EML 4501 Spring 2020 – Group 16
Carsten Bing, Roshon Condell, Chris Dume, Joshua Kickhoefer, Mina Kim, Michael Toth, Camilo Valles, Brett Vance

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Narrative Summary of Product Functionality

- The user is first brought in a wheelchair to the device and the trainer assists them in attaching the harness and inserting their feet in the fracture walkers.
- The user is lifted to a standing position with a set amount of their weight offset by the harness pulley system.
- As the user begins walking on the elliptical or treadmill, the harness pulley system utilizes a tensor sensor to make height adjustments in relation to the user's movements.
- There is a control box on the right side of the machine to allow easy access by the user or trainer.
- Handles allow the user to hold on to the frame, and a safety rope system prevents them from falling in case of machine malfunction.

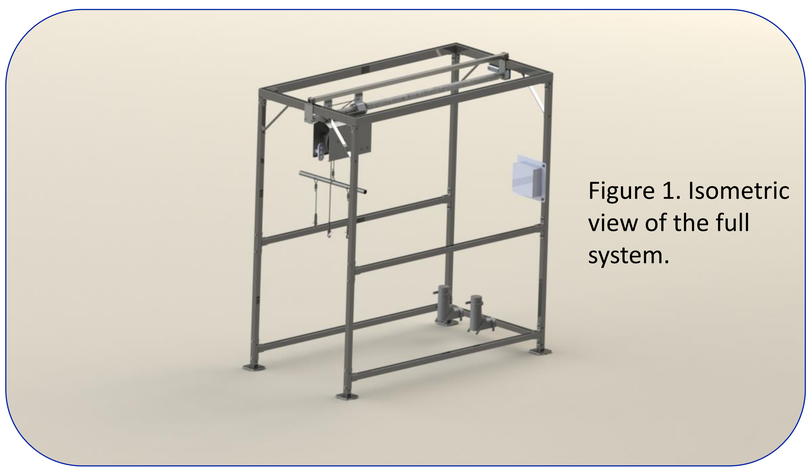
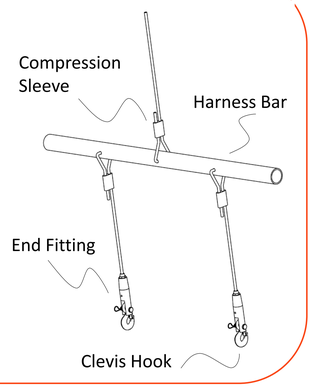


Figure 1. Isometric view of the full system.

Harness Feature

- User attachment using two ropes equipped with Clevis hooks
- 0.25” rope diameter made from steel allows for secure fastening
- Harness bar gives stability of motion
- Rope equipped with end fittings for hooks and compression sleeves



Costs

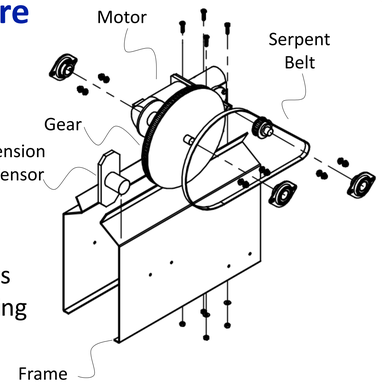
OTS Parts	**$ 2 239**
Raw Materials	**$ 1 223**
Manufacturing and Labor	**$ 674**
Energy Consumption/Hour	**$ 48**
Assembly Labor	**$ 234**

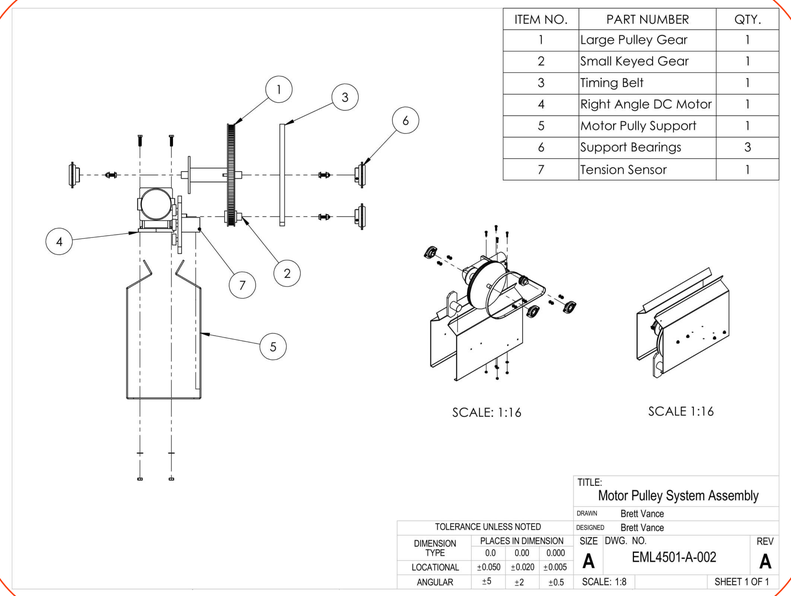
Product Abstract

Our design is named after the Norwegian word for “the support.” A shoulder mounted harness system allows the user to be comfortable and unrestricted, as he or she is transported to the locking boots for rehabilitation. Two motors are used in tandem: one powers a lead screw which moves the user horizontally over the elliptical, and the second is equipped with a transmission system for precise and powerful movements. The vertical control system includes a tension sensor and PID controller which will achieve a smooth exercise experience. The system’s frame is welded along the top and bottom joints, giving it the strength its name implies. Detachable side supports make it transportable. Ergonomic handrails and an adaptable user interface allow for a smooth experience for any user, with or without the help of an operator. All the previously described systems have safety and controllability as a primary concern. The ease of use and comfort allows the user to focus on rehabilitation.

