

TURNTABLE ELECTROHYDRAULIC WIRING DESIGN AND PROTOTYPE MANUFACTURING

Rasim ORHAN¹

Soner ÇELEN^{1*}

Department of Mechanical Engineering, Namık Kemal University, Tekirdağ, 59830, Turkey

**Corresponding author. Tel.: +90 282 250 2366*

E-mail address: scelen@nku.edu.tr

Abstract

Most part of the heavy industry equipment in our country that requires high technology is supplied from abroad. Especially, in sectors such as thermic, natural gas recycling, hydroelectric, wind power plants, petrochemical refineries heavy lifting and assembling work are always increasing. Moreover, equipment is being at a disadvantaged point when its size is too big to enter narrow and closed areas. In this study, it will be very useful for entering narrow and these aforementioned closed areas and carry almost the same amounts of weight. According to the analysis works and the outcomes founded, design verification work has been finished and in the wake of product design, its prototype manufacturing has been successfully done. This is the first in Turkey where it can carry 420 tons, can turn 360 degrees and smaller than its equivalents which makes it easier to mobilize in narrow places. With this Project, we will decrease Turkey's dependence to abroad on heavy lifting equipment and it will be produced on whatever capacity it is needed. Also, it will be a troubleshooter for firms providing heavy lifting services by supplying equipment to them.

Keywords: Turntable, Hydraulic, Pneumatic, Design.

INTRODUCTION

Men has used machines throughout history for the works that require big power. These hoisters are almost old as humanity and it has vastly changed in parallel with the technological developments. In order to supply the increasing demand, it has been a necessity to create a machine that could carry more every day and doing this while making sure that it is done very securely. The other necessity with increasing competition is to lower the cost as possible. While thinking all of this together, in order to work with maximum performance, businesses have renewed their production processes and conventional designs according to the needs of the era. With the increase in the usage of computers, new designs come in view very quickly. This usage provides an opportunity for control and analyses of the designs to become highly trustful and very fast [1].

Discontinuous lifting machines could be seen in 6 different ways: jacks, blocks, cranes, elevators and forklift trucks. Continuous lifting can be divided into three: with towing member, without towing member and fluid

flow conveyers. Cranes and winch composes most parts of the lifting equipment. In these lifting equipment similar constructing elements are used. According to DIN 15001(2) cranes are lifting and carrying elements which can carry the hanged loads and mobilize them in various ways. There are many variations of cranes such as: bridge cranes, portal cranes, rotary cranes and wire cranes. Many cranes could be founded in shipyards. Cranes are used to carry very heavy parts [4].

Within the scope of this thesis study, heavy weight carrying equipment had been produced that could carry with the capacity of 420 tons, can turn 360 degrees and lastly which is in reduced size according to its equivalents.

MATERIAL AND METHODS

After constituting the manufacturing datas (technical drawing, equipment list), laser cutting has been done for ST-52 steel sheets with the needed measurements and welding has been done for the surface. In the wake of this work, heat treating process has been done between 55-60 HRC. On the construction that came after the heating treatment, Wheel

bearing Ø2050x1590/200 has been assembled which helps he 360 degree turns. Hydraulic cylinders are the most effective machine equipment could be used to carry heavy weights in narrow places. In order to use the cylinders, two pistons had been assembled. Cylinders that are used are with the measurements of Ø200x200/120- Ø200x200/180 - Ø240x140/ and they are custom made. Sledges has been assembled to the construction. 71 cc/dev hydraulic pump which has variable displacement and is sensitive to load and flow is used for the transfer of hydraulic oil. For the energy required for the system, 55 kW electrical motor is used. The mounting of hydraulic pistons and hydraulic equipment to the completed construction have been done. The mounting of electric panel and equipment have been done and made appropriate for the working conditions for the system's control unit.

Equipment that are used:

1. ST52 sheet metal
2. Wheel bearing (which provided 360 degree turn)
3. Castermid
4. Hydraulic pistons
5. Hydraulic equipment
6. Control units

RESULTS AND DISCUSSION

Computer Aided Static Analysis

The work for this project has been predicted to be used for lifting and carrying purposes, crawling and the turning body that could make 360° turn was analyzed in two different cases. Limited conditions were designated and two analyses were done for assembly, turning and crawling cases. Later, the analyses were concluded.

