CHAPTER 4
NEW MEXICO STATE UNIVERSITY

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An Adjustable Chair/Swing for Handicapped Children

Designers: Ronald Russell, Timothy Shore, David Soule
Client Coordinator: Susan Nix,
Picacho Middle School
Supervising Professor: Dr. R. A. Willem
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INTRODUCTION

The adjustable chair/swing is a two-component design that was created for handicapped children at Picacho Middle School in Las Cruces, New Mexico. The two components consist of a support system, which includes a spreader and support ropes, and a bed in which the child will lie.

In addition to the bed's ability to conform around the child's body, there are also two well-placed security belts on the bed to give the child a sense of security and the teacher reassurance of the safety of the child.

Lastly, the design is collapsible, allowing easy storage and taking up little room when not in use.

SUMMARY OF IMPACT

A handicapped child often likes the feeling created when spinning in a snug, comfortable chair. Hence the suspended chair/swing is an ideal design for these children to get that feeling.

Although it is difficult to understand the therapeutic results of the chair/swing, it is obvious that something which is so enjoyable must be beneficial to them, since they are often limited in their physical and mental experiences.

The chair/swing is not designed to provide any environmental stimulation to help motivate these children. The feeling that it does provide, however, including flight and speed, are all feelings that children find much pleasure in. Therefore, this chair/swing can be looked at as a rewarding therapeutic "joy ride" for these children.

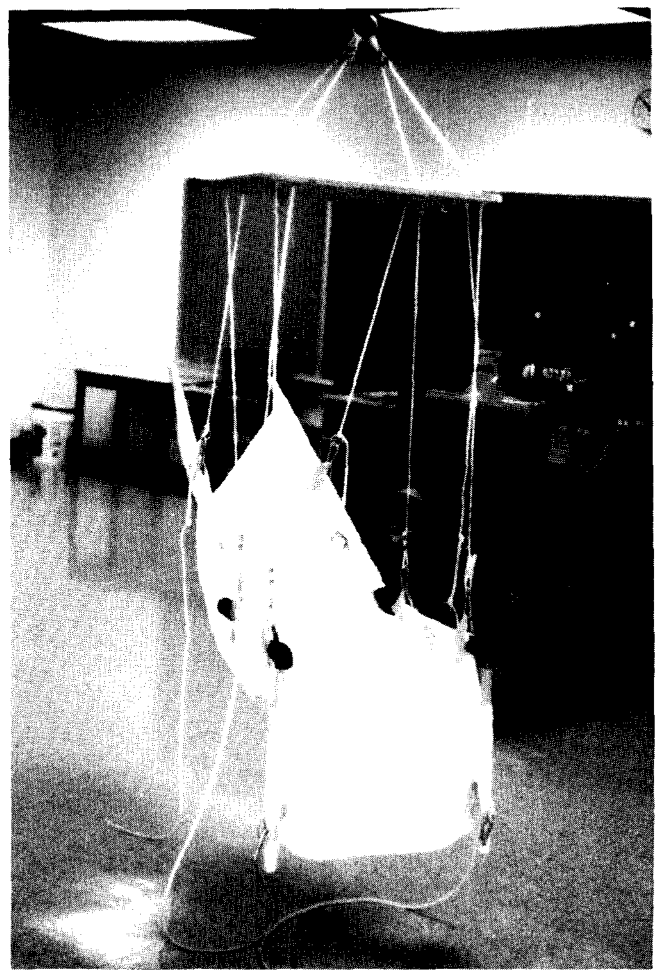

Fig. 4.1. Chair/Swing.

TECHNICAL DESCRIPTION

The adjustable chair/swing was designed to accommodate a variety of different sized children. The main requirements of the chair/swing were as follows.

- It must conform to the body of the child.
- It must be adjustable such that the elevation of the head and feet could be changed.
- It must hang from a single pivot so as to be able to rotate.
- The bed portion must be made of a safe, comfortable, easy to clean material.

In addition to these requirements, several advantageous modifications were also included in the design.

