CHAPTER 5
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Transfer Device For Handicapped Individuals

Designers: Victoria Phillips, Brian Smith, and Melissa Martinez
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INTRODUCTION

Using the restroom is difficult for handicapped people. Accommodations for these individuals usually consist of raised toilets and handrails. For quadriplegic people and others with limited use of their arms, handrails are useless. In teaching facilities, it is sometimes left up to the teachers to get such a person from their wheelchair to the toilet and back. In too many cases, the teachers have to physically lift these handicapped individuals. This not only endangers the disabled people, but also endangers the health of the teachers by placing large physical demands on their lower backs.

SUMMARY OF IMPACT

The Gantry Crane was designed to remove the physical demands on teachers and to ensure the safety of the disabled people during transfers from the wheelchair and the toilet. The crane is small enough to be used in a moderate size bathroom, simple enough to be used by one operator, and accommodating enough to allow the removal of the lower garments while in the lift. No physical lifting is required by the teachers. The handicapped person is transferred to and from the toilet quickly, safely and comfortably.

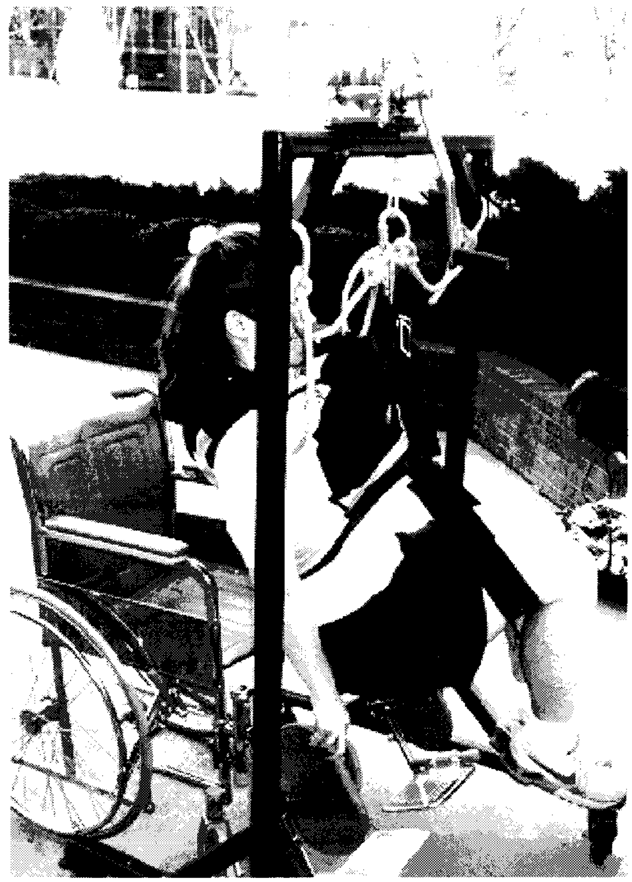


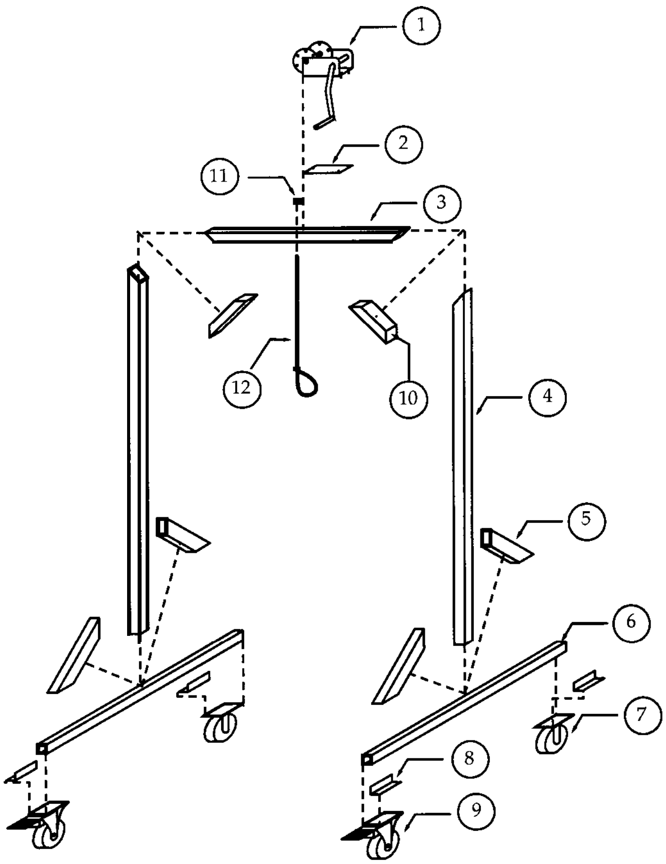
Figure 5.1. Person suspended in Gantry Crane.

