THE INTERACTIVE CONTROL CENTER IN THE FACTORY 2000

Aldinger, L.; Müller, R.

Fraunhofer-Institut für Produktionstechnik und Automatisierung, IPA, Stuttgart, West-Germany

ABSTRACT

Today in the manufacturing industry still planning panels and simple display units for production control are used. The efficiency is low, but with the help of computer aided information and planning systems the efficiency can be increased. For this purpose it was necessary to develop a new system for the plant control center. Because the research report revealed that graphic systems could increase the efficiency of supervision tasks, graphic systems have to be used in new systems for production controlling and scheduling.

INTRODUCTION

In the factory of the future the problems of planning and controlling production processes perhaps change in some points. But if there is a job production or a flow job production we will have also to do supervising, controlling and planning. Therefore we need a sophisticated system for planning and controlling production processes.

2 Tasks and problems of production-control centers

2.1 Tasks of a control center

The tasks to be performed by a control center can be obtained from the various functions of the control stand in the areas of planning, control and supervision. The significance of these individual tasks is evaluated in different ways, according to the specific company organization, or they may be allocated to another division.

In spite of different forms of organizational and plant-specific distribution of orders, some typical orders of production control can be established. These orders constitute the basis for the planning, controlling and supervising functions of the control station.

They are in particular:
- data management
- (plant)data collection
- supervision of machines and orders
- order allocation

and the connection of these separate orders respectively the resulting activities into a feed-back control system for directed failure reaction (fig. 1).

Fig. 1. Tasks of a Production Control Station
2.1.1 Data management

Data management in conventional control centers is performed with the aid of several files. These include:
- tool index,
- work plan index,
- machine index,
- production order index.

2.1.2 Plant data collection

In order to carry out the task of "data management" it is necessary to collect data (e.g. actual order data) in the production process, and to prepare it for further processing. A number of collection procedures are available for this purpose /5/, all capable of supplying a control center with a continuous flow of data.

2.1.3 Supervision of machinery and orders

The supervision of the machinery should only be provided in the form of discrete conditions (e.g. machine malfunction, machine stoppage), without making any evaluation or reference to target values.

The supervision of the orders, additional observations must be made as to whether the state of production at any particular time or the progress achieved in carrying out a job corresponds to a given nominal value or whether some corrective interaction is necessary.

2.1.4 Scheduling

The creation of an operating sequence is produced by detailed scheduling in the controlled centers of the individual orders prior to the machine stage. In the case of short term planning, it is generally no longer possible to make exact manual calculations related to the operating cycle, in order to optimize the job sequences.

Criteria such as:
- minimum average throughput time;
- maximum utilization of capacity;
- adherence to deadlines,

must be taken into consideration when making detailed scheduling. However, difficulties arise in this context, because the algorithms that are necessary in order to undertake heuristic or exact approaches to a solution are often too complicated for manual doing.

2.1.5 Order allocation

On the basis of the control center transport to the machinery and the commencement of the processing can be authorized. The deviations from the detailed scheduling (e.g. resulting from machine malfunctions, urgent orders) should be taken into account here.

2.2 Analysis of weak points in known conventional control center systems

An analysis of weak points carried out on conventional control centers demonstrated that the replacement of manual solutions by computer-aided solutions produced improvements in many areas. For example, the effects of routine work in data management (document preparation, sorting of index cards in files, search lists for data etc.) were regarded as inhibiting efficiency. Therefore EDP-support is needed. But in the realized EDP-systems for production control, lists are used. Lists are unsuited for supervision and short term planning in manufacturing systems, because they do not have the transparency of planning panels and other aids used in the known production control stations. With computer graphic systems it is possible to increase the efficiency of supervision and planning tasks.

3 Computer development stages

If only one or just a few tasks are to be handled with computer assistance in a control center, then such assistance should first be restricted to those tasks that do not require other tasks, as yet not using the aid of computers, to be assisted by computers immediately. For example, data management is the first task that can be carried out independently of the others. Although in drawing up a software and hardware system it is important to bear in mind, just which tasks remain to be dealt with by computers, nevertheless, software for data management for example is ready to run, without requiring implementation of other modules. The various tasks to be performed in a particular sequence with the assistance of computers is referred to as development stages 1 to 5 (see fig. 2).

Especially at stage three interactive-colour graphic-systems with EDP-support are needed for the supervision task. The "colour" components enables the display to show additional significant information. For example, by backing alpha-numerical symbols in red, an indication can be given regarding the degree