

TECHNICAL AND ORGANISATIONAL ASPECTS OF PRODUCTION PREPARATION ON THE EXAMPLE OF DOOR FACTORY

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ABSTRACT

The aim of the work is the analysis of the organization of production, and door-producing undertaking to propose technical solutions that could improve production efficiency and reduce costs. On the basis of an analysis of the existing organizational and technical production plant a proposal of changes was presented. These changes depend on replacing a group of machines with one CNC EGURKO automatic line.

Keywords: technical and organizational production preparation, factory.

INTRODUCTION

The production process is a structured set of operations, whose aim is to perform the specified products. The production process can be of reference specified product or production cells, in which these operations are slotted. Production processes are specific for each type of product. The main part of the production process is a technological process during which the input materials change their shape, dimension, appearance, physical-chemical properties or parts change the relative position (during assembly) [1, 5]. It is often necessary to customize the manufacturing process to changing environmental conditions. Frequently, production process must be adjusted to changing external conditions, including e.g. supply and demand shift, since the production process is geared towards realisation of a given aim or group of aims, which may, however, change [2, 6].

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The purpose of technical preparation of production is to prepare all the activities associated

with the production and, in particular, to produce a new product or service. The scope of these activities includes:

- modernization of the existing production,
- continuous exploration and continuous substitution of materials,
- the introduction of new technologies.

Technical production preparation comprises the following stages [2, 7, 9]:

- preliminary study and research,
- design preparation,
- technological preparation,
- organisational preparation,
- production initiation.

Organisational production conducts to determination of the time and space of the qualitative and quantitative compounds occurring between man work. Specific features affecting the organizational production are:

- different sequence and duration of individual processing processes,
- frequent changes of work pieces,
- a relatively high number of possible technological solutions,
- frequent changes.

Organisational production preparation is strictly connected with the preceding stage as the accepted technology, de facto, imposes certain production organisation solutions. Therefore, organisational production preparation works should be in parallel with technological and design preparation works. Additionally, what should be considered an essential aspect of organisational production preparation is a prior training for the staff, in order to improve their qualifications.

Organisational production preparation involves developing the following [1, 7]:

- preparatory works procedures required to start new production,
- production stations layout procedures, localisation of machining cells and production hierarchy,
- management structures,
- pre-operative planning procedures, including model schedules and production documentation,
- production start-up and development procedures.

Work stations and machining cells layout is to certain extent dependent on a selected machining technology. Nevertheless, proper planning of production stations layout may significantly shorten transport time or facilitate the transport between subsequent stations. Each such plan should take into consideration: particular stations size, required wall and transport route clearances, necessary installations accessibility, work ergonomics as well as transport between stations.

Production start-up involves test run, design and technological production preparation quality control as well as production stations and product quality control. If necessary, technical organisational documentation is revised. The purpose of the production start-up phase is to ensure full production capacity of production line in the shortest possible time [1, 3].

One of the key tasks of technical production preparation is to sustain technical development of both the product and its manufacturing, another is to ensure the producibility of the design. It is achieved by minimising the number of non-standard parts, selection of material and its shape. The importance of technical production preparation is growing with the technological and organisational progress of a company. It, moreover, enables introduction of new products and modernisation

of already existing ones in terms of the technology of production, which is, in turn, reflected in higher product market value.

Among the main indices of technical production preparation there are: productivity improvement and technological-economic indices of a company [2].

THE PRODUCTION CHARACTERISTICS

The production characteristic of the selected product is carried out on the basis of the enterprise, which since 1992 has been producing all types of doors. The company offers are: the doors and door sash, doors, exterior doors, entrance doors, edging with natural veneers. The company has a hall divided into four smaller rooms, one of which meets the storage function of semi-finished products, and the other three are individual workstations equipped with specialized machines and automatic lines for the processing of wood and laminates and other equipment, as well as the position of the manual.

The company has the following work stations:

- position the glazing,
- for foil,
- installation of handles, hinges, locks,
- dryer,
- hand station:
 - preparation of muntin (design frame),
 - preparation of fill (particle or honeycombed plate – fill in the frame).

An actual layout of work stations in a production line of the door is presented in Figure 1.

The existing organizational arrangements in the workplace are, inter alia:

- 1) serial production type,
- 2) repeatable (rhythmical), production.

Among the benefits of the serial production organization to be replaced:

- increase specialisation of positions and workers' skills,
- increase the possibility of mechanization and automation of production processes,
- the ability to invest in production and technology, and also in production lines,
- shorten the production cycle and reduce stocks of work in progress, as well as increasing the rotation of current assets,
- reducing the time of idle workers' and machines' rest.

