Denis Meleshkin

melesh.denis@gmail.com LinkedIn profile CV

Portfolio

Introduction

This is a brief summary of the main projects from my experience. Presented projects were made for non-commercial purposes. Watermarks and low-quality images are used to insure protection of intellectual rights.

Contents

1. Helium cryogenic cooling system with a capacity of 2 kW per 100-150 K

For my bachelor's degree thesis, a helium cooling system with required characteristics: **cooling capacity of 2 kw per 100-150K** was designed. Starting from the possible application of cooling high temperature superconductive elements, an analysis of possible solutions to achieve the required characteristics was carried out. Then the calculation, design and modelling of the chosen cooling system (figure 2) were made. Main devices such as main heat exchanger and centrifugal fan were designed (figure 1).

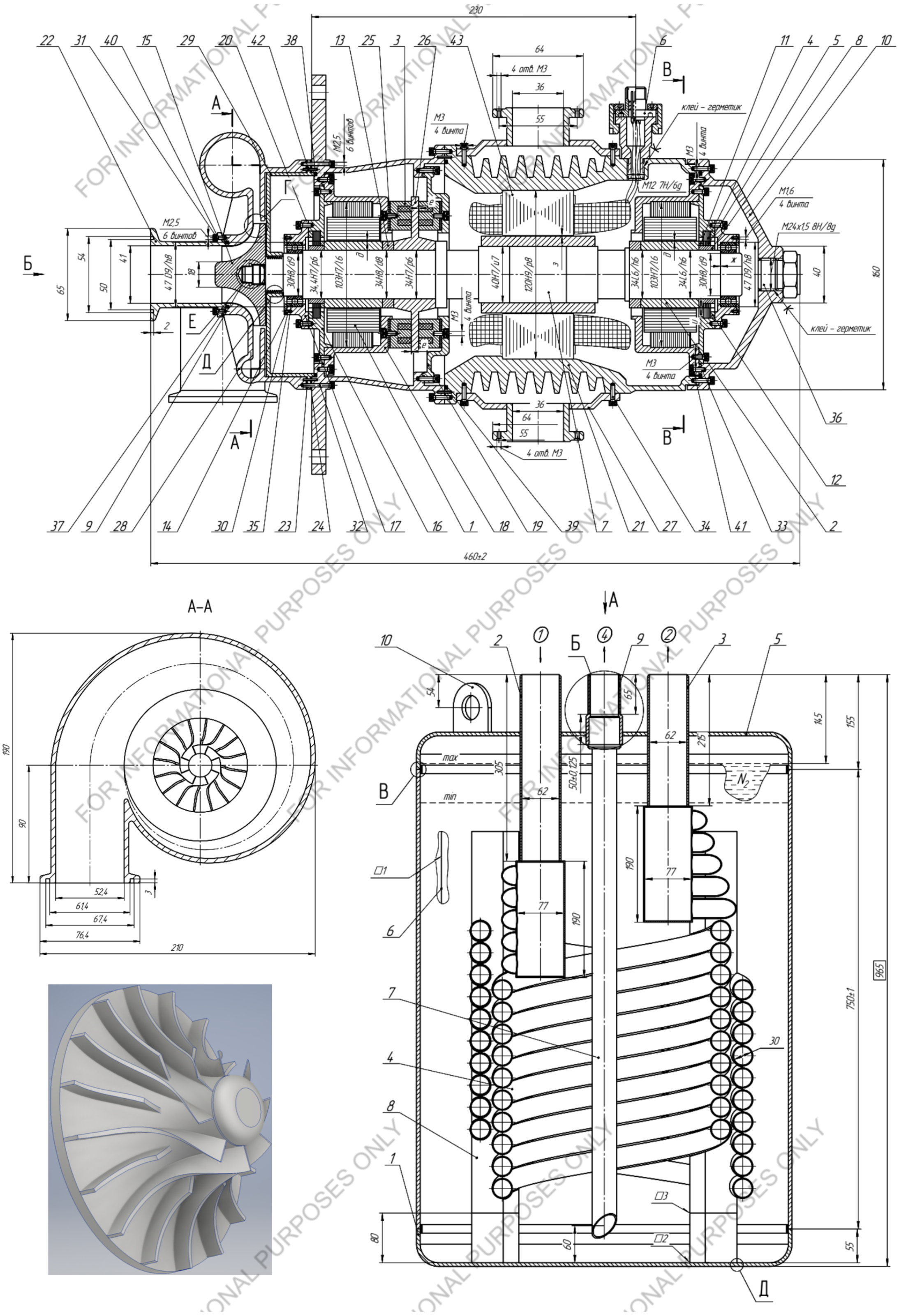


Figure 1: Designed apparatus

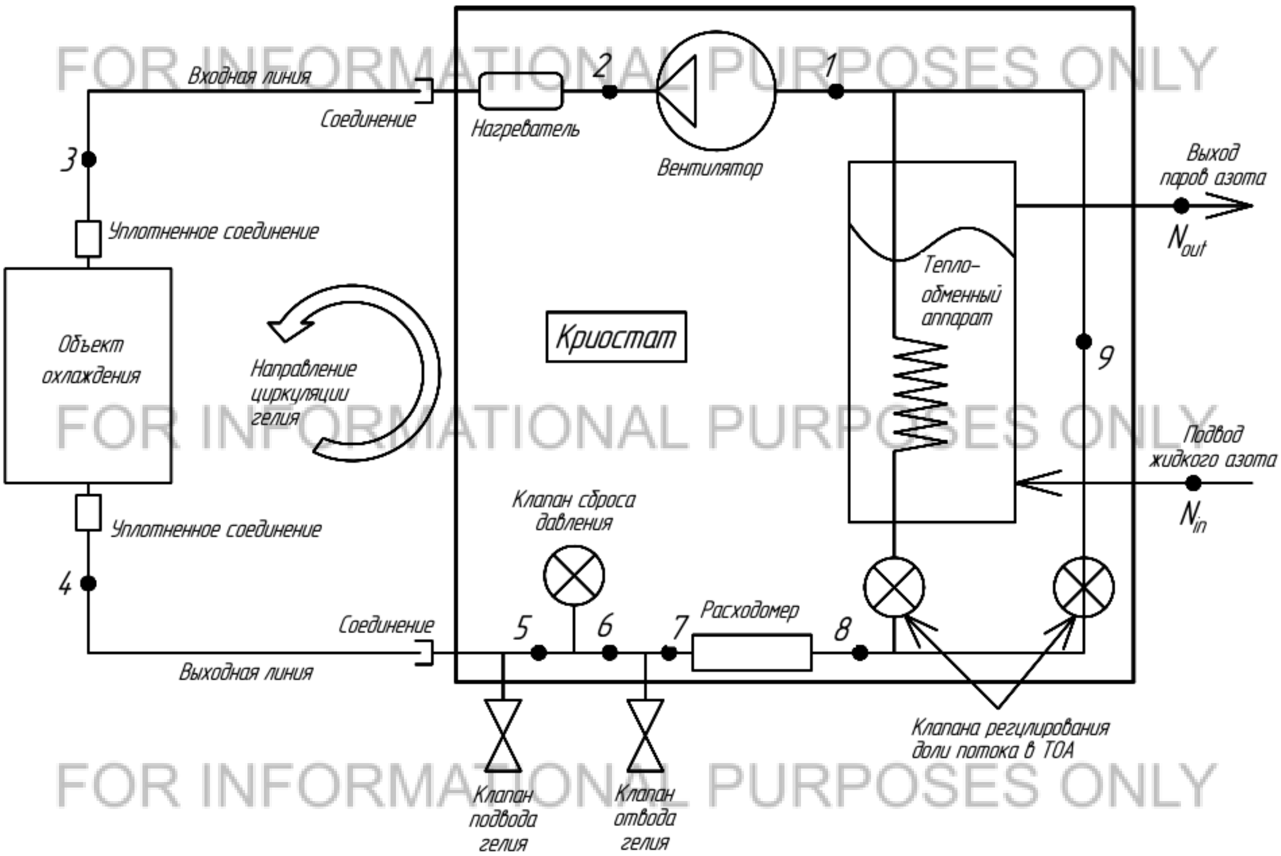
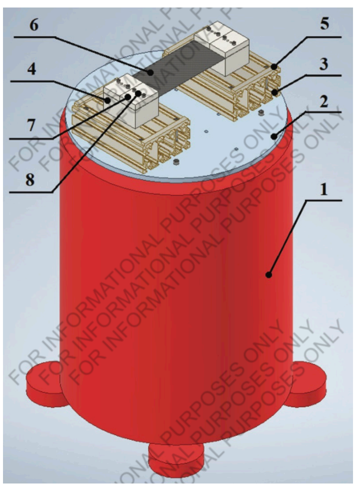