- It must be compact when in use.
- It must be easily cleaned and collapsed for easy storage.
- It must have security belts as a precautionary measure.

The overall design has two main components, the spreader and support system, and the bed. The spreader was made of 0.75” plywood and was placed approximately 4’ above the bed. Four ropes, attached to the midsection of the bed, ran through the spreader, and were secured to a metal ring which was attached to the pivot. The purpose of the spreader was to prevent the four ropes from converging too quickly which would have squeezed the child too tightly. The spreader (18" by 14”) was designed to allow the body weight of the child to apply just enough pressure on himself to cause a slight, comfortable squeezing effect.

The support system also consisted of two ropes each attached at the head area and the feet area. The purpose of these ropes was to allow the relative height of the head and the feet to be adjusted. Each rope was permanently attached to the spreader and each one had three rings securely fastened at an equal separation of about 9” near the bottom part of the rope. By fastening these rings to hooks, the elevation of the head and feet can be adjusted. Excess rope was left at the end of the rings in order to allow someone to pull on it to cause the bed to rotate.

Lastly, and most importantly, is the bed. The bed was made of a very strong fabric in order to support the weight of the child. Along each side of the bed ran two dowels, each one inside a sleeve. The purpose of the dowels was to prevent the bed from collapsing in upon itself once the child was placed in the chair/swing. There were two security belts, one at the chest area and one at the lap area to secure the child.

The bed was tested several times before it was delivered to the school. Although it will be used with children weighing up to 130 pounds, it was tested with a load of approximately 200 pounds. Each rope can sustain a maximum weight of 200 pounds. Hence the safety factor of the design is high.

After some use at the school, two modifications were in order. One was to add a spreader to the head area to prevent the dowels at the top from closing. Another was to add a protective covering to the exposed area of the dowels, which contained connecting eyelet’s, and was potentially dangerous to the children.

The final cost of the entire design was about $140.

Wheelchair Cane Holder
A Cane Holder Attachment for a Wheelchair

Designers: Mike Kirsch, Wencil McClenahan, Steve Rodriguez
Client Coordinator: Clare Jacquez,
Valley View Elemen ta y School
Supervising Professor: Dr. R. A. Willem
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INTRODUCTION

A cane holder was designed for a child at Valley View Elementary School. This child is in a wheelchair, but is not entirely confined to it. His therapist believes that one day he will probably only use canes and eventually discard the wheelchair altogether. A daily problem is that he has to carry his canes and backpack on his wheelchair to and from school. The current solution is to have someone carry his canes for him. This has caused the child to rely on help from other students at the school. Our group has developed and built an attachment that clips to the wheelchair, that enables the child to carry both the canes and the backpack. This gives the child more independence, and he is not forced to rely on his classmates. The cane holder is easily attached and removed and can be compacted for travel. The unit is made of aluminum for light weight, and is fully adjustable to accommodate the various sizes of wheelchairs and canes.

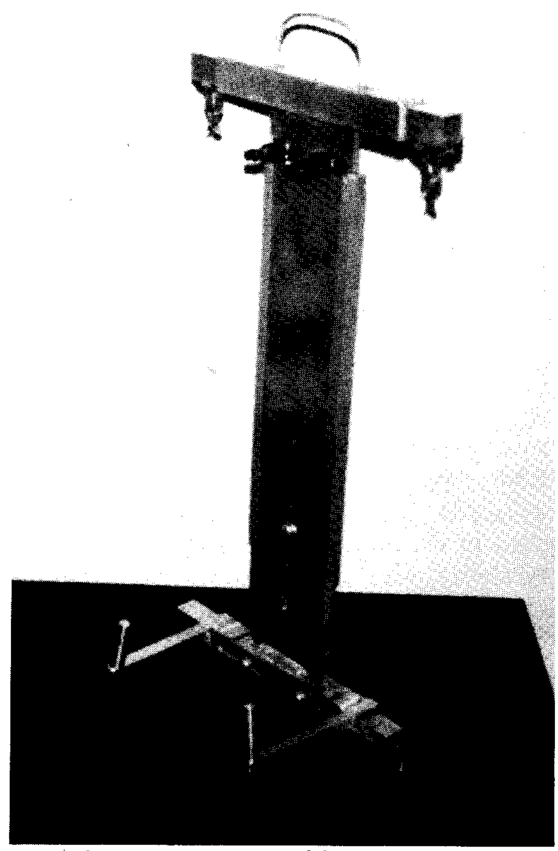

Fig. 4.2. Cane Holder.

