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Design and Modeling of Barber Wheelchair

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ABSTRACT

This research deals with the design and analysis of a barber wheelchair for the purpose of reducing the daily effort. It is a mechanical device to lower and raise the chair by means of power screw Jack and to move the chair to the right and left for about 200° in circular path on the railway by means of D.C. motor. So, the transfer of mechanical movements to the conical wheels happens by gear box system. The Solidworks software program used to analyze the stresses for designing the barber chair.

Keywords: Barber wheelchair, Design Modeling, Stress analysis, Solid works.

I. INTRODUCTION

Shaving career of the old professions that one's ever seen. It existed since ancient times, but this profession has health problems that afflict the barber as a result of the long and continuing to stand throughout the day, leading to injury with a pain of joints.

In this study we have designed and analyzed multiple motion chair (horizontal and vertical) specially used for barber to reduce the daily effort which to fall ill and to avoid diseases due to continuous downtime. Other reasons are to provide the best kept feasible for persons who suffer from disease such as varicose veins and could use this chair for other purpose with different design to enable disabled persons to move in required movement-trajectory.

This special chair is designed on a circular railway which has an ability to move horizontally at an angle from zero up to 200 degrees or reverse, and this movement achieved by a D.C. motor which is connected to the gearbox. So this device transfers the rotating movement by a shaft which has a conical wheel at the end of it. Also, this special chair needs vertical movement and this achieved by power screw jack with another D.C. motor. We chose appropriate D.C. motor speed in order to ease their movements.

II. SPECIFICATIONS OF BARBER WHEELCHAIR

No.	Description	Material	Quantity
1	Shaft	Alloy Steel, Aluminum alloy	2
2	Gear	Stainless Steel	2
3	Chair	plastic	1
4	Railway	Cast iron	1
5	Wheel	Cast iron	4

III. MODELING IN SOLIDWORK SOFTWARE

In this research, the final design was the result of sequential analysis and the phase modification. The wheelchair is fixed on four-wheels that are cone shaped designed to rotate on railway that is circulated up to 200-degree angle. The chair moves to the right and left with D.C. motor. But the vertical movement achieved by power screw jack with another D.C. motor (12 volts), this jack is designed to withstand a weight of more than 100 kg. We used a gearbox to reduce or increase motor speed and torque ratio.

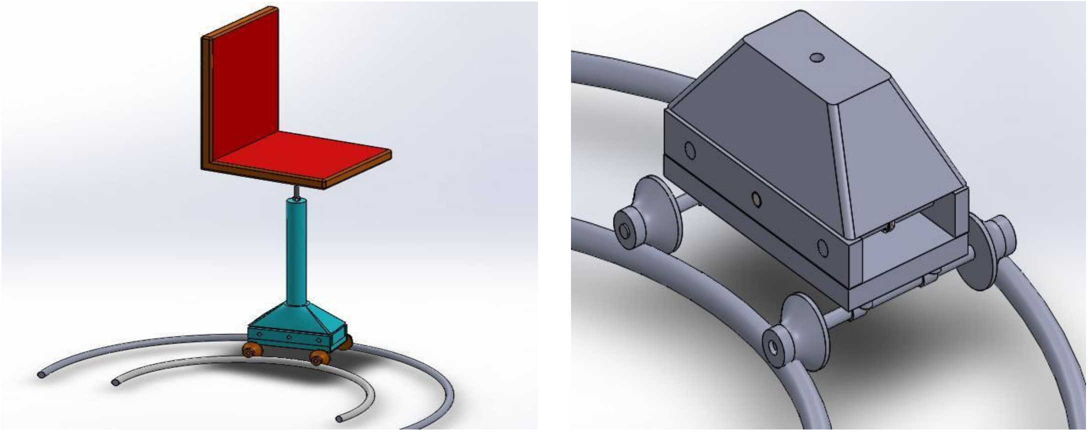

Fig.1: Model of barber wheelchair

IV. METHODOLOGY

A- Shaft dimensions:

