

Ministry of Education and Science of Ukraine  
Ternopil Ivan Pul'uj National Technical University  
Faculty of Engineering of Machines, Structures and Technologies  
Manufacturing Engineering Department

**YOUSIF DUHAIR**

UDC 621.9

**DESIGN DEVELOPMENT OF MACHINE SHOP AREA FOR THE CASE  
TSF-8.171.137 MANUFACTURE INCLUDING THE STUDY OF  
CUTTING TOOL GEOMETRICAL PARAMETERS INFLUENCE  
ON CUTTING FORCE PARAMETERS**

131 «Applied mechanics»  
Field of knowledge 13 “Mechanical engineering”

**Synopsis  
of master's degree diploma**

Ternopil - 2019

Diploma was done on Manufacturing Engineering Department of Ternopil Ivan Pul'uj National Technical University of Ministry of Education and Science of Ukraine

**Supervisor:** Ph.D., Assoc. Prof., Manufacturing Engineering Department  
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Diploma defence will be held on 26 of December 2019 at 10.00 am at the meeting of the examination commission №3 at the Ternopil Ivan Puliuy National Technical University at: 46001, Ternopil, 4 Lukianovych street, education building №11, classroom 11.

## GENERAL CHARACTERISTICS OF WORK

**Actuality of work theme.** Parts of type "corpus" are intended for installation, centering and fixation of assembly units, as well as for facilitating assembly of components. The most common technological operations in the manufacture of casings are the turning, drilling holes, cutting cutters and milling.

Elaboration of technological processes of processing such parts and designing on their basis of production sites, shops is actual scientific-practical task which defined direction of researches of Master's work.

**Purpose of work:** development of a mechanical workshop project for manufacturing case TSF 8.171.137 with the study of the influence of geometric parameters of the cutting tool on the force parameters.

**Object, methods and sources of research.** The main objects of research are the case, technological process and station for its manufacture. Methods of work performance: economic and statistical, graphic, comparative, mathematical modeling; Theoretical-empirical. Sources of research: basic technological process, manuals and textbooks on theory and practice of technological processes design, electronic resources, reference books.

### **Results obtained:**

- analysis of geometric parameters of the cutting tool is carried out, the patterns of their changes in the cutting process have been investigated, their influence on components of the cutting force, the quality of the treated surface and the wear of the tool;
- analysis of design and slug of destination details, basic technological process of its production;
- investigated methods of manufacturing similar parts;
- a project version of the technological process of manufacturing case for which equipment, equipment, cutting and measuring instruments has been selected;
- technical and economic justification for the decisions taken;
- the issues of information technologies, labor protection, safety in emergency situations and ecology are considered;
- designed the district of the mechanical workshop for the production of case.

### **Practical value of the results.**

The technological process, which can be implemented in real production conditions, is developed. The use of progressive equipment, special cutting tools, optimum layout of production equipment, which can be used in practical activity is proposed.

**Апробація.** Окремі результати роботи доповідались on the International scientific and technical student's conference of TNTU "Fundamental and applied sciences. Actual questions" 26th-27th of April 2018.

**Structure of work.** The work consists of explanatory notes and a graphical part. Explanatory notes consists of an introduction, 9 parts, conclusions, list links and applications. Amount of work: explanatory notes – 180 pages of A4 format, graphic part – 11 drawings format A1.

## MAIN WORK CONTENT

**In the introduction** a review of the current state of the engineering industry and the main tasks to be solved in the master's degree work.

**The analytical part** considers the analysis of the state of issue according to literary and other sources, provides slug purpose and characteristics of the production object, the actuality of work, analysis of technical requirements for the product, manufacturability Its structures, conclusions were formulated, statement of the problem for Master's work was made.

**In the research part** The geometrical parameters of the cutting tool are analyzed, the influence of radius of cutting edge and cut angles on components of cutting force and durability of the tool in processing process is investigated.