SUMMARY OF IMPACT

Numerous children are confined to wheelchairs due to certain disabilities. Some children, such as our client, have some capability of walking, but have no one to carry their canes while they're in their wheelchair. A simple solution to the problem is an attachment that carries the canes while they're in their wheelchair. The design of the cane holder provides this solution. The client, parents and teacher are very pleased with the performance and appearance of the cane holder.

TECHNICAL DESCRIPTION

The cane holder was designed to fit various sizes of wheelchairs and to grow as the wheelchair grows. The design goals for the cane holder were as follows.

- Make the cain holder lightweight, detachable, completely adjustable, safe and easy to use.
- Make the cain holder aesthetically pleasing.
- Make the cain holder virtually effortless to remove the canes.
- Make the cain holder small enough for easy storage and handling.

The cane holder has two pairs of horizontal and adjustment bars. It also has a vertical bar for height adjustment. The horizontal adjustment bars are made of telescoping aluminum tubes 1 1/4" square. A set screw is used to locate and hold the tubes in place. A spring clip is riveted to each end of the four tubes for attachment to the wheelchair. The vertical adjustment consists of two flat aluminum plates 1/4" thick by 4" wide. A 1/2" aluminum channel is welded to the back plate for additional rigidity. Each vertical piece has a 5" long slot for the adjustment. The vertical adjustment bars are welded to the horizontal tubes and a 1/2" aluminum angle is welded to the lower horizontal tube. A pin is attached to the angles and this pin supports the canes. At the top end of the vertical adjuster, two more spring clips are attached, to hold the canes in place. A handle is welded on the top horizontal tube for easy handling. Initially, the cane support had been fabricated from 1/8" flat aluminum strip however, these strips proved weak so they were replaced with the 1/2" angle. The system attached to the wheelchair the first time and the canes slipped right in place. Final grinding and polishing followed.

An estimated cost of the cane holder, neglecting labor cost, is approximately $200.

Fig. 4.3. Canes, Cane Holder and Wheelchair.

Voice Activated Therapy Device
A Voice Activated Light Array and Music Device

Designers: Derek Jones, Shawn Kempton, Dolores Schafer, Tony Serna
Client Coordinator: Martha Robertson,
Valley View Elementary School
Supervising Professor: Dr. R. A. Willem
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INTRODUCTION

A voice activated therapy device has been designed for physically and mentally disabled children at Valley View Elementary School, in Las Cruces, NM. A disabled student does not experience cause and effect in their interaction with the environment since they interact little. Also, several of the students only have control of their voice, so it is very important for the children to develop their voices. Given this situation, we need to maintain some communication with the students. The voice activated device encourages the students to use their voice, in hopes of possibly developing some type of communication with the students.

SUMMARY OF IMPACT

As mentioned above many of the children attending Valley View School are mentally as well as physically handicapped. The Client Coordinator made several specifications which we were to follow in pursuing this design. Initially the device was to voice activate a toy which performs some type of movement. This was ruled out because of the difficulty in finding the appropriate toy and possible difficulty of students seeing the toy. Next, with the approval of the Client Coordinator, we decided that bright colored lights would work if they are arranged in an attractive manner and they were bright enough. Finally we decided that arranging the light array in a bulls-eye manner with lights turning on and off in a random order would be very attractive. In addition to the light array, we installed an audio cassette player which is also activated by voice. The audio cassette is important for children who may be visually impaired. Although we have not had the opportunity to test this device in an actual situation, it meets all the design criteria and was very well received by the coordinator.

