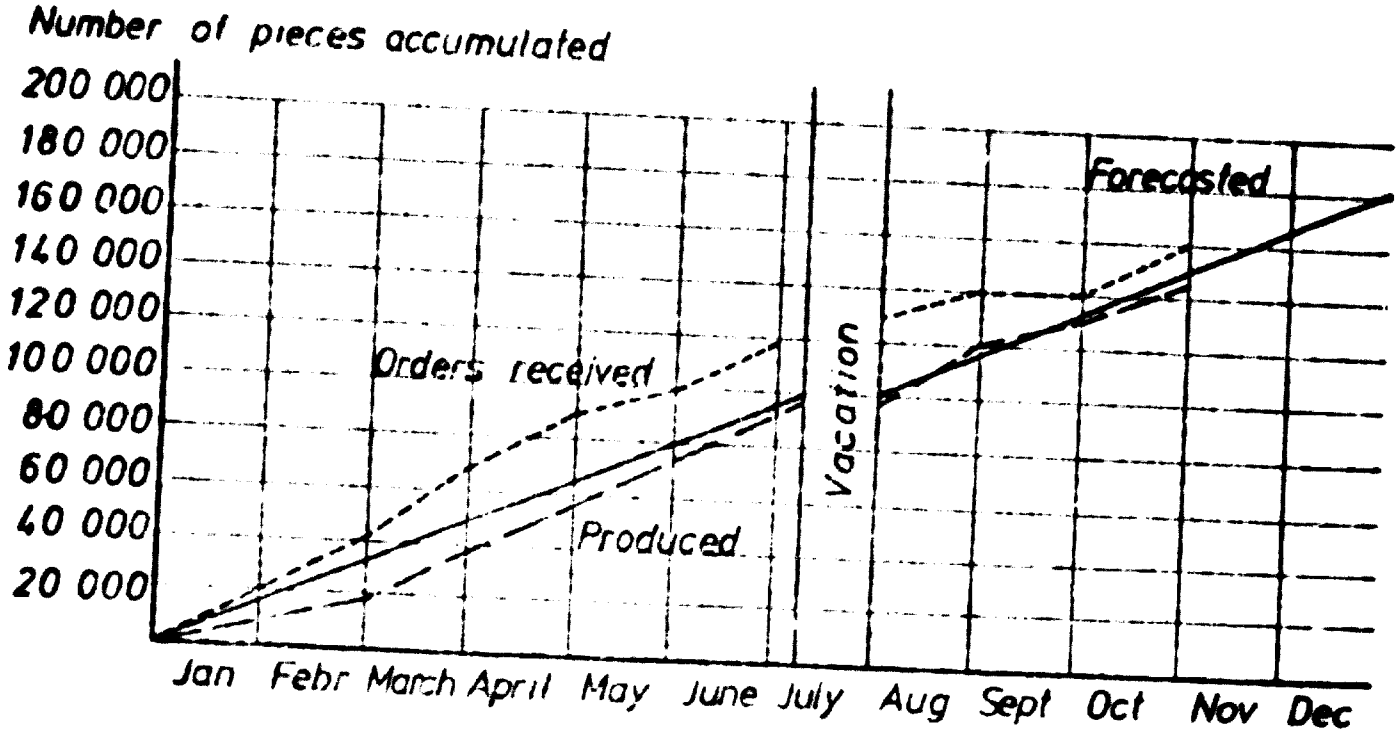