Figure 2: System layout

2. Vibrodiagnostics and numerical analysis of composite materials

During my last year of Bachelor's degree, I worked in a group research project about vibrodiagnostics of composite materials. The project consisted of the both mathematical and experimental analysis of the characteristics of carbon fibers plate.

At first, a stand suitable for the experimental conditions was developed. Starting from electric vibration generator the goal was to design such equipment, that would be able to fix firmly a thin plate in various positions. At first, a 3-D model was made (figure 3a), than it has been analysed for strength and compliance with stiffness requirements, and then the actual equipment was made using manual machines (figure 3b).



(a) Model of the experimental setup

(b) Actual experimental setup

Secondly, a theoretical assessment of natural frequencies was carried out using finite element analysis. In particular, *ANSYS* packages were used. Results are presented on the figure 4.

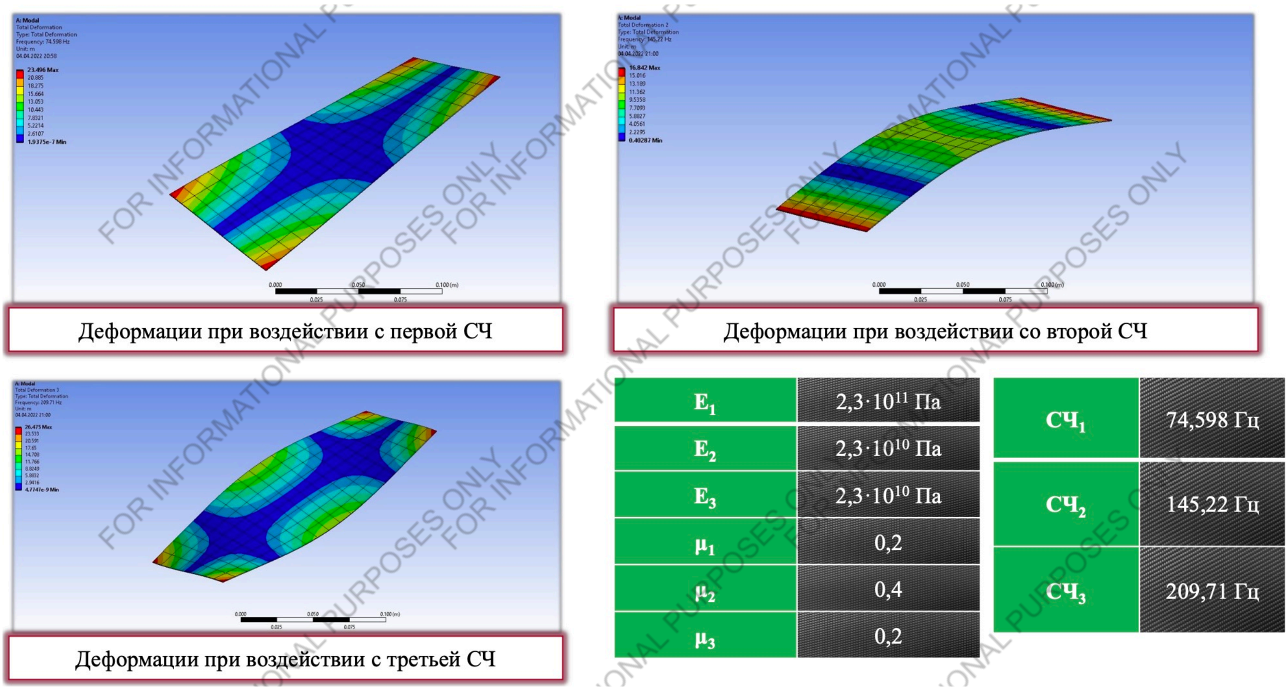


Figure 4: Results of finite element analysis

Then, an experiment was carried out. The received data was processed through *LabVIEW* software.

At the end, natural frequencies obtained theoretically and experimentally were compared.

3. Design of a twin shaft shredder with drive

Another big project from mechanical engineering field was a design of a twin-shaft shredder power 7,5 kW with drive(figure 5).

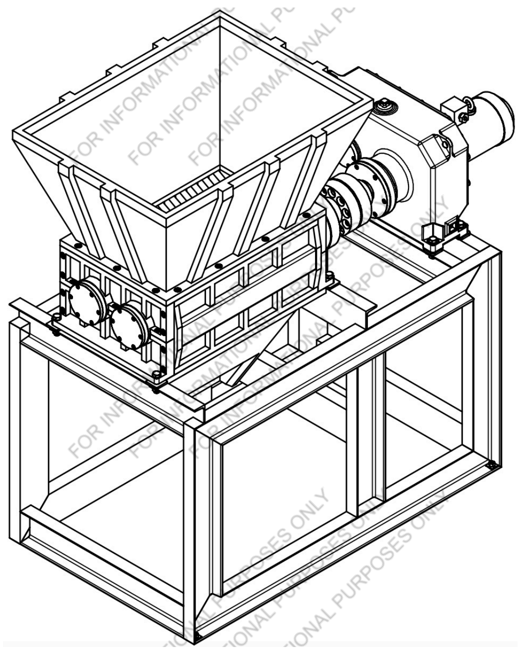


Figure 5: Twin shaft shredder with drive

The project included selection of electric motor and design of all the other devices: the shredder itself (figure 6), two-stage coaxial gearbox (figure 7), sleeve-pin coupling with rubber elastic elements (figure 8a), and the rack (figure 8b).