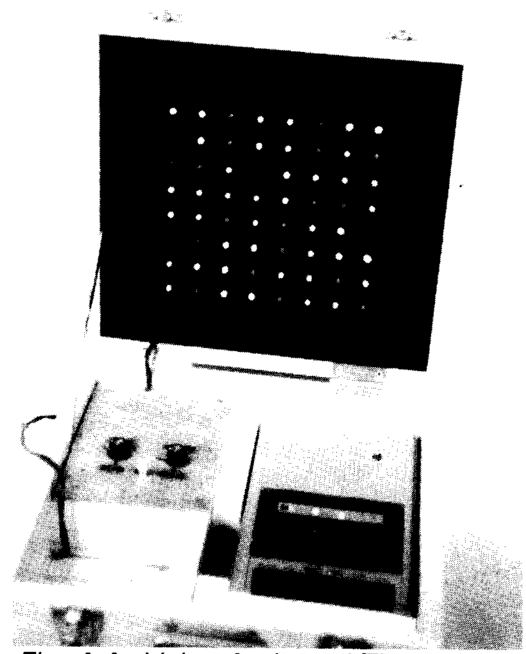

Fig. 4.4. Voice Activated Therapy Device.

TECHNICAL DESCRIPTION

The main design requirements were as follows.

- Activation sensor needed to be variable so children with different voice levels could use it.
- The lights needed to be bright enough to get the child's attention.
- It needed to allow a variety of music to be used.
- It needed to provide a sufficient level of satisfaction, i.e., lights and music must perform in a variable manner.

- It needed to be portable as well as easily stored when not in use, and it had to be safe to use.

The voice activated device has two main components, the chassis and the internal components. The chassis is a rectangular box, with outside dimensions of 13 1/2" x 12 1/2" x 6 1/2". The lid has a depth of 1 5/8", in order to protect the light array, and is attached to the bottom via a hinge. The lid contains the light array and stays open when in use. The bottom has depth of 3 1/8" and contains the audio cassette player and electronics. A false bottom is placed over the left half of the chassis in order to hide the internal components, and place a variable time delay, sensitivity and on/off switches.

The internal components consists of three circuits, audio cassette player, and light array. All the internal components are securely attached to the chassis. The first of the circuits is the variable voice activation element. This needs to be variable to suit the individual students voice level. The second of the circuits activates the lights in a “bulls eye” fashion. The last circuit is a time delay switch, which is also variable. Once again this is necessary to suit the individual students. The audio cassette player is installed with connections running the time delay switch and voice activation sensor. Several LED's (Light Emitting Diode) are placed in the lid which also have connections running to all three circuits.

The final cost of the voice activated therapy device was approximately $200.