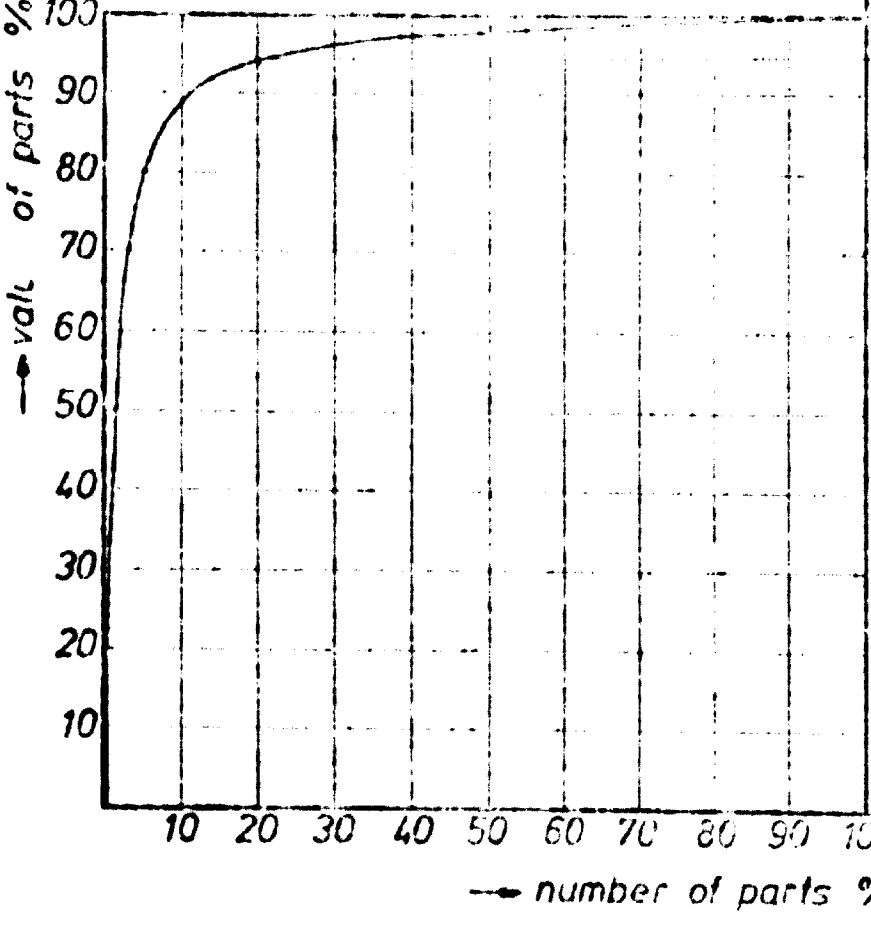