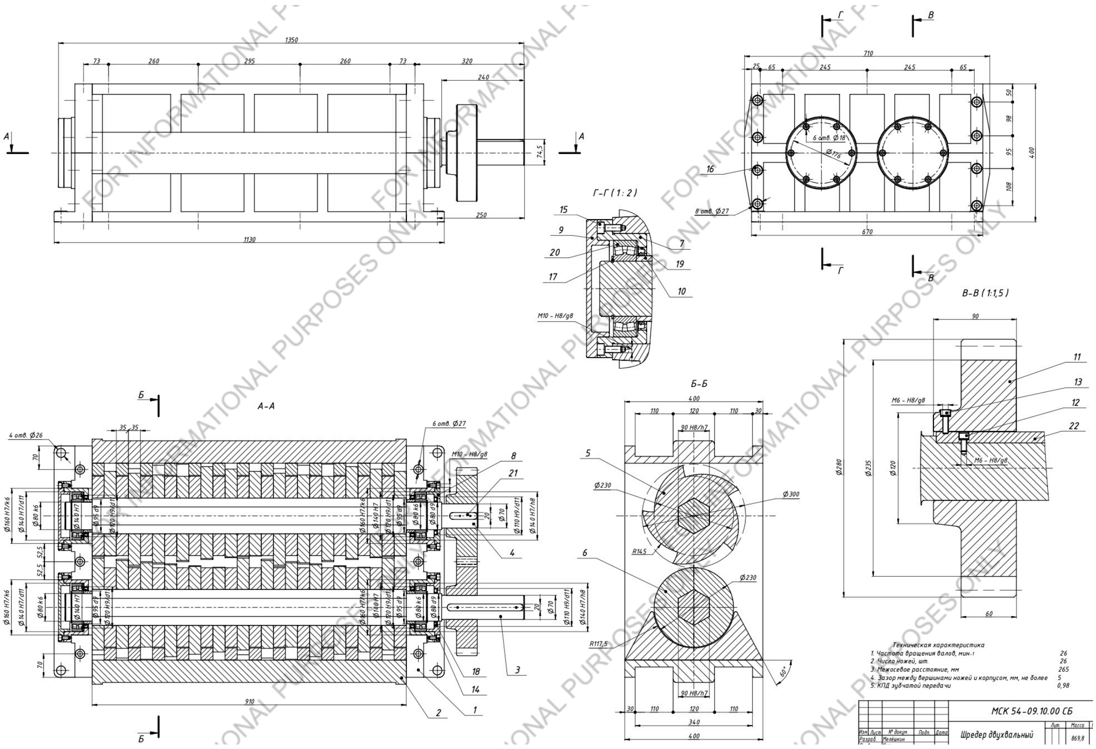


Figure 6: Twin shaft shredder

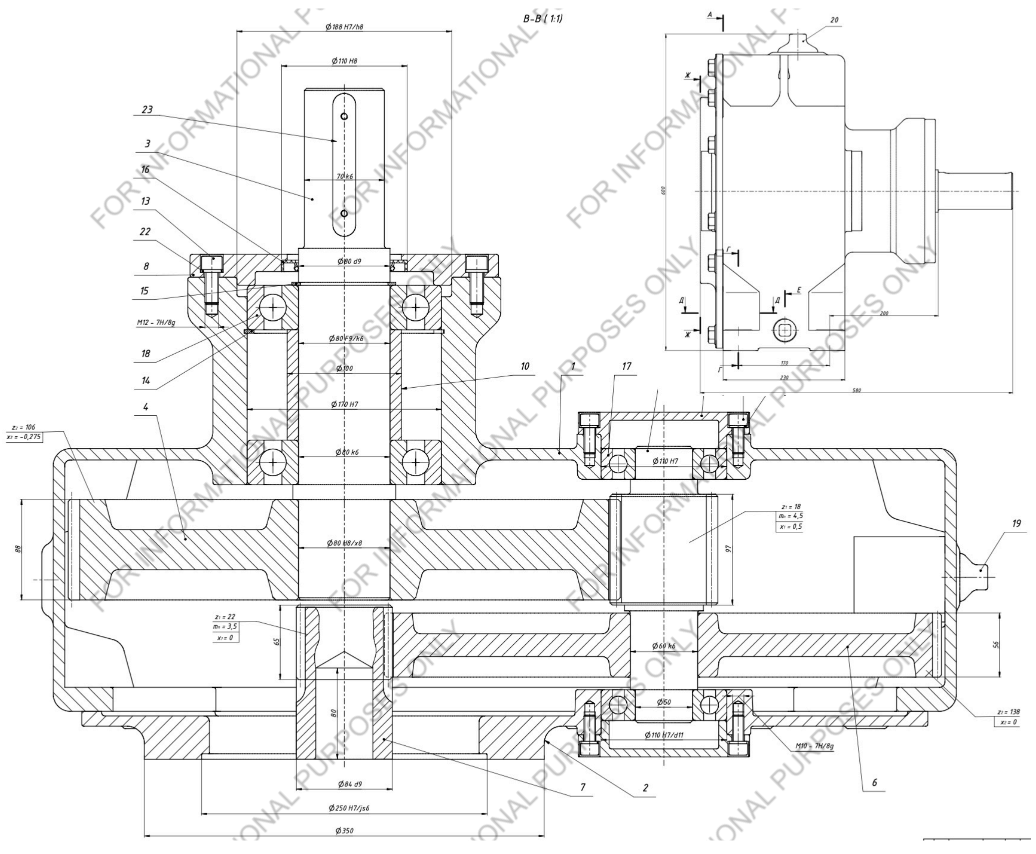
