Beyond Disabilities

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Background

When it comes to exercising, there are many different types of machines that allow people to workout different muscles. However, the machines are difficult to manage properly for individuals with physical disabilities. For this project we will be focusing on redesigning a functional trainer, specifically the pulley adjustment system in order to make it more user-friendly for people with mobility/dexterity based disabilities.

Overview / Design Specs

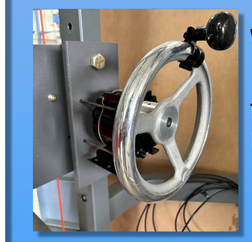
Our final outcome revolves around a fully mechanical capstan with a wheel attached to one end. The wheel have numerous attachments to accommodate a wide range of disabilities, similar to ones used on steering wheels for cars. The system has a cable that wraps around the capstan and by turning the wheel, we induce linear motion. The other advantage is the force generated by the capstan. which would be able to essentially lock the cable-pulley system in place at any height. Regardless, we also implemented a rope clutch that will double down in locking the system into place.

Exploded View

Final Design

Image of the finalized product

Hardware / Key Components



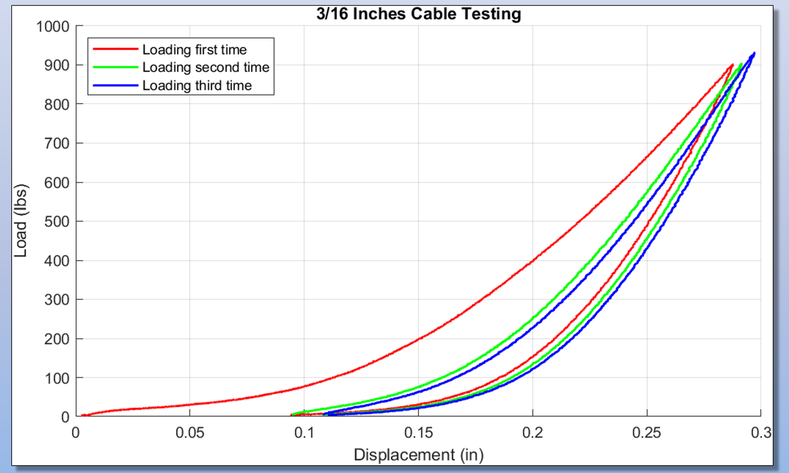
Wheel
10in diameter hand wheel with a knob to facilitate the grip.
Used to drive the gearbox.

Winch
Worm gear winch with rating of 1500 lbs that is driven by the gearbox

Turnbuckle
Used to add tension to the cable and adjust the cable length needed

Gearbox
28.1:1 double stage gearbox used to drive the winch.

Key Result #1 (Tensile Test)



The cable did not fail under a 900 lb load.
Permanent Strain introduced
Preload necessary to ensure no extra permanent strain.

Key Result #2 / References / Conclusion

Specification	Specification Achieved
Wheel height	3 feet off the ground
Rotations needed to fully transverse	~15 rotations
Force needed to operate the wheel	~12 pounds
Self locking	Yes
Safety factor	7

Fulfills ASTM safety standard standard for gym equipment
Accessible from wheelchair or standing up

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