Ing.,PhD., Jozef Jurko
Technical University of Košice

FROM CLASSICAL MOVING ASSEMBLY LINES TO COMTEMPORARY CONTINUOUS FLOW PRODUCTION

This paper deals with production methods in the consumer products industry and surveys the situation existing in many plants. After a discussiion to the ideas currently held,often illustrated by quastions, some of the main problems are dealth with: What exactly is meant by continuous flow production? What social aspects are involved? Many factories appear to be moving towards continuous flow production, and are, as such, involved in activities aimed at reducing manufacturing throughput times, reducing batch sizes and so on. It also turns out that the soscial aspects in general revice insufficient attention.

1. INTRODUCTION

Briefly summarised they may be stated as follows:

1. Market requirements have changed considerably in recent years. From a seller's market situation dominated by efficiency, we are now in a buyers' market where it is becoming increasingly necessary to satisfy at the same time requirements relating to efficiency, quality and flexibility
2. To meet these requirements, factories will need to have the following characteristics:

- Long operational times,
- Continuous flow production , is a way of manufacturing, characterized by the fact that products are almost continuosly being worked at, in other words as little time as possible is wasted on waiting, transport and being in stock. Furthermore, it is assumed that a variety of products is being produced in the same production process.
- Short throughput times,
- Motivated workers.

3. A strategy aimed at attaining these characteristics comprises the following elements:

- Integral approach,
- Reduction of complexity,
- Flexible organisation,
- Socio-technical choices,
- Advanced technologies.

1.1. Fingdings from factory visits

All plants visited are working hard on improvements as indicated in the aforegoing parts. This means all of them are looking at such matters as:

- Accelerating materials flows in order to reduce stocks,
- Quality and reliability of suppliers,
- Reduction of batch sizes,
- Increasing quality levels,
- Introducing new, flexible, production technologies.

The situation reached at present, and the speed with which improvements are being implemented, differ of course from plant to plant and depend to a great extent on:

- The circumstances of the relevant plant or product divisin, such us current profit margins or flexibility requirements,
- The views held with regard to future automation, especially with respect to the possible speed of introduction.

The main priorities are the following:

- Improvement of process control and quality,
- Introduction of new technologies, mainly SMDs (Surface Mounted Devices)
- The flow of information from and to production machines,
- Integration of units to form production systems.

In the implementation of projects aimed at the realisation of, above all, short throughput times, much attention is paid to:

- Transport systems,
- Quality reporting,
- Organisation,
- Technologies

1.2. Transport systems

The considerable amount of attention paid to transport systems stems from the fact that they determine the infrastructure of the plant to a large degree, and as such greatly influence the flexibility of the production. And that flexibility is needed because of the wide assortment of products to be pproduced at any given time.
Two financial problems arise in this case:

- Transport systems are expensive,
- Transport systems, no matter how flexible in principle, become even more costly the greather the deviation from a line set-up.

1.3. Quality

In future production fast feedback will be essential for obtaining and sustaining the required quality levels. Much attention is therefore paid in the projects to this point. In general, fast feedback is achieved by immediatelly testing products and feeding back the results as soon as possible, whether or not via group leaders, to the workers involved. Short cycle times are an absolute necessity for reaching the required quality levels. There is a trend towards higher-grade functions, where operators are required to:

- Solve problems themselves,
- Undertake minor maintence,
- Stand in for one another.

1.4. Organisation

Fewer organisational barries are important for achieving short throughput times. To this end, staff services here and there are detached to the line so as to arrive at better integration and to give the employees concerned more knowledge and understanding of the production prrocess. Recently many of our staff services have been decentralised. Otherwise they don't know enough about what exactly happens in production. Efforts are also made in various ways to

couple product and process development more closely, and also the development and production departments. The organisation must learn to think more in terms of product responsibility.

1.5. Technologies

In many instances, it is not possible to just decrease batch-sizes using the existing production equipment. This is mainly due to the much too long resetting times of the machines. Many factories are on the way to drastically reduce set-up times, using the SMED (Single Minute exchange of Die) method.

The problems that have arisen come under the following headings:
- Plant engineering
- Production
- Development,
- Staff departments,
- Economic and commercial criteria,
- Socio-technical criteria

2. Continuous flow production

Continuous flow production has the following characteristics:
- Products are almost continuously being worked on, that is to say as little time as possible is lost in waiting, storage and transport,
- Different products can be produced by the same production process.