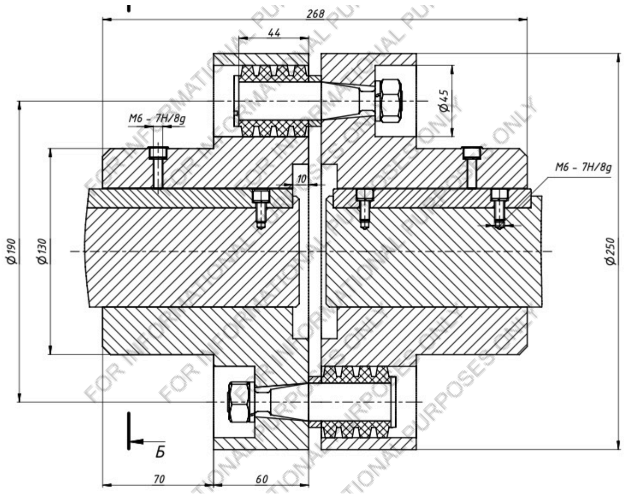
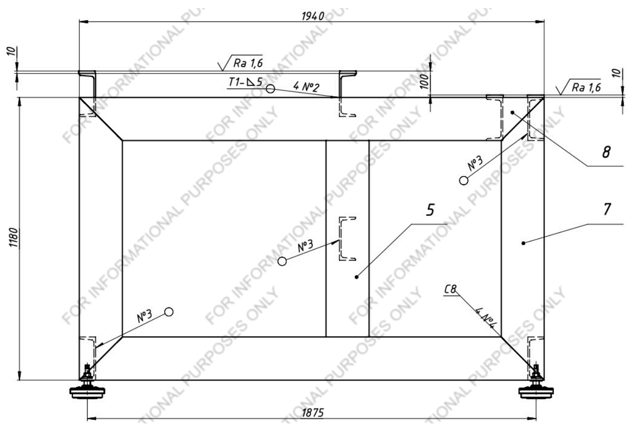