Weight Adjustment Feature

- Weight adjustment using a DC motor
- Gear ratio creates positive mechanical advantage
- Bearing and gear system relieves motor from having to bear radial load
- Three pulley tension sensor allows reliable sensing without introducing a new mode of failure.
- Size of 20” x 8” x 15”
- Frame made from sheet metal





ITEM NO.	PART NUMBER	QTY.
1	Large Pulley Gear	1
2	Small Keyed Gear	1
3	Timing Belt	1
4	Right Angle DC Motor	1
5	Motor Pully Support	1
6	Support Bearings	3
7	Tension Sensor	1

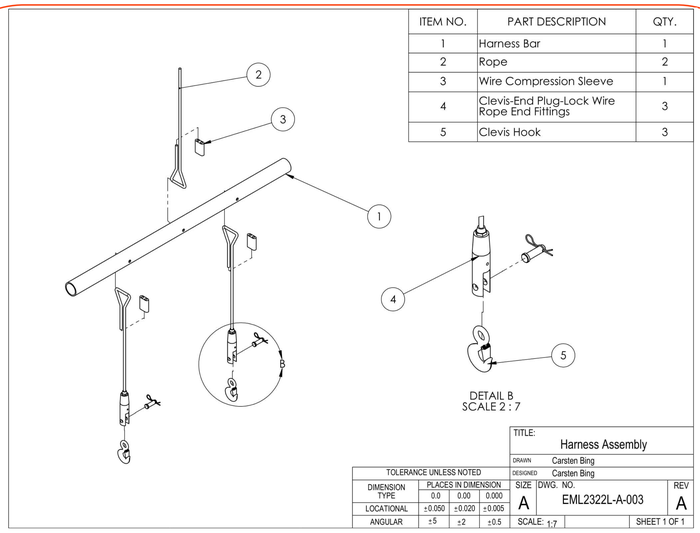
SCALE: 1:16

SCALE 1:16

TITLE: Motor Pulley System Assembly					
DRAWN	Brett Vance				
DESIGNED	Brett Vance				
TOLERANCE UNLESS NOTED				SIZE	DWG. NO. REV
DIMENSION TYPE	PLACES IN DIMENSION 0.0	0.00	0.000	A	EML4501-A-002 A
LOCATIONAL	±0.050	±0.020	±0.005		
ANGULAR	±5	±2	±0.5	SCALE: 1:8	SHEET 1 OF 1

Customer Needs

1. Fits inside medical/rehabilitation facility
2. If powered, runs from 120 VAC from 10 amp breaker capacity wall outlet
3. Does not interfere with elliptical’s operation
4. Supports full weight of user
5. Acceptable factor of safety
6. Includes a fail-safety system
7. User is lifted and placed at safe, comfortable speeds
8. Prevents user from swinging/hitting trainer or wheelchair during transfer
9. Allows user to translate vertically during exercise
10/11. Prevent user from losing balance in a fall
12. Lifts user from seated to fully suspended
13. Moves suspended user over elliptical
14. User is suspended over trainer while being strapped into trainer
15. Accommodates body sizes from 5% female to 95% male
16. Once user is attached, transition to preset offset weight
17. Allows user to select between 0% and 100% body weight offset value
18. Mounted from walls or ceiling or can sit on floor
19. Provides continuous, user-defined offset weight throughout exercise
20. Offset weight support feels continuous to user
21. Provide pre-set weight offset over range of user’s motion during exercises
22. Is programmable
23. Has intuitive user interface
24. Prototype cost does not exceed $4,000
25. Includes emergency shut-off actuated by user or trainer
26. Includes automatic, force-based safety limit shutoff that shuts down device
27. Has visual indicator showing when system is on, what mode function it is in, and how much weight is being offset
28. Has operational lifetime exceeding 3x that of a standard elliptical trainer



ITEM NO.	PART DESCRIPTION	QTY.
1	Harness Bar	1
2	Rope	2
3	Wire Compression Sleeve	1
4	Clevis-End Plug-Lock Wire Rope End Fittings	3
5	Clevis Hook	3

DETAIL B
SCALE 2 : 7

TITLE: Harness Assembly					
DRAWN	Carsten Bing				
DESIGNED	Carsten Bing				
TOLERANCE UNLESS NOTED				SIZE	DWG. NO. REV
DIMENSION TYPE	PLACES IN DIMENSION 0.0	0.00	0.000	A	EML2322L-A-003 A
LOCATIONAL	±0.050	±0.020	±0.005		
ANGULAR	±5	±2	±0.5	SCALE: 1:7	SHEET 1 OF 1

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