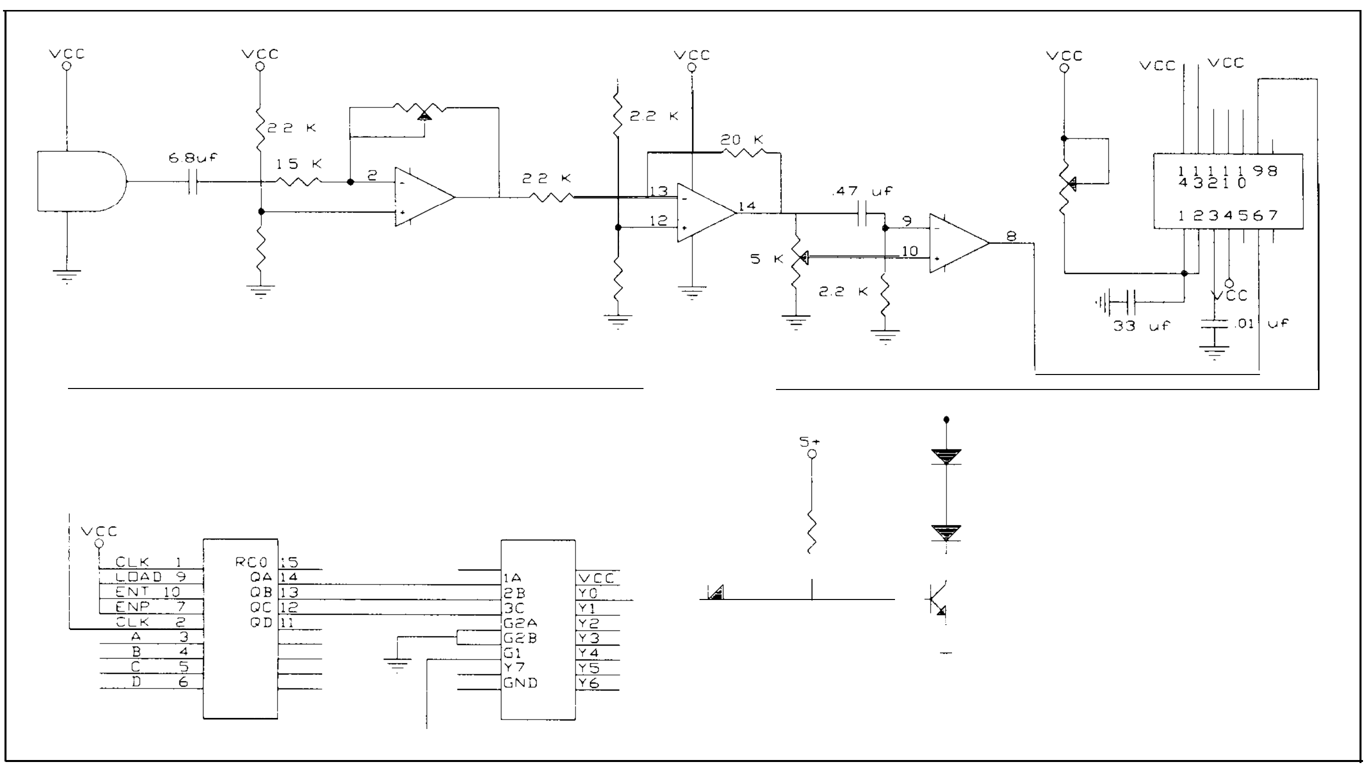

Fig. 4.5. Circuit Diagram.

Alternative Bicycle Braking System for a Rider With Arthritis

Designers:: Andrew Engelmann and Robert Jones
Supervising Professor: Dr. O'Neill Burchett
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INTRODUCTION

The purpose of this design project was to design an alternative braking system on a bicycle that can be safely used by someone with severe arthritis of the hands. The design must use the existing cantilever style braking levers already on the bike. Any additional power supplies must be small, lightweight, and safe. The rider must be able to make short emergency stops. The design must be reasonably aesthetically pleasing and be fail safe. The total cost of the system must be under $500.

The goals for this semester project were to design and build a working system that incorporated all of the stated limitations. The design process started with a look at last semesters previous work. Due to new information on the riders limitations, a complete new system had to be designed. Next, parts and materials were collected and the system was manufactured. The final step in the design process was testing and evaluation.

SUMMARY OF IMPACT

The alternative bicycle braking system was designed for a rider with extensive arthritis of the hands. He has very little motion in his wrists and his fingers are in a permanent cupped or curled position. The system was designed to circumvent these limitations by making the brakes solely operable by the riders leg power.

The rider was an accomplished competitive rider before his disease set in. This new design allows him limited but enjoyable freedom on the bicycle. The bicycle can be easily stopped by simpl rotating the pedals backward. A sprag clutch has been installed on the left side of the crankshaft. When the rider pedals forward the clutch spins freely and allows normal pedaling. But when the rider pedals backward the clutch engages and pulls on both of the brake cables that are attached to it. It is very similar to the braking on the old dirt bikes except that this system operates the cantilever style brakes instead of a coaster brake. The system is also redundant for safety. When engaged by the rider the system pulls on the back brake cable and engages the back brake. The front brake doesn't engage but is still on line and will work if something goes wrong with the back brake.