Figure 7: Two-stage coaxial gearbox



(a) Sleeve-pin coupling



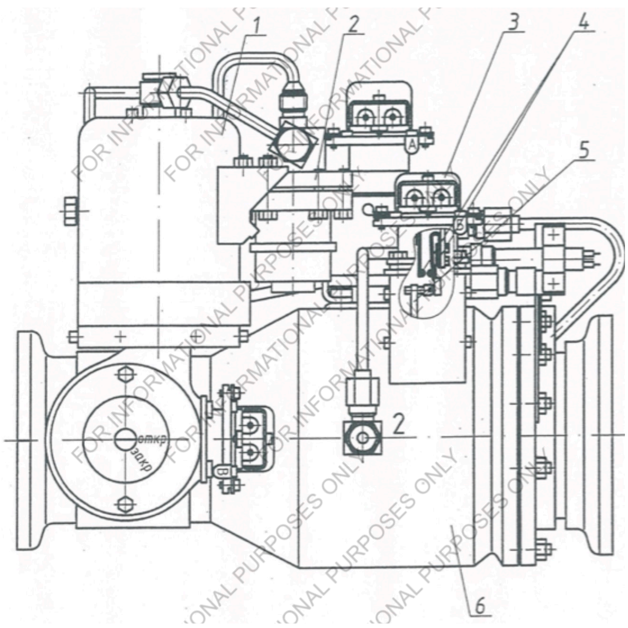
(b) The rack

Figure 8: Designed devices

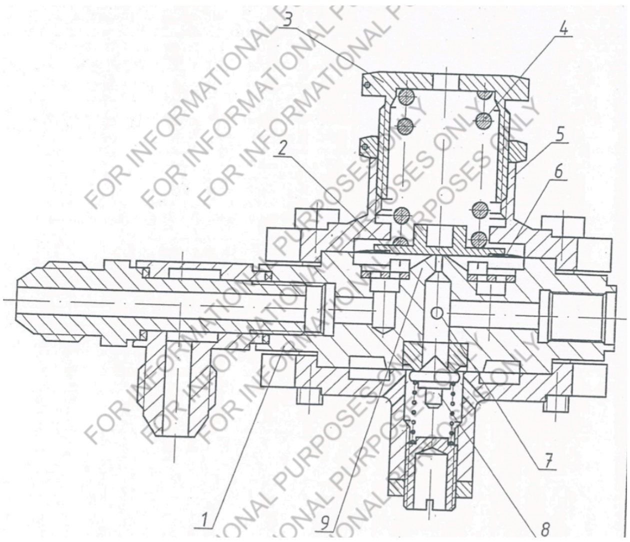
Initially everything was designed as three-dimensional models using Autodesk Inventor software. Then design documentation was made according to the standards, through Autodesk AtuoCAD.

4. Pressure regulator command mechanism manufacturing