Figure 12.

Follow-up of forecasting, sales and production



Group	The parts' Number	%	Value $	%
C	5 400	80	10 000	5
B	1 200	15	30 000	15
A	400	5	160 000	80
	8 000	100	200 000	100

Figure 13.

ABC-grouping in a manufacturing for stock system

	Group of parts		
	A	B	C
Value of parts $	150 000	30 000	10 000
%	80	15	5
Number of parts	400	1 200	6 400
%	5	15	80
Order point	Sales budget	Order point in stock book	Consumption statistics (no book-keeping)
Order quantity	Economic order quantity	Yearly consumption per 2-4	Yearly consumption
Change limit for demand, constancies and order quantity	3-5%	10-20%	30-50%
Priority	High	Medium	Low
Control of manufacturing	Every operation	Main operations	Arrival in stock only
Stock keeping	Locked stock	Stock	Open stock or places of work (no stock requisition)

Figure 14.

Selective manufacturing for stock system

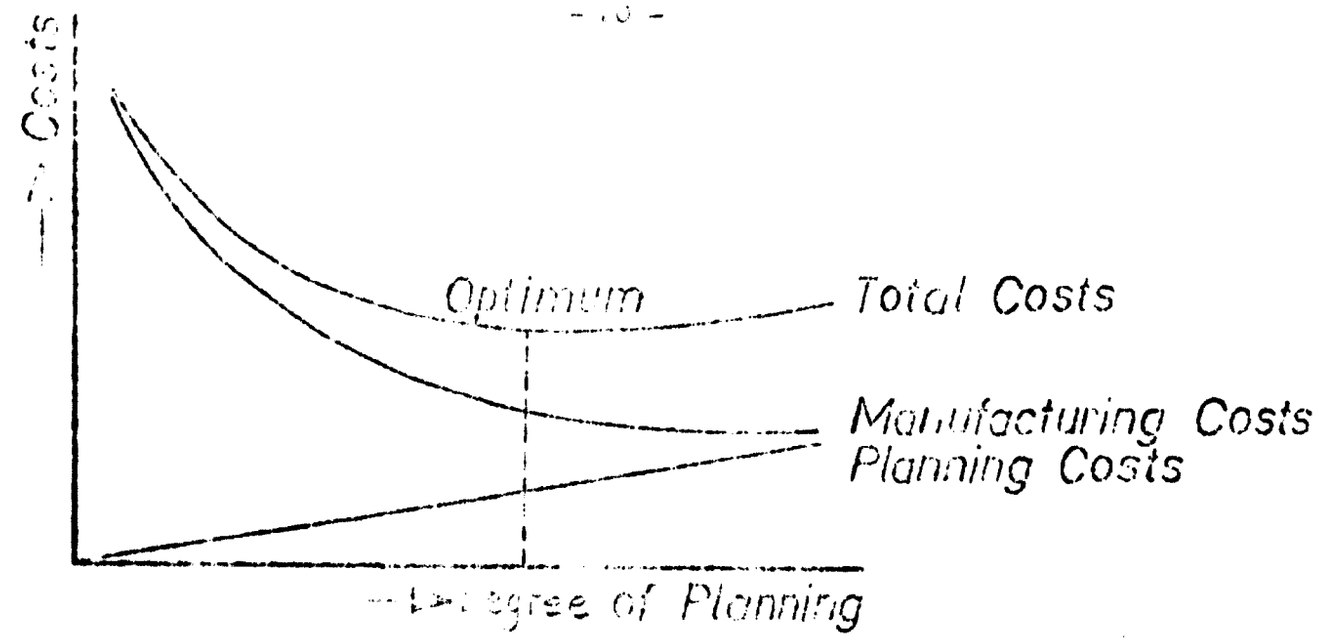


Figure 14.

Optimizing of planning and manufacturing costs

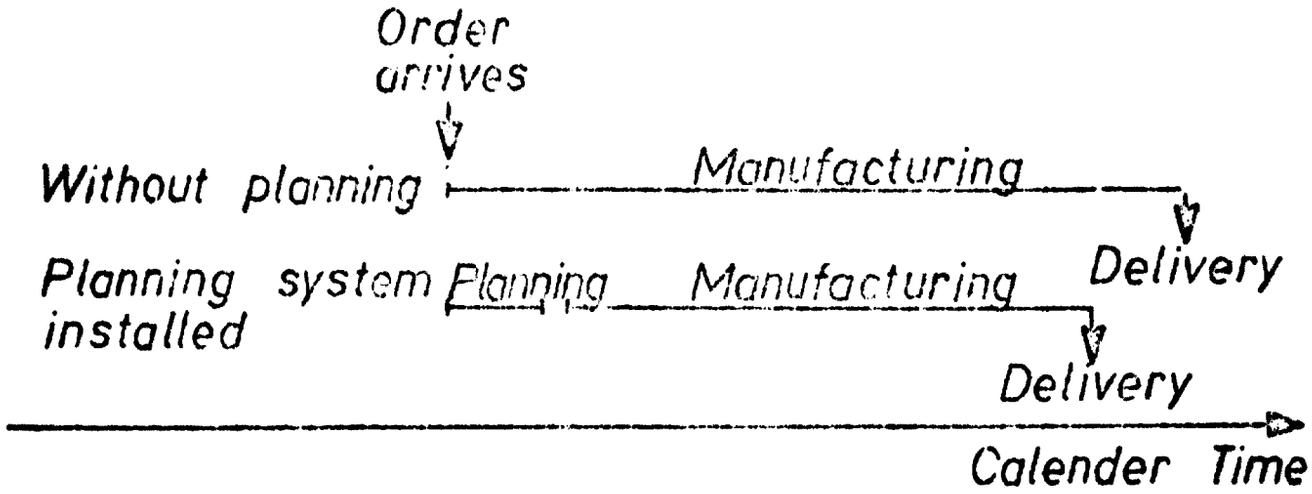


Figure 15.