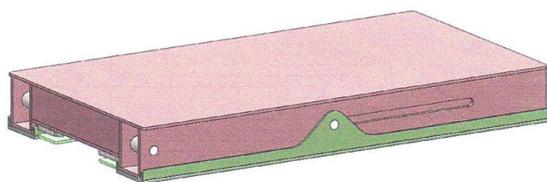


Fig. 1. Turning Tray Transfer Construction General Outlook

There has been 1624029 vital points and 981647 staff recruitments made for rotary motion shown in figure 2. The equipment that are used for the rotary motion are seen in Table 1.

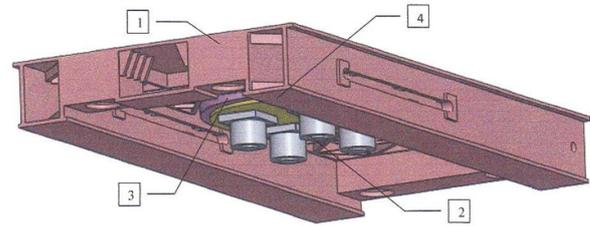


Fig. 2. Spinning Movement Model General Outlook

Table 1. Spinning Movement Model Part List

Component Number	Name	Material
1	Carrier Body	St-52
2	Spinning Movement Pistons	Rijgid
3	Turning Tray	Rigid
4	Piston Plate	St-52

During the rotary motion, construction turn table assembled rigidly identified hydraulic pistons rises up the load and then rotation operation begins via turntable. In this point, limit conditions are acknowledged as hydraulic pistons being stable to the surface.

Force has been implemented in a way of being vertical and spread as shown in figure 3 to the constructed carrier body. Moreover, gravity effects are taken into consideration, and that the mass comes from the construction are also added to the analysis limit conditions.

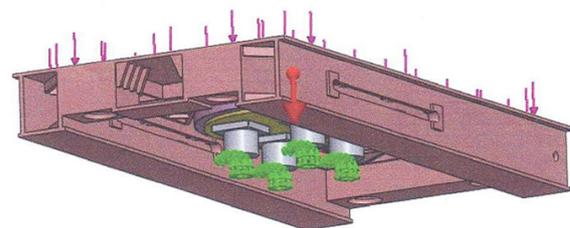


Fig. 3. Spinning Movement Model Limit Conditions Outlook

1707568 vital points and 1027684 staff recruitments are made for the crawling motion as shown in figure 4.

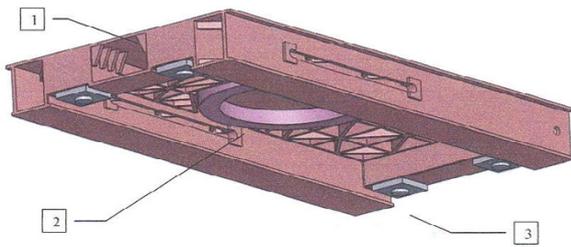


Fig. 4. Dragging Movement Model General Outlook

Table 2. Dragging Movement Model Component List

Component Number	Name	Material
1	Carrier Body	St-52
2	Turning Tray	Rigid
3	Friction Movement Pistons	Rigid

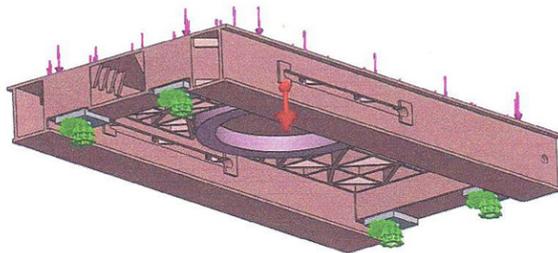


Fig. 5. Dragging Movement Model Limit Conditions Outlook

After the hydraulic piston's -which is parallel to the ground, mounted to the four corners of the construction, rigid-defined vertical working, rising the load during the dragging movement in Figure 5, the sled can be moved horizontally thanks to the piston which is parallel to the ground and located in the sides of the construction. After that, the load is lowered to the ground again with the pistons and slided on the sled to put the construction back to the beginning form which causes the dragging movement. Dragging movement continues until the load reaches to its place. For this case, rigid-defined hydraulic pistons are considered constant from the areas of their points which touch the ground.