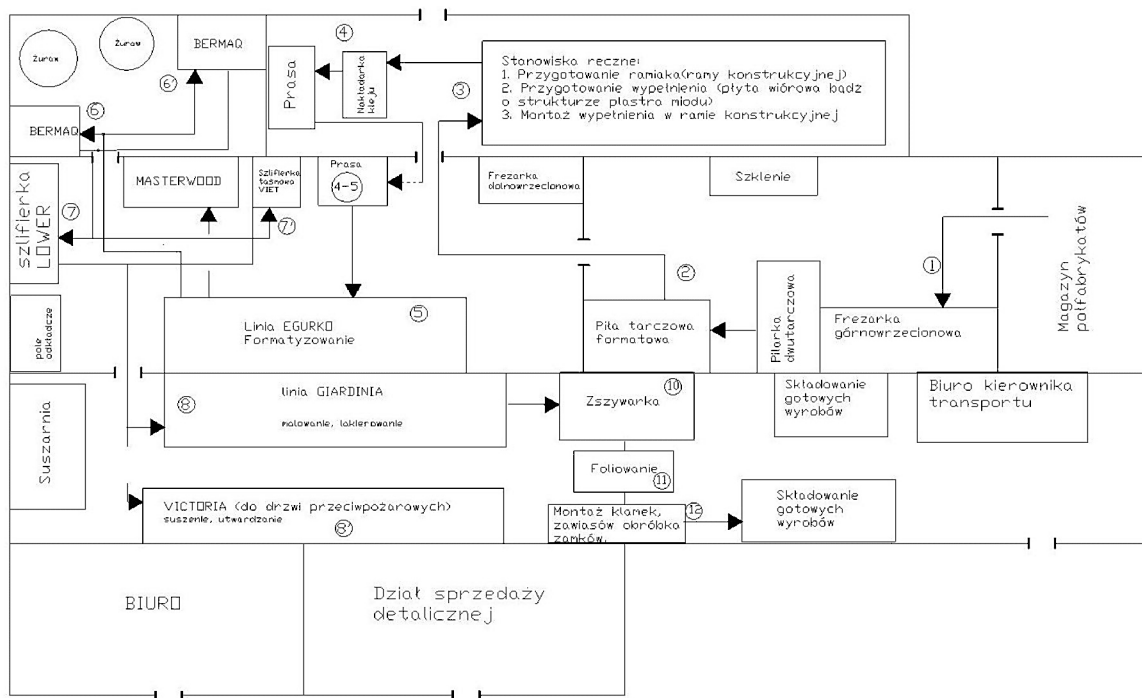


Fig. 1. Production stations layout of door (the original figure from [10])

While the repeatable production is characterized by:

- regular repetition of the same phenomena in equal intervals
- invariable adopted the technology, the production volume and the range of manufactured products,
- long-term break tasks into smaller units, carried out in shorter intervals,
- allocation of productive tasks to individual workstations to detail operation,
- fixed schedule during the production process.

The characteristics of the possibility of rational planning of production of certain products is presented, in order to plan the supply of

materials, reduce storage costs and improve the use of posts.

THE TECHNICAL AND ORGANIZATIONAL MODIFICATION

The basis of an analysis of the organizational and technical solutions which existed in factory a proposal for change was presented, involving replacing a group of machines with one automatic line CNC EGURKO. It is proposed that machines can be replaced with one automatic line CNC EGURKO, the following:

- Jarome veneering machine,
- format the line EGURKO,

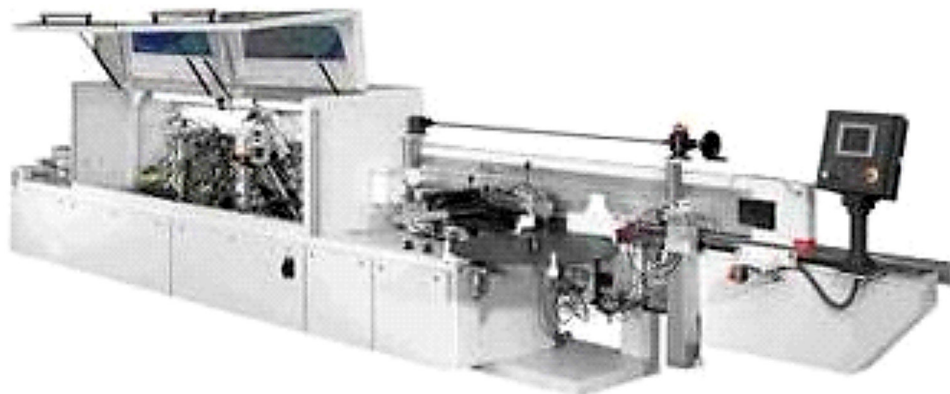


Fig. 2. The veneering machine in combination with dimension saw machine view [10]

- CNC milling machine EGURKO Bermaq,
- CNC milling machine MASTERWOOD,

In the prepared solution, it is proposed that the line will include the following stations: EGURKO CNC:

- glue spreader and veneering machine,
- press with a dryer,
- veneering machine in combination with dimension saw machine (Figure 2).

