KOKKUVÕTE

Bakalaureusetöö eesmärk oli projekteerida automaatse rippkonveiersüsteemi aknaraamide hoidja, ajam ja teerada puiduettevõtte OÜ Rasper värvimisruumi värvimise jaoks, kus aknaraame saaks ümber pöörata. Rippkonveiersüsteem võimaldaks ettevõttel tõsta tootlikkust värvimisruumis eemaldades sellega tööliste töö aknaraame ise käsitsi ümber pöörata ja ümber tõsta värvimiskambrist manuaalsele rippkonveierile.

Töö esimeses etapis sõnastati ülesande püstitus ja ettevõtte poolsed lähteandmed. Nendeks andmeteks olid värvimisruumi mõõtmed ning ruumis asetsevate objektide täpsed asukohad, mille järgi loodi sobilik teerada. Ettevõtte soov oli saada 60 kuni 80 aknaraami rippkonveieril.

Järgmisena sai teostatud turuanalüüs, mille käigus uuriti üksikasjalikult rippkonveierite komponente erinevatel tüüpidel. Kirjeldati nii automaatsest, manuaalsest ning automaat ja manuaalsest rippkonveieri tüüpi. Seejuures anti ülevaade olemasolevatest teeradadest, veokettidest ja kelkudest. Veel uuriti Eestis ja välismaal pakutavaid rippkonveiersüsteemide terviklahendusi ning kirjeldati nende ehitust.

Kolmandas etapis võeti ette rippkonveiersüsteemide komponentide variatsioonid ning analüüsiti, millised oleksid parimad lahendused projekteeritavale süsteemile. Otsustati, et parimaks rippkonveieri tüübiks oleks toitega rippkonveier, mille teerajaks oleks kinnine teerada, kus veokett ja kelk on ühena antud süsteemil. Lisaks loodi erinevaid kontseptsioone aknaraamide hoidjate ja kavandi valiku jaoks. Mõlema puhul kavandati kolm erinevat varianti ja analüüsiti, milline täidaks eesmärki kõige paremini.

Projekteerimise etapis sai esimese asjana otsustatud kindla kavandi poolt, millel oli määratud ajami asukoht ja suund. Järgmisena loodi aknaraamide hoidja, mis disainiti nii, et peaks vastu 16 kg kaaluvale aknaraamile. Aknaraami hoidja tuli see-eest oma algsest disainist erinev, mis sai eelmises etapis otsustatud. Erinevus tulenes selles, et kui konksuga ühendus oleks kinnitusvahendi küljes, siis oleks hoidja hakanud kiikuma, kuid oli vaja fikseeritud hoidjat. Erineb ka pöörlemine. Nüüd saab seda teha värvija ise, hoides aknaraamist kinni ja seda keerates. Aknaraami hoidjaid see–eest mahub rippkonveierile ainult 34, mida on soovitust vähem, kuna teerada on lühike, kus enamuse ruumist võtab aknaraamide pöörlemise vajadus. Ettevõtte jaoks osutus hoidjate kogus liiga väikseks, kus soovituks koguseks oleks ikka üle 60 hoidja. Seejärel projekteeriti ajam, kus sai arvesse võetud liigutatav koormus 682 kg, mida ajam peab suuteline vedama olema. Ajami puhul leiti sobilikud ketirattad, keti pikkused,

veerelaagrid, reduktormootor ja ka projekteeritud võllid, kus on roomikkett, mis rippkonveieri veoketti veab. Viimasena loodi teerada. Teerada pidi käima kokku eelneva kavandiga, millele pidi valima õige pikkusega teeraja komponendid. Samuti pidi määrama detailid, millega teerajad omavahel kinnitatakse, kui ka detailid, millega teerada lae külge fikseeritakse. Detailid keevitatakse teeraja külge, millele ka tehti analüüs. Sellest tuli välja, et ühele keevitusele on sobilik jõud kuni 15 kN. Keevitusi on see–eest rohkem seega on tugevus on tagatud.