TECHNICAL DESCRIPTION

The design uses a clutch mounted on the left crank. The clutch allows free spinning in one direction but not in the other. The rider can pedal the bike freely in one direction, and when pedaled in the other direction, the clutch engages and the reverse pedaling action pulls on the brake cables engaging the brakes.

The first thing we needed to determine was which clutch to use and how to mount it to the bike. We thought of using the clutch mechanism in the back hub of most road and mountain bikes but we didn't like the constant clicking sound that it made and we weren't sure if it would be strong enough. Another idea was to use a sprag clutch that can be found in many automobile automatic transmissions. The sprag clutch had many attractive features. It operated on a roller cam action and didn't make any clicking sounds. It also could readily be found in local auto shops and since it was built for a car transmission it would be strong enough for our bicycle application. Sprag clutches come in a variety of sizes. We found out that even though the sprag clutch is part of a large transmission system, we could find a size suitable for our purposes.

We went around to some transmission shops in Las Cruces and got some information on the sprag clutches available. We found that we could buy one for about $45. Then we went to a transmission shop and they were kind enough to give us an old one that they had left over in a parts pile. It was from a

GM TH 350 69-86 automatic transmission and in good shape. It was also about 4 inches in diameter and about 1/2 inch thick which fitted our application well.

The next thing we did was buy a bike. We wanted to buy a very comfortable bike and one that was very stable. Since the rider was not going to be riding over rough terrain we bought a cruiser bike. These bikes have very comfortable seats and the rider's position on the bike is very upright. This upright position is comfortable because the rider isn't leaning over and having to support his upper body weight with his hands and arms. This was very important to accommodate the riders problem of arthritis. The wheels on the bike do not have very big nobbies and tread. This gives the bike a very smooth ride. All together the bike was very well built and would suit the rider.

In order for the clutch to properly pull on the brake cables, the cables have to be aligned directly above the outside ring of the clutch. We designed a simple cantilever support that attached to the bicycle frame. The support had two tapped holes to take a pair of adjustable hollow screws. These hollow screws held the cable housing but let the cable pass through the support and down to the clutch. The cable tension could also be adjusted by simply screwing or unscrewing the hollow screws.

The most difficult and time consuming part of designing this project was determining how to mount the clutch to the left side crank. We first thought of putting a new left crank on from a tandem bicycle. The left crank on these tandem bikes have a bolt pattern on them that is used to attach gears. We thought we could use this bolt pattern to mount our sprag clutch. We looked into ordering one of these cranks and found that we would have to order a complete set and it would cost about $100.

We also considered using the existing left crank arm and welding an attachment piece on it. We could then use that piece to mount the clutch. We decided to do it this way because we could save money and we could custom design it to get a good fit. The mounting piece was complicated because it had to match the non-circular curve of the outside of the left crank arm.

We decided to hold the entire clutch assembly together by using two thin plates and bolting them onto either side of the clutch mounting piece.

Throughout our design process we left options open in case unperceived problems came up. Since we wanted to mount the clutch close to the bicycle frame, we could have had a problem with the clutch hitting the frame. We kept the option open of installing a longer crankshaft. This could move the crank and the clutch away from the bike frame.

After we had our complete design and crucial sprag clutch we began building the system. It took about two weeks to build and assemble. Unfortunately photos of this project were taken and lost; new photographs could not be taken since the bike was no longer in Las Cruces. The cost of the project was approximately $500.

Safety Chair for an Autistic Child

Designers: Derek Armstrong, Maher Meer, Patrick Garcia
Client Coordinator: Marian Dawson,
Hermosa Heights Elementa y School
Supervising Professor: Dr. R. Willem
Department of Mechanical Engineering
New Mexico State University
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INTRODUCTION

A safety chair has been designed for an autistic child at Hermosa Heights Elementary School. The chair consisted of two modular components, the chair itself, and a tub used for the base. The chair is made of a molded foam produced by *Tumble Forms* as a feeder seat. It is equipped with safety belts for securing the child in the chair. The tub is a large, molded plastic, circular dish. The two parts can be disassembled for easy transportation and storage.