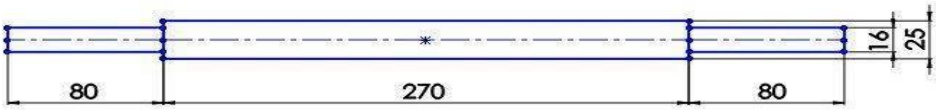

Fig.2: Shaft dimensions in mm

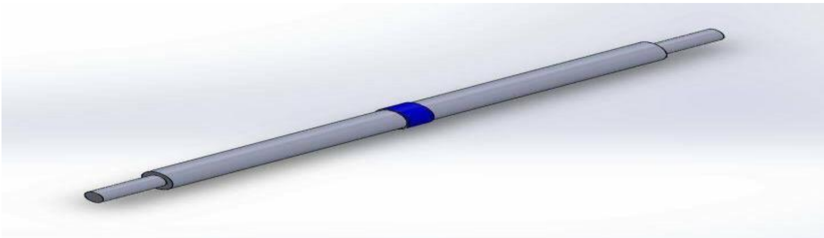

Fig.3: Isometric view of shaft

B- Shaft Analysis:

We chose Steel alloy and Aluminum alloy and other metals with same dimension. We studied the stresses that are resulted from the weight of the barber (125Kg =1226.25N) concentrated on bearings. Each bearing exposed to (613.11N).