TECHNICAL DESCRIPTION

The Gantry Crane frame is constructed from ANSI1020 steel, 1.5-inch square tubing. The tubing is 0.188 inches thick (7 gauge). The exploded view and parts list of the gantry crane is shown in Figure 5.2. The top beam (3) is 31 inches long cut at 45 degrees on both ends with a 0.5-inch wide 1.5-inch long slot cut through the top and bottom at the center of the beam. The side columns (4) are 52 inches long cut at 45 degree angle on the end which joins the top beam. The runners (6) are 36 inches long. The side braces (5) are 11.5 inches long cut at 45 degrees on both ends. The top corner braces (10) are 8 inches long cut at 45 degrees on both ends. Other components that were used are the Fulton Brake Winch (1), the Petzl Light C70 Commercial Harness (not shown), 4 pivoting, Colson Tech-Lock wheels (7 and 9) (2 with brakes), and 4.5 feet of polypropylene, mountain climbing rope (not shown), used for safety, tied to the two top comer braces and to the loop at the end of the 3/16 inch plastic coated steel cable (12). A plate (2), 2.5 inches wide, 6 inches long and 0.13 inches thick. Edge braces (8) 1 inch by l-inch angle bar 1/8 inch thick and 4 inches long. Surgical tubing (11) with a 1/4 inch inside diameter. The structure was designed to yield strength for a 200 pound person with a safety factor of three. All joints are welded.

The Gantry Crane can be stored, straddling the toilet. When it is needed it is rolled out and rotated so that the wheelchair and individual can be rolled inside the frame on the side opposite the crank handle. The harness is put on the disabled person and then attached via a carabineer to the loop of the lift cable. The person is then raised by turning the handcrank and the wheelchair is removed. The lower garments can now be removed and the crane rolled over the toilet. The reverse is done to return the individual to the wheelchair. Figure 5.1 shows a suspended individual with the wheelchair removed.

The parts cost is $530.72.



No.	Name	Description	Qnty
1	Fulton Brake Wench		1
2	Plate	1020 steel (2.5in * 6in * 0.13 in)	1
3	Top beam	1.5in sq 1020 steel tubing 7 gauage	1
4	Side column	1.5in sq. 1020 steel tubing 7 gauage	2
5	Side brace	1.5in sq 1020 steel tubing 7 gauage	4
6	Runner	1.5in sq 1020 steel tubing 7 gauage	2
7	Rigid caster	4 in wheel diameter *1.25in treadwidth	2
8	Edge brace	1020 steel (1.5 in * 1 in * 4 in)	4
9	Swivel caster with 4in wheel diameter *1.25in treadwidth tech-lock brake		2
10	Top corner brace	1.5in sq 1020 steel tubing 7 gauage	2
11	Surgical tubing	0.25 in inside diameter	5in
12	Steel cable/u-clamp	3/16 in diameter / plastic coat	48in

Figure 5.2. Assembly of Gantry Crane.

The Tracking Tracer

Designers: Chris Ballard, Donna Clark, and Mark Fuller
Client Coordinator: Ms. Bernadette Luce
Supervising Professors: Dr. Edward O'Brien and Mr. Jack Mahaney
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INTRODUCTION

The Tracking Tracer (TT) is a microcontroller-based device that aids in the stimulation of eye hand coordination of children with learning disabilities and who are multi-handicapped. These children are from six months to thirteen years of age. The type of testing our client has use of now is limited to things such as: moving a pen from one place to another on a table, moving a paper clip around on a table, etc. She is interested in the development of the TT because it gives her an alternative to this style of testing. The TT displays a circle, square, triangle, rectangle, diamond, horizontal line, vertical line and a random placement of lights. The shapes of the TT also have various tracing speeds so that the device can be used with students of different abilities. The front of the grid is made of a transparent smoked lexan so that a grease pencil can be used in tracing. The observer of the children is able to see the eye movements of the children during tracing. This allows the observer to accurately determine how well the children are doing.

SUMMARY OF IMPACT

Because of the TT design, the children can have a little fun while they learn. Not only do they get the satisfaction of accomplishing the goals of the day, but also they want to keep learning because it is fun. The therapist, Ms. Luce, also benefits from the device because it allows her more freedom to focus on the child's eyes during testing instead of having to move objects around in front of her.