The essence of continuous flow production is thus that a variety of products, is small serries, smoothly follows a total production process which necessarily consists of a number of process steps one after the other.

It can be proved the following conditions must be met in a continuous flow production:
- Very small batch sizes, preferably batchsize one,
- Very short machine set-up times,
- Process steps with closely matched cycle times,
- High quality levels both in products as well as in processes,
- Being relatively insensitive to disruptions

Figure 1 shows how many different forms a systém of work stations in a continuous flow production can have.

Continuous flow production requires mix flexibility and short manufacturing throughput times. Moreover from the viewpoints of complexity reduction and profitability the highest possible degree of machine utilisation is required together with a simple product flow. From a purely technical point of view a solution for the before mentioned problems may be found in a line production in which flexible, quickly resettable work stations are set up in a seriál arrangement. However, the drawback of a much too high sensitivy to disturbances remains. This can be reduced by shortening the line, for example by arranging the work stations in parallel , Fig. 2. Annother possibility is a ssystémof loops, with work stations beside the loops, Fig.3.

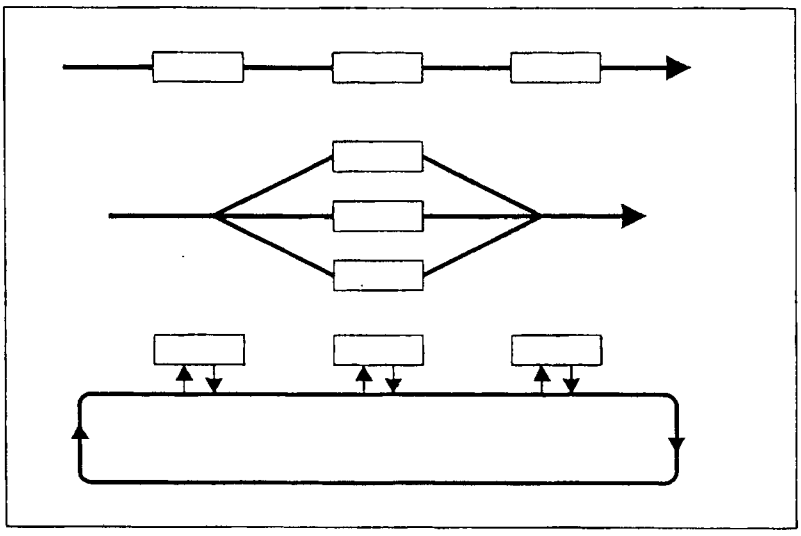

Figure 1 Some examples of possible continuous flow productions

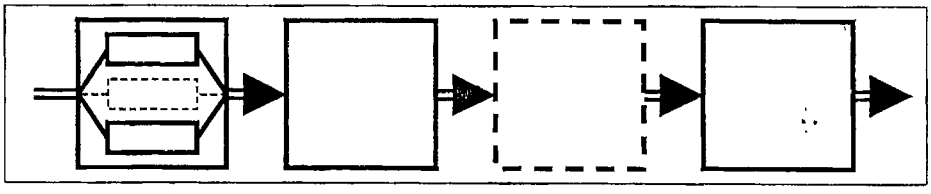

Figure 2 Production line with parallel work stations

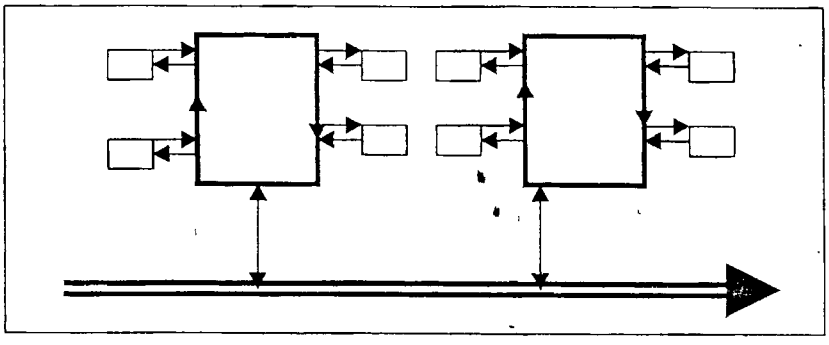

Figure 3 Production systems with loops

Literature

[1] JURKO, Jozef: Design for automatization assembly process : In: Zborník z naukowo-technicznej konferencie Automation 2000 Warszawa 12.-14. maj 2000, Warszawa : PIAP, 2000, s.160-162, ISBN 83-902335-8-4