

## Kokkuvõte

Käesoleva bakalaureusetöö ülesandeks oli konstrueerida toruotsa presspinki ettevõttele Mainsten OÜ. Lõputöö peamiseks eesmärgideks oli töötada välja lahendus presspingile, mida oleks võimalik kiiremini seadistada, mille raam oleks suurematele jõududele vastupidavam ning seade sobiks projekteeritavasse tootmisliini.

Enne projekteerimise alustamist koguti infot nii ühistelt koosolekutelt, töölistelt kui ka tehti turuanalüüs sarnaste seadmete parameetrite kohta.

Projekteerimise algusfaasis loodi ning võrreldi erinevaid kontseptsioone. Algfaasis oli põhiliseks ülesandeks parima lahenduse leidmine. Lahenduse, mis tagaks vajaliku tulemuse ehk pingi seadistamise kiiruse ja mugavuse ning seeläbi tööefektiivsuse tõstmise. Projekteerimise käigus analüüsiti erinevaid lahendusi ning koostati tabeleid, mille kaudu leiti ettevõttele kõige sobilikumad presspingi lahendus.

Esimeses projekteerimisfaasis alustati raami projekteerimist, kuna eelneva masina raam paindus töösükli ajal läbi, tuli leida uus lahendus, et muuta raam vastupidavamaks. Probleemi vältimiseks tugevdati raami ülemist tala ning muudeti metalli profiile. Tagamaks suuremat võimalust erinevate pikkustega ümartorusid töödelda, muudeti kelgu liikumislahendust tööpinnal ning parandati kelgu konstruktsiooni.

Järgnevalt tehti vajalikud mudelid programmis SolidWorks, et näha masina visuaali ja arutati läbi ka täiendamist nõudvad sõlmed, mis eelneval masinal olid. Peale lahendusvariantide genereerimist tehti valmis täielik mudel ning analüüsiti see veelkord läbi. Toruotsa pressi mudeli valmimise järel tehti mitmeid arvutusi nii raamile kui ka kelgule. Kelgu arvutuste juures vaadeldi erinevaid koormamisvõimalusi, et tagada vastupidav konstruktsioon. Tugevusarvutuste tegemisel arvutati välja ka kinnitusvahendite tugevused. Antud arvutus kinnitas ka ostutoodete vastupidavust konstruktsioonis.

Masina maksumuse peatükis kirjutati üldiselt lahti, kuidas masina hind kujuneb ning kui suure osa moodustab miski masina maksumusest. Arvesse võeti nii materjali ja materjali töötlemisega seotud maksumust, tööliste palgakulu kui ka detailide värvimis- ja transpordikulu.

Antud bakalaureusetöö tulemusena valmis konstruktsiooni terviklik lahendus toru otste pressimiseks, kus on arvesse võetud nii ettevõtte poolt ette antud kriteeriumeid kui ka pingis tekkivaid erinevaid koormusi. Probleemi lahendamisel on läbi mõeldud ja analüüsitud erinevaid lahendusi ning leitud nende seast antud hetkel parimad.

Käesoleva töö autor leiab, et antud töö on praktiliselt teostatav ning seda saab edukalt rakendada tootmises. Tegemist on tootega ning kindlasti on toodet võimalik edasi arendada ja muuta see veel efektiivsemaks. Järgnevalt tuleks hakata mõtlema pingi automatiseerimisele ning efektiivsemale tootmisliinile, kus töölisel on vaja lükata liini pealt toru pinki, vajutada nuppu ning toru edasi liinil lükata.

Kokkuvõtteks võib öelda, et lihtsa pingi konstrueerimine ja erinevate lahendusvariantide ning kokku sobitamine oli keerukam ja aeganõudvam kui algul arvata võis. Töö autori arvates oli töö seotud väga tihedalt erialaga ja andis ka hea ülevaate masina konstrueerimisest.

## Summary

The task of the present Bachelor's thesis was to construct a pipe end forming machine for Mainsten OÜ. The main goals of the Bachelor's thesis were to develop a solution for forming machine that could be set up faster, whose frame would be more resistant to higher forces and the machine would fit into the designed production line.

Before starting the development, the necessary information was collected during the meetings, workers were interviewed and market analysis was performed on the parameters of similar equipment.

In the initial design phase, different concepts were created and compared. The main task was to find the best solution for the company. A solution that ensures the required result – the speed and convenience of setting up the machine and thus increasing work efficiency. During the design, various solutions were analyzed and tables were compiled and that was how the most suitable press bench solution for the company was found.

In the first design phase, the design of the frame was started, because the frame of the previous machine was bent during the work cycle, a new solution had to be found to add another frame. To avoid this problem, the upper beam of the frame was reinforced and the metal profiles were changed. In order to ensure a greater possibility to process round pipes of different lengths, the movement solution of the carriage on the work surface was changed and the construction of the carriage was improved.

Next, the necessary models were made in SolidWorks to see the visuals of the machine, and the nodes that needed to be upgraded on the previous machine were also discussed. After generating the solutions, the complete model was designed and re-analyzed. Next, the completion of the pipe end forming machine model, several calculations were made for both the frame and the sled. The sled calculations consider implementation of extra forces to ensure a durable structure. The strengths of the fasteners were also calculated during the strength calculations. This calculation also confirmed the efficiency of the purchased products in the design.

The chapter of the machine cost generally described how the price of a machine is formed. There were taken into account the material related and material processing

costs, the labor costs of the workers as well as the costs of painting and transportation.

In the course of this Bachelor's thesis, a complete solution for pipe end forming machine was completed, taking into consideration both the criteria issued by the company and the different loads on the bench. Problem solving has been thought through and analyzed, and the best of them have been found.

The author of the present thesis finds that this work is practically feasible and can be successfully applied in production. Generally, it is just a product - it is certainly possible to develop it further and make it more effective in the future.

In conclusion, it can be said that the construction of a simple bench and the matching of different solutions and assembly was more complicated and time-consuming than initially thought. According to the author of the thesis, the studied topic was very closely related to the mechanical engineering specialty and also provided a through overview of the construction of the machine.