TECHNICAL DESCRIPTION

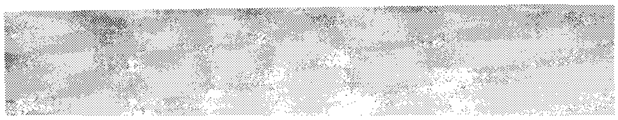
The TT is of 3/4" pine construction with dimensions of 20"x11"x18" and a weight of 18 1/2 pounds. A photograph of the device is shown in Figure 5.3. The display of the TT consists of a wood frame enclosing three panels of 1/4" smoked lexan. The center panel houses 256 LED's where the LED's of each row are daisy chained together and the LED's of each column are daisy chained together. The LED rows and columns are connected to the electrical circuitry in the base of the device by ribbon cables and connectors. The cabinet is finished with a lead free light blue paint covered by clear enamel for easy cleaning. A handle has been placed on the top of the device to make the device easier to transport.

The controls of the TT are SPDT switches contained in the control panel, which allow the user to choose a shape, a low, medium, or high speed, or to manually step through the shape. The stop and start switches are SPST switches and allow the user to stop a tracing to change to another shape, speed, or to restart the same shape. The signals from these switches go through a debouncing circuit (7403), a counter circuit (7490), and a decoder circuit (74155) to an 8751H Intel microcontroller. The programmed microcontroller interprets these signals and sends the appropriate output signals to a data distributor (74154) which in turn, sends the column signal through a PNP current amplifier to the LED grid and the row signal straight to the LED grid. These signals light up the requested LED.

All the shapes and speeds are controlled through software. The program is written in assembly code and takes up 1.5K of the available 4K of memory on board the 8751H.

A 9-volt AC/DC transformer powers the TT through a 7805 linear IC voltage regulator to the circuitry.

The cost of the prototype was $239.



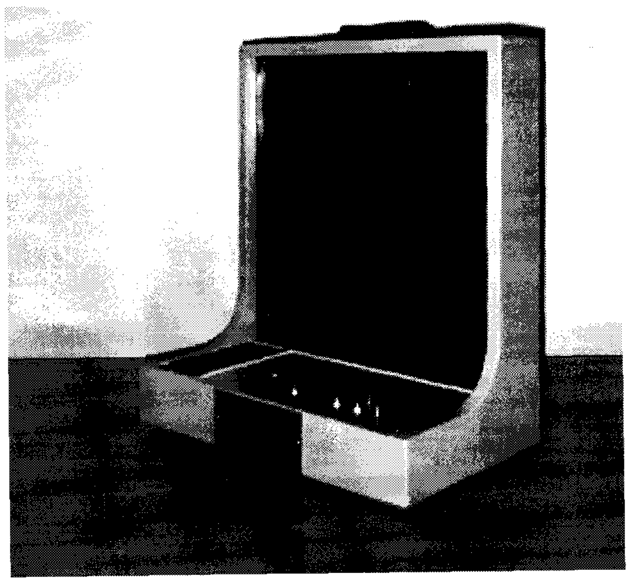


Figure 5.3. Photograph of the Tracking Tracer.

The Portable Wheelchair Lift

Designers: Chad Boggan, Samuel James, Matthew Vining
Client: Edward Erwin
Supervising Professors: Dr. Edward O'Brien and Mr. Jack Makaney
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INTRODUCTION

The portable wheelchair lift is a device used to raise and lower a wheelchair and it's user. The lift was not actually made. This project focused on the design, analysis, and devising of test plans for the eventual construction of a wheelchair lift. The design is intended to actuate the user to strictly vertical heights, such as onto rampless platforms or up to podiums. It uses a scissors lift mechanism powered by two powerscrews. The platform is transported to the location of its use in six sections then assembled. Once in place and assembled, the user rolls onto the lift platform and actuates up or down with a control switch located on a handrail. There are existing lifts that are capable of lifting the same amounts of weight but none incorporated the same safety features and user accommodations.

SUMMARY OF IMPACT

This project has laid the groundwork for further revision of the portable wheelchair lift design. It has given an analysis, detailed drawings, and test plan for the design. It has taken into consideration the human factors such as usability, ease of assembly, and safety. Although a wheelchair lift was not actually constructed, it made the eventual analysis, building, and testing of one more efficient.

TECHNICAL DESCRIPTION

The portable wheelchair lift is comprised of a 44" x 46" platform supported by four 41" angle iron legs that rest on a 43" x 46" base frame. There are two 17.625" power screws located to left and right on the base. These power screws have ballnuts on them that connect to the legs through clevises. There are rollers under the platform and on the base at one end of the legs to provide smooth up and down movement of the lift. There is a flopgate on the front of the lift to allow the user to roll onto the platform when it is in its lowest position of 2 inches. The flopgate also prevents the wheelchair from rolling off the platform when the lift is raised. The 1/3 horsepower motor is connected to one power screw by a roller chain. The power screws are connected to one another by a roller chain that runs under the platform and above the base. A 12-volt battery in a plastic battery box is connected to the motor.