SUMMARY OF IMPACT

Many autistic children have mood swings which can include temper tantrums. They can become violent with forceful body motions which can harm themselves and others. One of the tactics for controlling the child is to confine him in a chair equipped with a restraining belt. The previously used chair resembled a wooden high chair and was susceptible to tipping over during a tantrum. This is because the chair has a high center of gravity. Our safety chair corrected the tipping problem and protects the user and individuals around him. The tipping problem was corrected by the tub. The tub was originally intended for use as a rocking toy, designed not to tip over. We modified this tub to be used as the base for our safety chair, utilizing the rocking motion. The size of the tub also provides a boundary which limits physical contact between the user and other students. The chair serves two functions. The first function is to confine the user. The second function is to help lessen self-inflicted injury due to striking the chair. In addition to the security the chair provides, it can also be a source of entertainment. Both teacher and student are pleased with the device.

TECHNICAL DESCRIPTION

The safety chair was designed with a particular child in mind, but could be used by others with the same, or smaller build. The main design requirements of the chair were as follows.

- The chair must be a reasonable size to function in the classroom, and be portable.
- The chair must be easy to use and store and perform the intended function.
- The chair must be safe for the user and others around it.
- The chair must be economically feasible, and aesthetically pleasing.

The safety chair has two main components, the tub and the chair as shown in Figure 4.6. The tub is a large circular plastic dish, 50” in diameter, 12” deep, and 3/8" thick. Two pieces of 2” by 12” wood cut 18 1/2" long were joined and shaped to fit in the bottom of the tub. The top piece had three holes routed for alignment and to minimize shifting. The two pieces of wood are joined by glue and wooden screws. The wood was then glued to the tub, completing the base.

The dimensions of the chair are as follows: overall height 34", outside width 17", inside depth 13 1/4", inner height 29”. The chair was glued and strapped by a belt to a wooden platform which fits on the wooden part of the base. This platform is 18 1/2" long, 12” wide, and 8” high. To prevent horizontal motion, there are three plugs on the bottom that are oriented to mate with the routed holes in the base. The platform is assembled using wooden screws and the plugs are fastened with glue.

The base and chair are easily assembled and disassembled using latches. They prevent vertical motion when the chair is in use, keeping the chair firmly in place.

Initial testing resulted in the failure of the first type of latches we selected. We believe that the failure was due to the quality and application of the latches. Therefore, we replaced them with toolbox-type latches which we believed will perform better in this application.

The approximate cost for materials was $380.

Fig. 4.6. Safety Chair.

A Stairs and Ramp Unit for Disabled Children

Designers: Charles Slaby, Chris Payne, Kenton Pierce
Client Coordinator: Susan Nix,
Picacho Middle School
Supervising Professor: Dr. *R. A. Willem*
Department of Mechanical Engineering
New Mexico State University
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INTRODUCTION

Some physically and mentally handicapped children can gain benefit by practicing stair climbing. In addition to improving this very practical physical skill, it also provides exercise and improves physical coordination. The teacher at a local middle school asked that a set of stairs be developed for use in her classroom. Though the device was designed to meet the needs of a particular child, it was also intended to be used by many children. For this reason, in addition to being stairs, the device also has a ramp attachment. In addition to performing a function, the device also had to be safe, attractive and store compactly.

The design produced is shown in Figure 4.7. In the extended configuration it is a stable set of five stairs with handrail. The stairs are easily collapsed into the stored configuration occupying approximately a third of the extended floor area.

SUMMARY OF IMPACT

The collapsing stairs were successful in meeting their objective. They were found to be safe and effective in providing stair climbing practice as well as practice in ascending an incline. They are also easy to deploy and compact when not deployed.

TECHNICAL DESCRIPTION

The final design has five steps, a folding handrail along one side of the stairs and a stationary handrail around three sides of the upper platform. When extended, the stairs are 81 inches long, and 40 inches wide and 79 inches high to the top of the handrail (40 inches to the top of the platform). When collapsed, the 81 inch dimension becomes 32 inches. A separate ramp, five feet long, can be attached to any of the three lower steps to provide three inclines.