Impact of planning on the through time

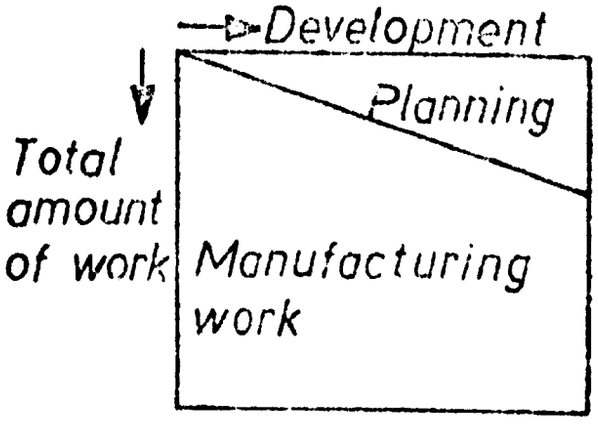
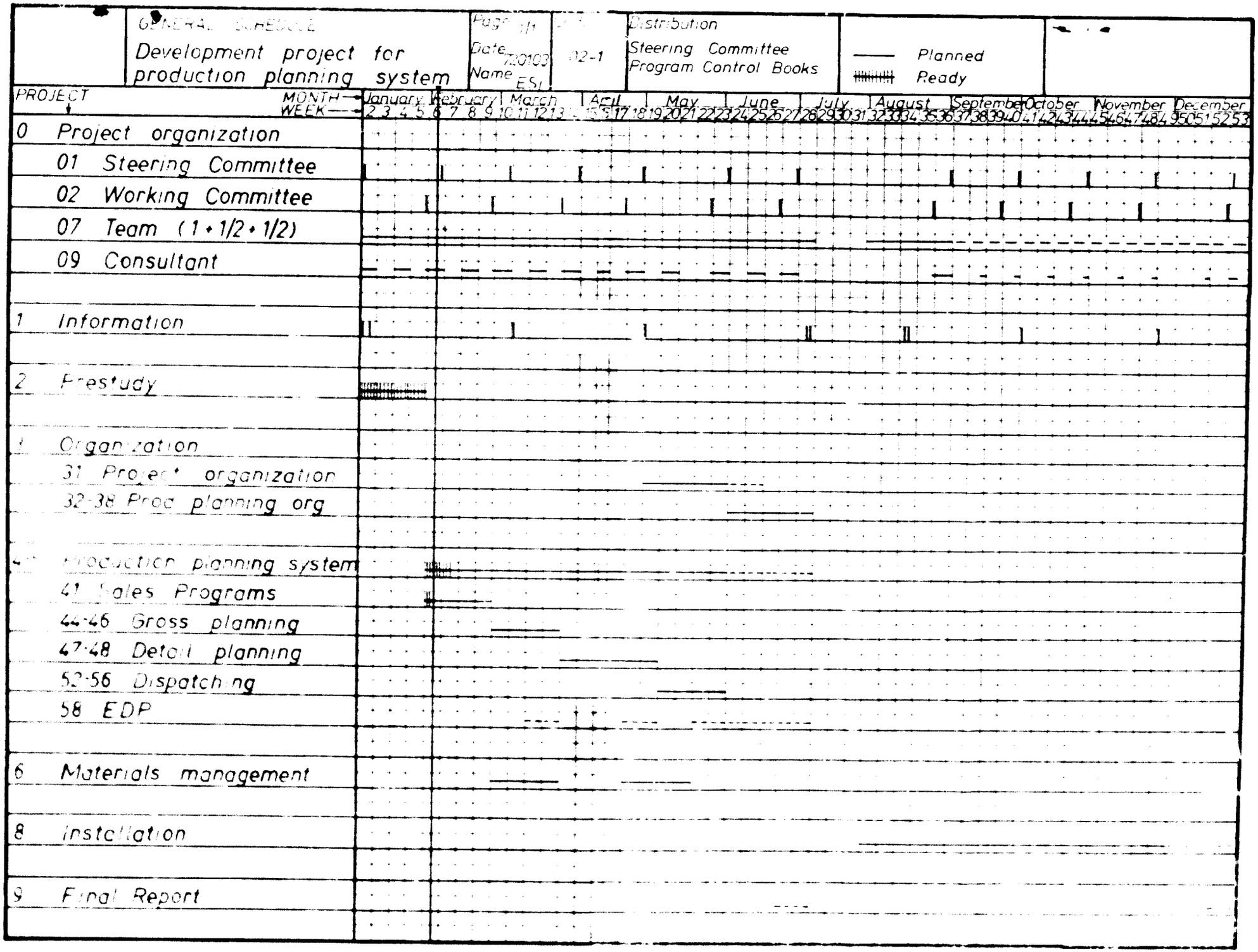
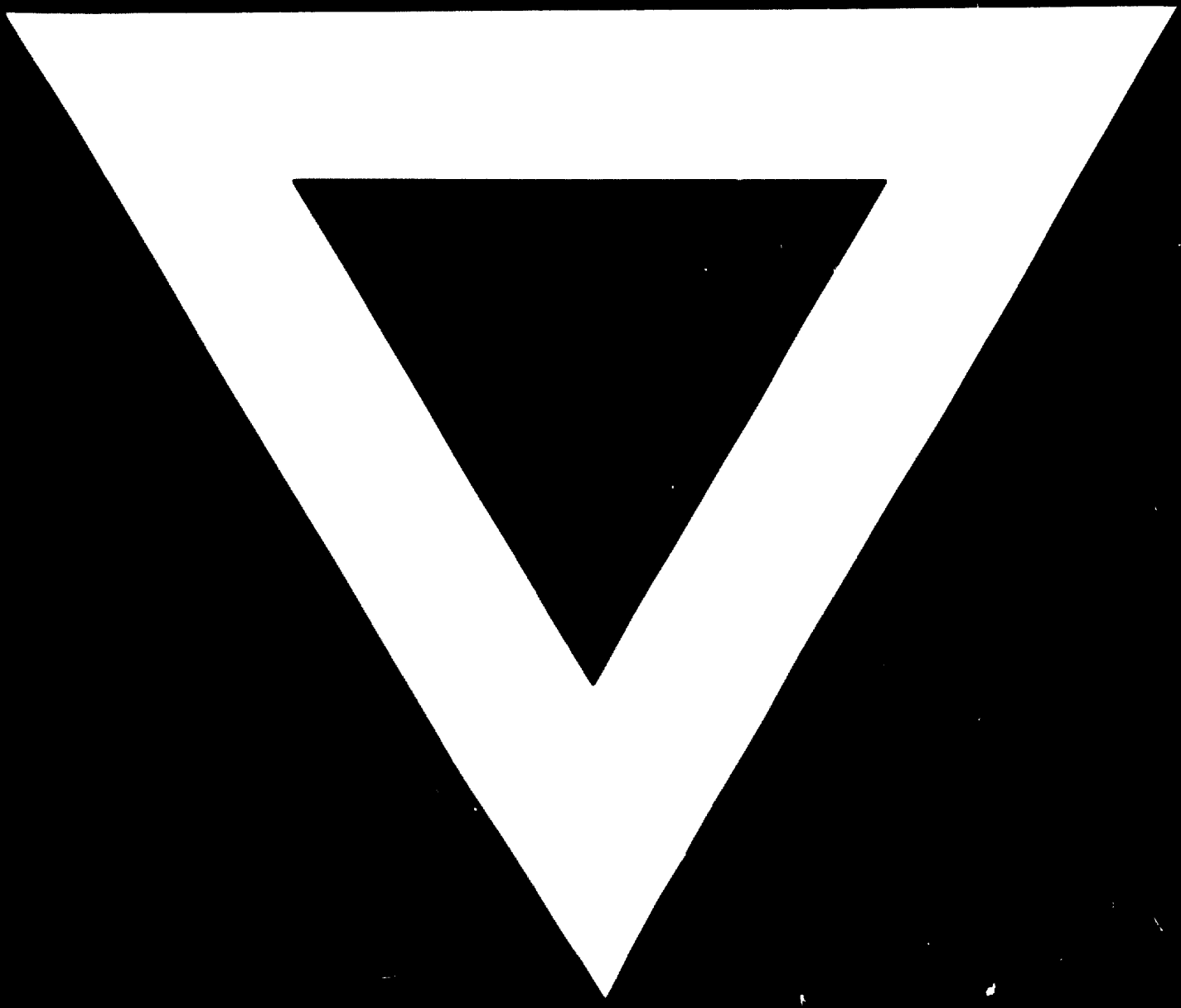


Figure 16.

The planning part of the total amount of work

Figure 1: - General schedule





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