- **Alloy steel Analysis:**

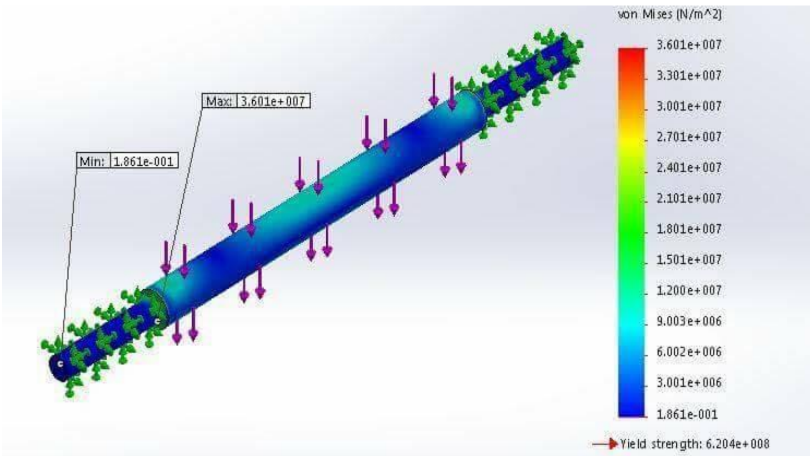

Fig.4: Von Mises Analysis for the Alloy Steel Shaft

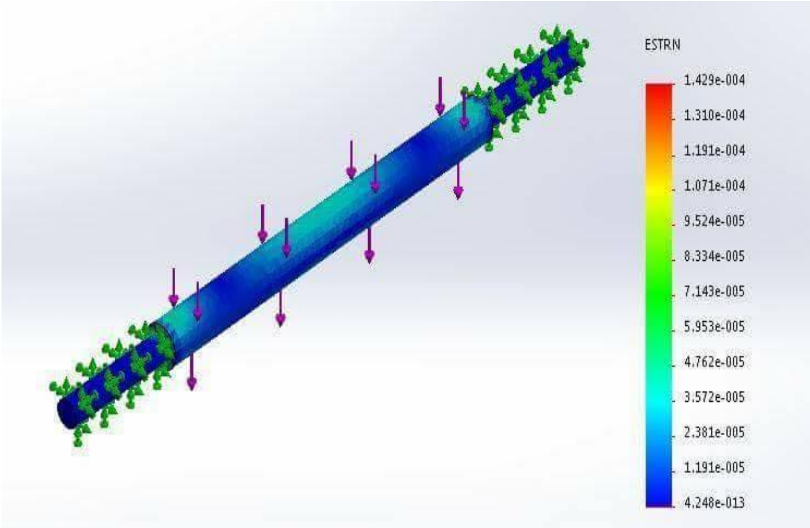

Fig.5: ESTRN Analysis for the Alloy Steel Shaft

- **Aluminum alloy:**

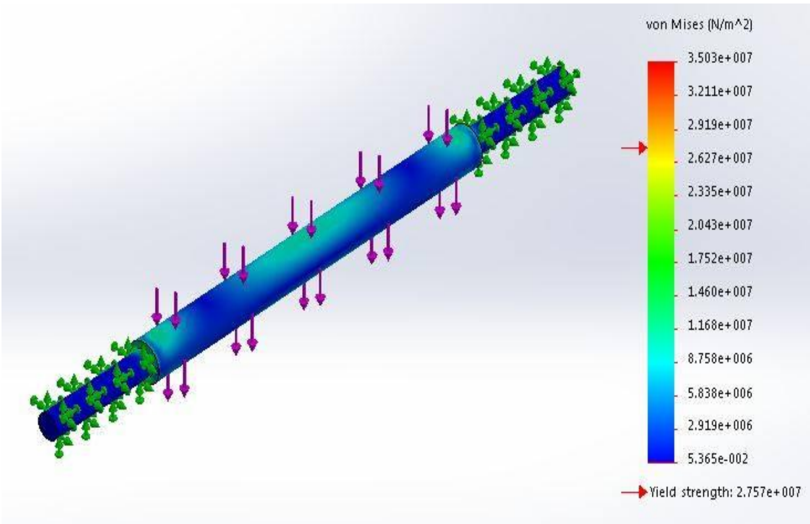

Fig.6: Von Mises Analysis for the Aluminum Alloy Shaft

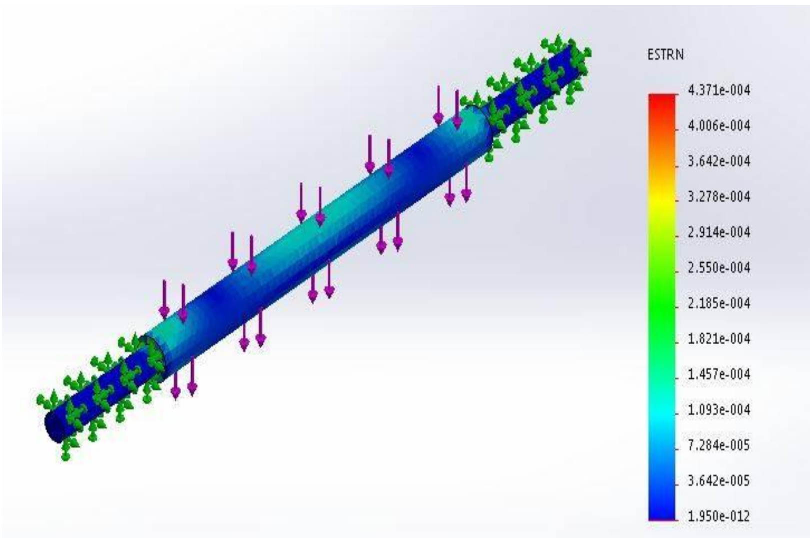

Fig.7: ESTRN Analysis for the Aluminum alloy Shaft

C- Analysis of shaft with wheels:

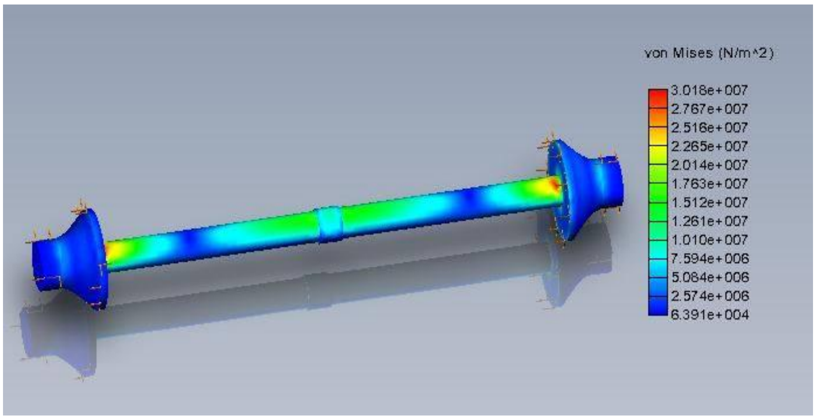

Fig.8: Von Mises Analysis for the Alloy steel shaft with wheels

D- Gear Analysis:

According to the calculations for selecting spur gear parameters we chose gear with dimension D_1 = 45 mm and D_2 = 77 mm, Number of teeth Z_1= 36, Z_2 = 60, the figure below shows analysis of gear [1, 2].