Between the lines the segments are mounted on a special automatic roller conveyor (Figure 3), thanks to which the material is moved from one location to another without human involvement (which saves 20% time and set the material transport industrial movement technology machine tools). The proposed scheme of CNC EGURKO automatic line is presented in Figure 4.



Fig. 3. The roller conveyor view [10]

ADVANTAGES AND LIMITATIONS OF THE PROPOSED SOLUTION

The advantages of the proposed changes include:

- time saving – 20% (no need for manual transport of materials between work stations),
- no manual setting and removing the material from the machine table- in the proposed dissolution of the machining time, one lot (10 pieces) is much shorter. On regular machines the time amounts to approximately 230 minutes, and in the automatic line it is estimated at about 130 minutes, and so it would be less by about 57%;
- the possibility reducing the number of qualified staff;
- 3 operators for 1 service line (while in the existing solution, the machines are operated by 6 people), in view of the fact that in the existing three shift system, employment reduction will reach 12 full time equivalents.

In addition, you can replace some of the production line, as the space-saving takes less space than 3 milling machines, veneering machine and dimension saw machine along with the spaces on the material before and after treatment. Another important advantage in view of the current volume production might include the improvement of ergonomics. However, the presented solution also has some disadvantages, among which one should mention that the line is dedicated to only one type of product (door), which affects some limitation in the implementation of the proposed solutions to the enterprise. In addition, an account should be taken of the need to reorganize the pro-

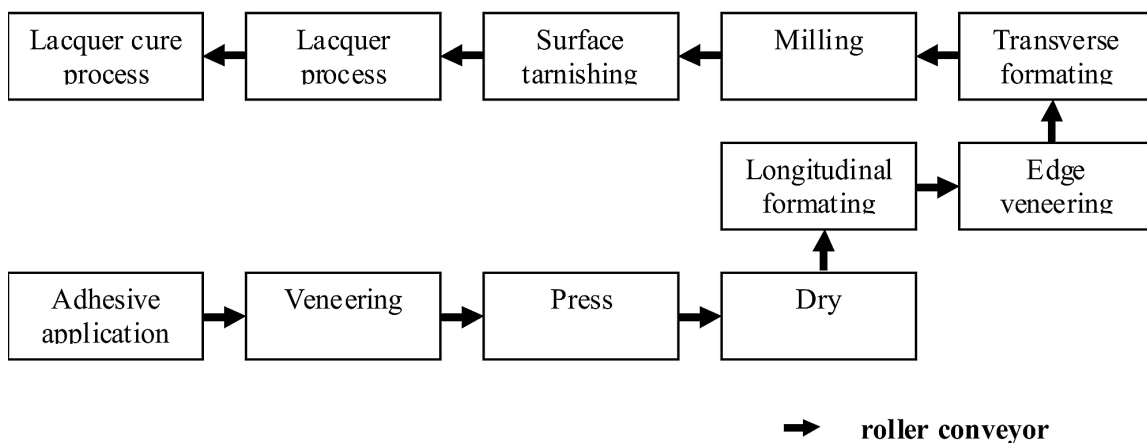


Fig. 4. The scheme of CNC EGURKO automatic line

duction establishment when changes are made in door manufacturing. This reorganization results in difficulties during the installation of automatic line production, especially in cases where the department was unable to make the breaks in the door production. One solution is to move the production of the door to another production hall or to limit the number of manufactured products at the time of the assembly line. Another limitation of the proposed solution is also a significant cost of purchase and installation of such a line, which should be considered in the financial analysis of the company.

SUMMARY

Superior purpose of the company is its survival and development, which is conditioned by gaining appropriate profit in longer periods of time. Proper preparation and organization of the production and the reduction of production cost and time are very important for the business. Despite the disadvantages of the proposed solution, the purchase of the automatic line will bring more benefits than losses. The cost of this line will return after 3–4 months of its work, and at the end of this time, the company will begin to make money on the investment.

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