When the control switch is activated, the motor turns the power screws. This actuates the ballnuts on the power screws, which in turn moves the end of the legs connected to the ball nuts. This action causes the scissors lift mechanism to straighten vertically and raise the platform. There are limit switches located on both ends of the motor side power screw to ensure that the lift is not raised or lower too much. If the ball nut touches one of the limit switches the motor shuts off and the lift stops. The pitch of the power screws holds the lift in place when the screws are not turning.

The approximate parts and materials cost of the lift was $1500.

The following figures show the lifting mechanism minus the lifting source, a sideview of the final design, and frontview of the final design respectively.

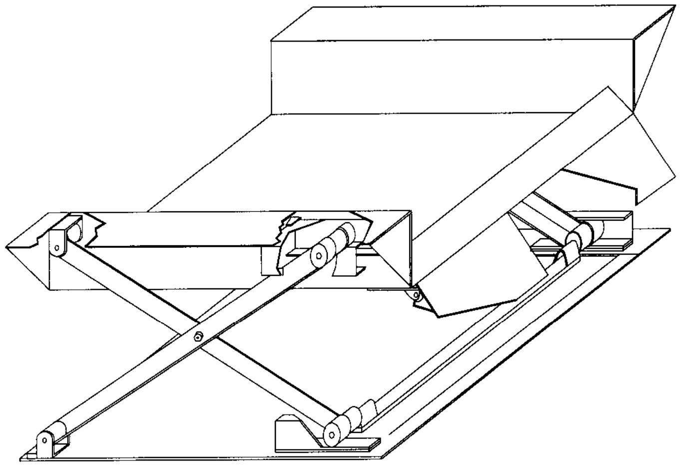

Figure 5.4. Three-dimensional view of lift mechanism minus the lifting source.

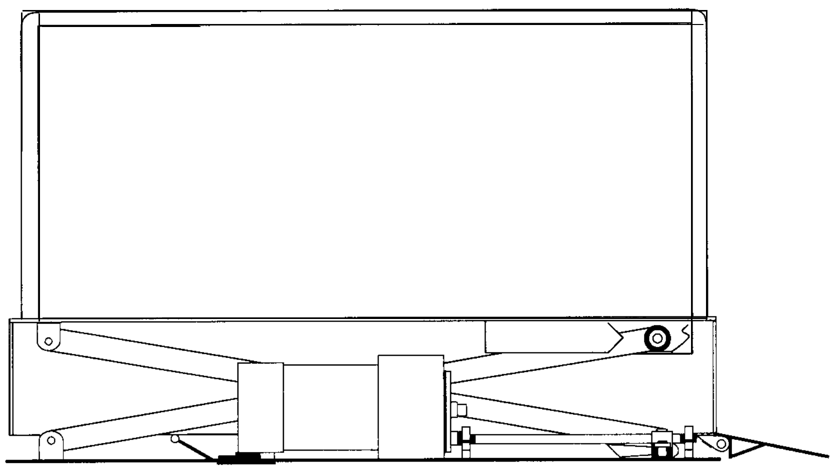

Figure 5.5. Sideview of final design.

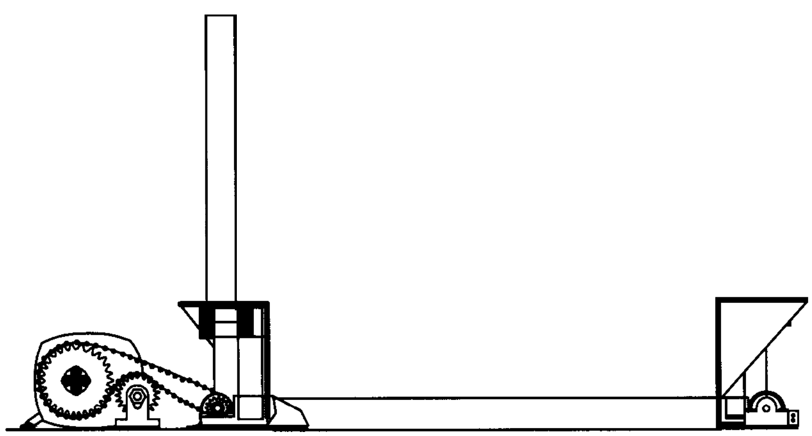

Figure 5.6. Frontview of design.