During the technological practise at the NPO Nauka enterprise I designed a manufacturing process of a part of pressure regulator (figure 9a): a command mechanism (figure 9b). Under the mentorship of a company employee the manufacturing map was designed, choosing optimal instrument and processes.



(a) Pressure regulator



(b) Command mechanism

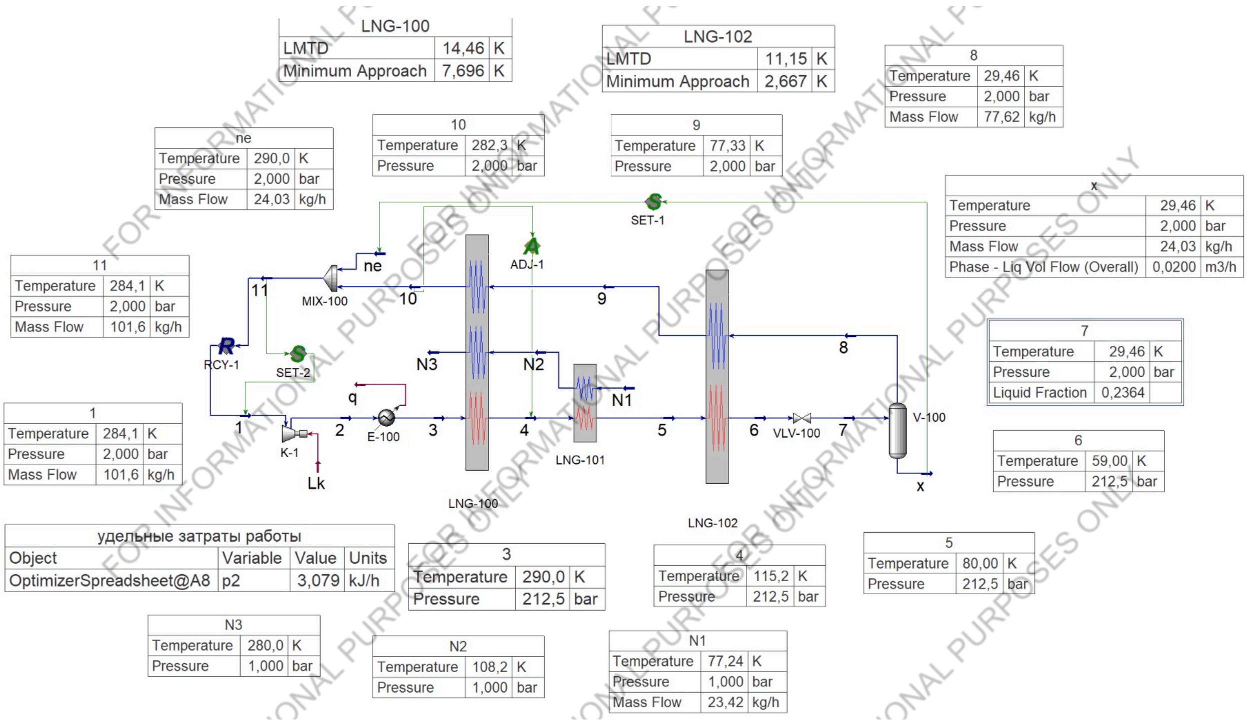
Figure 9: Pressure regulator an command mechanism