Viimases etapis määrati omahind komponentidele ja materjali kulule, mida on vaja rippkonveieri aknaraami hoidjate, ajami ja teeraja ehituseks. Lõplikuks hinnaks tuli 7819 €.

Probleemid, mis võiksid päevakorda tulla tulevikus, oleksid kõikide kettide õlitamine. Kuna värvimisruumis on keskmisest kõrgem temperatuur, võib õlitatus kiirelt kaduda. Veel oleks ajami kinnitamine ruumis vastavalt kooskõlas teeraja ja veoketiga. Viimaseks oleks elektrooniline pool, kus peaks ette võtma rippkonveiersüsteemi juhtimise pool, kus oleks vaja valida sobilikud kontrollerid ja nupud, et värvija saaks süsteemi ise liikuma panna.

SUMMARY

The aim of the bachelor's thesis was to design a window frame holder, a drive system, and a path for an automatic hanging conveyor system, which is going to be used in a woodworking company's OÜ Rasper painting room, where the window frames would be rotatable. An overhead conveyor would allow the company to increase productivity in the painting room by removing workers from manually turning the window frames over for painting and transferring them from the painting booth to the manual overhead conveyor.

The first phase was to formulate the statement of the task and to gather initial information from the company. Information like the dimensions of the painting room and the locations of the objects in the room, according to which a suitable path was to be created. Also had to determine the weight of the window frames, which was 11 kg. The company wished for 60 to 80 window frames on the overhead conveyor.

Next, a market analysis was carried out, during which the components of various overhead conveyor types were studied in detail. Automatic, manual and automatic and manual overhead conveyor types were described. At the same time, an overview of the existing road tracks, transport chains and sledges were given. Complete solutions of overhead conveyor systems offered in Estonia and abroad were also studied and their construction was described.

In the third phase, the component variations of the overhead conveyor were undertaken and analyzed for which would be the best solution for the designed system. It was decided that the best type of overhead conveyor would be a powered overhead conveyor with an enclosed track, where the chain and the carriage are typically combined on the given system. In addition, different concepts were created for window frame holders and path design selection. For each, three different options were created and analyzed to see which one would best serve its purpose.

In the design phase, the first thing that was decided was the specific design of the conveyor path, which had the location and the direction of the drive system determined. Next, the window frame holder was created, which was designed to support a 16 kg heavy window frame. On the other hand, the final design of the window frame holder was designed differently, which was decided in the previous phase. The difference was that if the hook connection was attached to the fastener, the holder would have started to swing, but a fixed holder was needed. The rotation element is also different. Now the painter can do it himself by holding the window frame and turning it. On the other hand,

only 34 window frame holders can fit on the overhead conveyor, which is less than wished for because the track is short, where most of the space is taken up by the need to rotate the window frames. The amount of window frame holders turned out to be too few for the company, where the desired amount would still be more than 60 holders. Then the drive system was designed, which took into account the movable load of 682 kg, which the drive system must be able to carry. For the drive system, suitable sprockets, chain lengths, rolling bearings, gear motor were chosen and also shafts were designed for the caterpillar chain that drives the overhead conveyor drive chain. The path was created last. The path had to match to the previous design, for which components of the right length had to be selected. It was also necessary to determine the details with which the tracks are attached to each other, as well as the details with which the tracks are fixed to the ceiling. The details are to be welded to the path, which was also analyzed. It turned out that a force of up to 15 kN is suitable for one weld. There are more welds, so the strength is guaranteed.

In the last phase, the cost was determined for the components and the materials that are needed for the overhead conveyors window frame holder, drive system and path. The final price was 7,819 €.

Issues that could occur in the future would be oiling of all the chains. Because the temperature in the painting room is higher than average, the oiling can evaporate quickly. Furthermore, fixing the drive system in the painting room in accordance with the path and the drive chain. Lastly, the electronic side of the system is needed, where the control side of the overhead conveyor system is needed, where it would be necessary to select suitable controllers and buttons so that the painter could set the system in motion by himself.