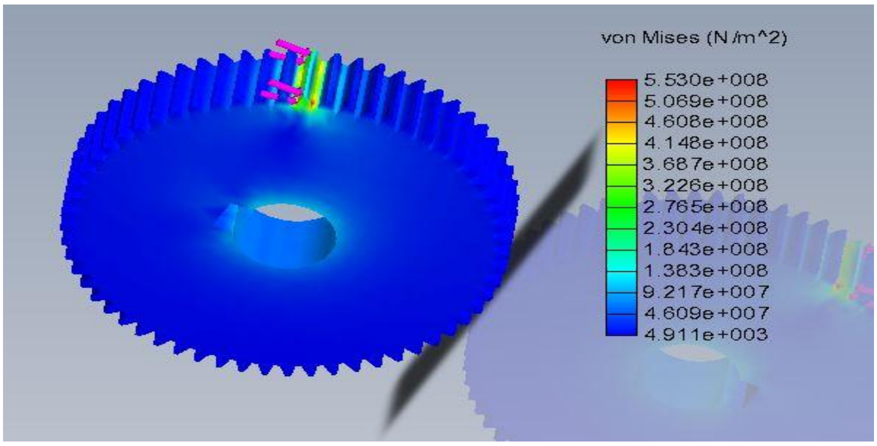

Fig.9: Von Mises Analysis of Spur Gear

E- Analysis of power screw:
The analysis below in fig. 10 shows the maximum and minimum values deformation for power screw of diameter 12 mm selected according to calculations [3]. Power screw works to move the barber chair up and down. It exposed to barber weight (125 kg).

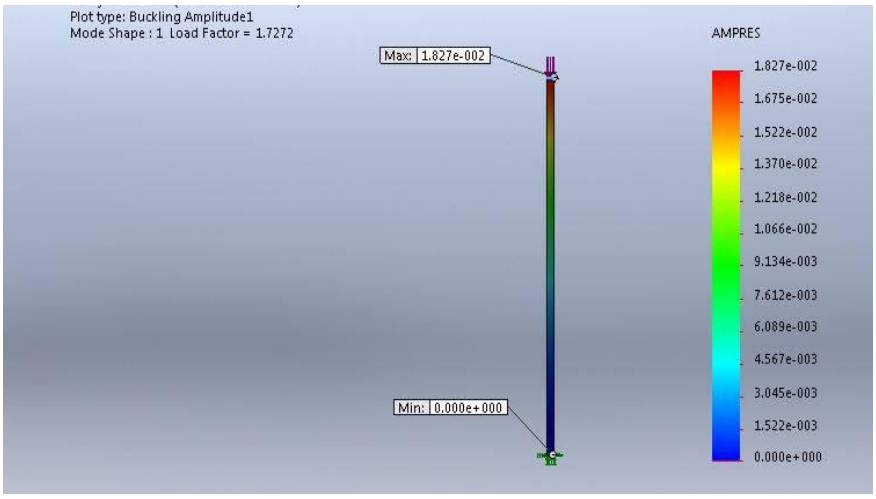

Fig.10: Buckling Analysis of power screw

V. RESULT & DISCUSSION

Through analysis of assembly parts by Solid works we note that parts are safe with dimension and the material that we chose has no red areas which are considered failure zones. The force that represents the maximum weight of barber is applied on bearings 125 kg. In the shaft analysis of Alloy Steel we see max. Von Mises is 3.601e+007 while in Aluminum alloy Von Mises is 3.503e+007, so we chose Alloy Steel in our design shaft chair. In fig. 8 when we applied maximum weight of 125 kg. We saw there was a weak red region on the shaft because of difference in diameter between big dia. (25 mm) and small dia. (16 mm) as shown in fig. 2, and then stresses are concentrated in this region. In fig. 10 we see that power screw analysis exposed to the buckling. Maximum deformation is very small equal to 0.144 mm which has no effect for the function of the chair.

VI. RECOMMENDATIONS

We suggested that the use of mechanical arm instead of railway it will be better to move the barber right and left around the customer chair. Also, we advise to cancel the power screw to decrease production price and maintenance and let the customer chair move up and down hydraulically instead of barber chair.

REFERENCES

[1]. Machine Design – R.S. Khurmi.
[2]. ABDUL MUBEEN, Ph.D, M.I.S.M.E. Machine Design Fifth Edition 2012 4575/15, Onkar house, Opposite Happy School Daryaganj, New delhi-110002.
[3]. Fastner Design Manual Richard T. Barret Lewis Research center Clevland, Ohio March 1990.