There is a force applied to the construction carrier body part which is used to load. Also, the gravity effect is considered in the analysis and the weights caused by the construction itself is added to the analysis limit conditions.

As the material, S255J2G2 (a.k.a. St 52) is appointed for the construction analyzed. The gravity effect is taken as the base and acceleration value of gravity (G) is: 9.81 m/s²
 Flowing Tension : 255 MPa
 Rupture Tension : 520 MPa
 Poisson Rate : 0,28
 Elasticity Module: 210 GPa

Turning Tray Carrying Construction Research Results

The tension which occurs as a result of spinning and dragging is shown at Figure 6-9.

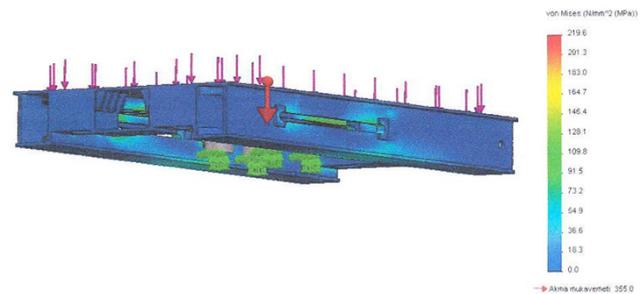


Fig. 6. Spinning Movement Analysis Result and Tension Distribution

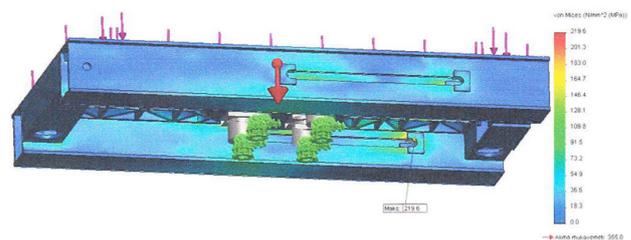


Fig. 7. The area which has the maximum tension according to the dragging movement analysis result

When 4120000 N power is applied to the spinning movement model under the mentioned circumstances, the maximum tension reaches to 219,6 MPa in the carrier body part which is made of St-52.

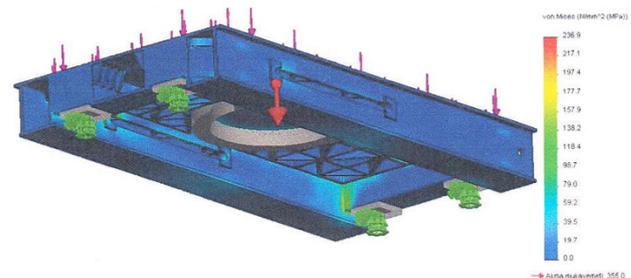


Fig. 8. Dragging Movement Analysis Result and Tension Distribution

Table 3. Comparison to the Equivalents Abroad

Comparison of the Project to the Potential and Current Ones in Domestic/Foreign Markets			
Technical feature	Project Output	Karun Goldhafer	FLJ Shanghai
Sales Price	200.000EU	585.000 EU	512.000 EU
Progressive Shape	Sliding	Rolling	Rolling
Dimensions	6000x2250x720 mm	18000x2000x1175	18500x2990x1070
Tonnage	420	500	270

It's planned to present the hydraulic electrical walkers produced after this work both in and outside of the country. The hydraulic electrical walkers produced in our country will be low-cost compared to the ones abroad. Therefore, they will be likely to be chosen as they will have the price advantage. We will be able to produce utterly with our country's own sources for new international projects after this project succeeds.

Especially in the energy sector, high weight lifting equipment are very expensive and the time to possess these equipment is very long due to the increasing weights. Also, equivalent equipment is disadvantaged in narrow and closed areas because of their sizes. With this project, it's aimed to develop high

weight lifting equipment both for the firm and the country. As this domestic lifting equipment are more optimum compared to their equivalents, they will be able to be used in narrow places too.

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