**In the technological part of** The description of type and organizational form of production is provided, the choice of a preparation method and requirements retractable to it is justified. The allowances for surface treatment of the parts in the analytical way were calculated. The dimensional analysis was carried out, the route of technological process was developed on mechanical processing operations case TSF 8.171.137. Cutting and rationing operations were calculated.

**In the design part** the choice and design of the means of technological equipment and equipment for manufacturing the details, calculations of measuring instruments, construction of industrial work.

**In a special part** is considered the subsystem of optimization CAD, overview of the most common CAD world manufacturers, the study of methods of designing technological processes of manufacturing parts through a package of applications TIII CAIP, The block diagram of the algorithm of automated design of technologies is presented, analysis of technological process of production of details, obtained with the help of CAIP TII.

**In the project part** A mechanical shop was made designing for realization of the developed technological process, namely the refined program of production, calculation of the capacity and machine-tool capacity of manufacturing of products on the basis of developed Technological processes, determined the annual need for technological equipment, defined the quantitative composition of working in the mechanical compartment, defined the size of the main and auxiliary areas of the shop and district, developed the warehouse plan of the workshop and the plan Equipment placement, lifting and transport facilities selected.

**In terms of "justification of economic efficiency»** The issues of production organization, main technical and economic indicators of the district are considered, efficiency of design decisions was calculated.

**In terms of occupational health and safety in emergency situations»** The question of organization of labour protection in production is presented; Dangerous production factors at the polling stations and measures for their reduction; Systems for safe operation of equipment on a projected site are offered.

**In part "ecology"** proved the relevance of the environment, the issue of possible emissions of harmful substances into the atmosphere, reduction of production waste at the site of a mechanical shop for the production of case, defined measures for Reduction of exhaust gases toxicity.

In general, the conclusions concerning the thesis are described by the technical

solutions and organizational and technical measures adopted in the diploma, which provide the task for the design; Original technical solutions, adopted by the author in the process of performing master's work; Technical solutions that can be introduced into production are also proposed; Technical and economic indicators and their comparison with the basic.

The annexes to the explanatory note are the information specifications, the set of technological documentation.

In the graphics part the drawing of the details from the designation coordinate axes and surfaces, drawing of the workpiece, schemes of technological constructions, assembling drawings of technological equipment and equipment, plan of placing of equipment at the polling station is presented. Mechanical processing, results of comparative analysis of technology options and results of the research conducted.

## **CONCLUSION**

Accepted in the thesis work of scientific and engineering solutions allowed to design the district of mechanical processing for the manufacture of parts of the type "corpus" and achieve a substantial improvement of individual indicators of the technological process. The elaborated technological process of manufacturing the details is more refined and has considerable advantages before basic technological process.

Production of the workpiece by the proposed method allowed to reduce allowances for mechanical processing and labor capacity, as well as to reduce the cost of the workpiece by 10-30% by reducing the cost of the material and operating costs.

Changes in the basic technological process of processing the part. Two universal operations-coordinate-boring and radial drilling replaced by one using multipurpose machine. This allowed reducing the number of major and auxiliary workers, reducing the area of the district mechanical workshop for handling the housing.

On a vertically milling operation the use of progressive cutting tool-two-stage end cutters is offered. Due to the reduction of work moves the energy costs of processing the material are reduced by two times. In all operations, where it is necessary to control geometric accuracy of the machined surfaces, special templates are used that reduce the auxiliary time for control and size measurements.

The calculation of economic efficiency confirmed the correctness of the project decisions and showed that due to the implementation of design technology decreased not only the cost details, but also decreased the volume of investment, and improved the main Techno-economic indicators.

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## ANNOTATION

Yousif Duhair. Design development of machine shop area for the case TSF-8.171.137 manufacture including the study of cutting tool geometrical parameters influence on cutting force parameters. Abstract of the thesis for master's degree: speciality 131 "Applied mechanics". - Ternopil Ivan Puluj National Technical University. - Ternopil, 2019.

The thesis develops the design of machine shop area for manufacturing the case and researching the impact of cutting tool geometrical parameters on cutting force components and tool life.

**Key words:** technology, process, shop area, machine tool, machining