5. Cryogenic cycles modeling using *ASPEN HYSYS* software

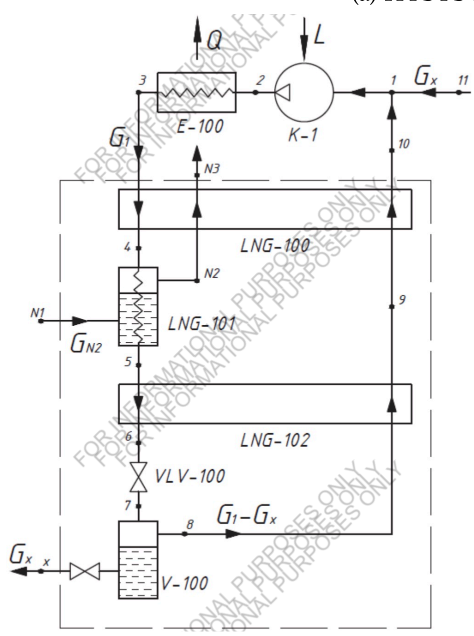
Previously I also had an experience in modeling cryogenic systems using not only calculation programs such as *MATLAB* and *PTC Mathcad* with integration of the *REFPROP* fluid properties database, but also simulating in *ASPEN HYSYS* software.

Among them were models for simulating various cryogenic cycles, such as: helium liquefaction cycle; air double throttling cycle; Claudet cycle for various fluids; Linde cycles for argon, oxygen, and air; air rectification cycle including column calculation; double expansion cycle; and others.

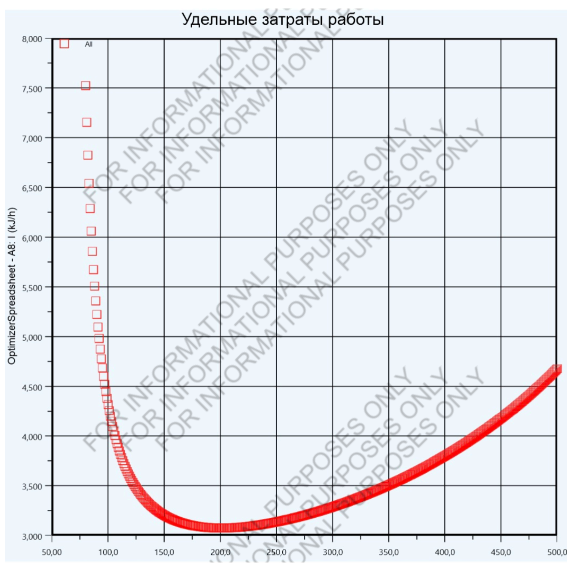
Here I will provide an example of the Hampson–Linde cycle for neon liquefaction with nitrogen pre-cooling stage with capacity of 20 liters per hour at the pressure of 2 bar (figure 10).



(a) HYSYS model after optimization



(b) Circuit diagram



(c) Specific work dependence of the compression pressure

Figure 10: Hampson–Linde cycle for neon liquefaction