KOKKUVÕTE

Käesoleva lõputöö eesmärgiks oli projekteerida omatarbeks kompaktne rehviriiuli lahendus, mis sobiks 18m^2 garaazi tingimustesse ning ei hõivaks põrandapinda. Turu-uuringu käigus tutvuti erinevate turul pakutavate rehviriiulite lahendustega ning analüüsiti nende puuduseid. Turu-uuringu tulemuste põhjal sõnastati nõuded antud töös projekteeritavale riiulilahendusele ja alustati ideede arendamisega. Selleks, et riiul ei hõivaks põrandapinda tekkis idee projekteerida tõstetav riiul, millele oleks võimalik ilma redelit kasutamata rehvid peale asetada ning seejärel lae alla tõsta.

Esmalt võrreldi erinevaid lahendusi, mille abil oleks võimalik riiulit koos rehvidega lae alla tõsta. Sobiva lahenduse peamisteks valikukriteeriumiteks oli lahenduse hind, kompaktsus ja kasutusmugavus. Otsuse langetamise lihtsustamiseks võrreldi lahendusi hindamismaatriksi abil, mille tulemustest selgus, et kõige optimaalsemaks lahenduseks osutus trapetskruvi ja mutri lahendus. Seejärel leiti arvutuslikul teel sobiv keermeprofiil ning sobiv mutter.

Järgmisena alustati riiuli alusraami projekteerimist. Alusraami puhul võrreldi esmalt erinevaid rehvide paigutusviise. Kuna rehvide hoiustamisel on oluline rehve mitte üksteise otsa virnastada jäid valikusse ainult kaks võimaliku alusraami lahendust, millest oli sobivam nelinurkse kujuga terasprofiilidest keevitatud alusraam, millele oli lisaks välja mõeldud „kaitseraua" konstruktsioon, vältimaks rehvide kukkumist riiulilt. Lisaks ohutusele tekkis kaitserauale ka teine funktsioon – kinnitades kaitseraua alusraami külge teistpidi, muudab see riiuli laiemaks ning sellel on võimalik ka teisi esemeid hoiustada kui selleks peaks vajadus tekkima. Riiuli alusraami analüüsiti ka lõplike elementide meetodi abil Ansys keskkonnas.

Seinaraami projekteerimisel oli fookus suunatud kompaktsusele. Seinaraami konstruktsioonina kasutati S235 terasest 50x50x5mm nelikant toru, mille tsentris on trapetskeerme varras. Trapetskeerme varda külge kinnitatati trapetsmutriga alusraam. Selleks, et alusraami ühendada, on seinaraami toru ühele küljele freesitud sisselõige, milles alusraam liikuda saab. Seinaraam on projekteeritud selliselt, et seda oleks võimalik vajadusel ka lahti võtta hooldamise tarbeks. Seinaraamis olev trapetskeerme varras oli mõlemast otsast laagerdatud korpusega laagrisõlme abil. Lisa turvalisusmeetmena olid seinaraamile lisatud tihvtid, mis väldivad riiuli iseenesliku alla liikumist koormuse mõjul. Tihvtid lükatakse läbi seinaraami toru kui riiul on kõige ülemises võimalikus asendis.

Viimaseks lahendatavaks probleemiks jäi ajami valimine. Väljavalitud ajamiks osutus juhtmevaba 18V akutrell, mis on võimeline koormatud rehviriiulit tõstma. Akutrelli kasutaminel on mitmeid eeliseid, millest oluliseim oli kompaktsus, kuid samas ka asjaolu, et sobiv akutrell oli autoril juba varasemalt olemas ning sellega ei kaasneks lisakulusid.

Kokkuvõttes võib lugeda tõstetava rehviriiuli projekteerimist õnnestunuks. Töö alguses püstitatud eesmärgid said täidetud ning järgmise etapina alustab autor tõstetava rehviriiuli reaalse valmistamisega. Toote omahind on küll kallim kui turul pakutavatel toodetel, kuid see-eest on antud töös konstrueeritud riiulisüsteemil ka olulisi lisaväärtusi, mida ükski kaubandusest leitav riiul ei paku.

SUMMARY

The main goal of this thesis was to design a compact tire shelf solution for personal use, which would be suitable for the conditions of an 18m2 garage and would not occupy the floor space. In the course of the market research, the various tire shelf solutions offered on the market were examined and their shortcomings were analyzed. Based on the results of the research, the requirements for the shelf solution in this thesis were formulated and the development of ideas began. In order for the shelf not to occupy the floor surface, the idea arose to design a liftable shelf on which it would be possible to place tires without using a ladder and then raise it to the ceiling.

Firstly, a comparison was made between different solutions that could be used to raise the shelf with the tires under the ceiling. The main selection criteria for a suitable solution were the price, compactness and ease of use. To simplify the decision-making, the solutions were compared using an evaluation matrix, the results showed that the most optimal solution was the trapezoidal screw and nut solution. A suitable thread profile and a suitable nut were then calculated.

Next, the design of the shelf base frame began with comparison of the different possible tire layouts. As it is important not to stack the tires when storing, only two possible base frame solutions remained of which the more suitable was a welded base frame made of rectangular steel profiles, which was also designed with a safety feature frame construction to prevent the tires from falling off the shelf. In addition to safety, another function has been added with safety frame construction - by attaching it to the base frame in the opposite direction, it makes the shelf wider and it can also store other items if the need arises. The shelf base frame was also analyzed using the finite element method in Ansys environment.

When designing the wall frame, the focus was on compactness. The construction of the wall frame was made of S235 steel 50x50x5mm square tube with a trapezoidal thread rod in the center. A base frame with a trapezoidal nut was attached to the trapezoidal thread rod. In order to connect the base frame, a cut was made on one side of the frame tube wall, in which the base frame can move. The wall frame is designed in such a way that it can be disassembled for maintenance if necessary. The trapezoidal threaded rod in the wall frame was fixed at both ends by a bearing assembly. As an additional safety measure, pins were added to the wall frame to prevent the shelf from moving downwards due to the load. The pins are pushed through the wall frame tube when the shelf is in the highest possible position.

The last problem to be solved was the selection of the motor. The selected motor unit turned out to be a wireless 18V cordless drill capable of lifting a loaded tire rack. There are several advantages to using a cordless drill, the most important of which was compactness, but also the fact that a suitable cordless drill already existed in the author's inventory and would not involve additional costs.

In conclusion, the design of the liftable tire shelf can be considered successful. The goals set at the beginning of the thesis were achieved, and the next step is for the author to start the actual production of a liftable tire shelf. Although the net cost of the product is more expensive than the products offered on the market, the shelving system designed in this thesis has also significant added value that no commercially available shelf offers.