The unit is made from half-inch birch-veneer plywood. The three components of the collapsible stairs move relative to one another on metal slides which are commercially available for that purpose. When the stairs are in the collapsed configuration, they can be easily pushed about on the four coasters which support the main structure. The cost of building the unit was about $800.

Fig. 4.7. Stairs and Ramp Unit Opened and Closed.

Mobility Walker Modification

Designers: Andy Meier, Wayne McCorkle
Client Coordinators: Susan Nix,
Picacho Middle School
Supervising Professor: Dr. R. A. Willem
Department of Mechanical Engineering
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Las Cruces, NM 88004

INTRODUCTION

This design project involves the modification of a walker that assists a disabled student in walking. Originally the walker was purchased to help this disabled student learn how to walk under her own power.

The user is connected to the walker by two adjustable Velcro straps that wrap around the waist and the chest. There is also a small seat on which the user may rest a portion of her weight. This seat and strap configuration is connected to the tubular frame by four metal bars and a spring. There is a bar on the front of the walker for the user to hold onto. Figure 4.8 shows the walker. The modifications to this walker consisted of implementing a braking system that would not only retard the forward movement of the user, but also make the turning more difficult. Also, in order to accommodate the user more comfortably and allow for future growth, an improved adjustment technique needed to be devised.

SUMMARY OF IMPACT

Once the student is secure in the walker, she is free to move about the room as she pleases. At first, the walker seemed to be adequate for the intended use, but real life experience showed there were some shortcomings. The physical therapist recommended that some rolling resistance be added to the walker in order to increase the leg strength of the user. The second problem was in support of the user. While the whole support mechanism moves up and down, it was not adequate for the clients height. In addition, the original geometry of the support mechanism was not totally adequate. In the original setup, the user simply had to lean forward a great deal in order to achieve motion. This detracted from the entire purpose of the machine.

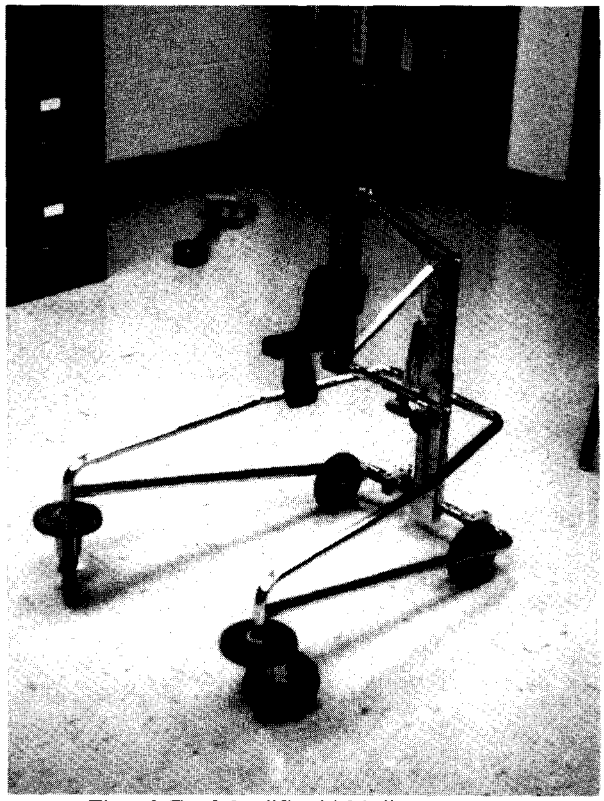

Fig. 4.8. Modified Walker.

TECHNICAL DESCRIPTION

The modifications were made with our particular client in mind, but also so the walker would be suitable for other users. Some working constraints for this design were:

- no addition could be a permanent fixture,
- no addition could look like it was not original equipment,
- the addition had to function well and be safe..

In response to the first problem, a braking system was developed. The system consists of two aluminum brake pads that rub against the rim of each rear wheel. Each pad pivots about a bolt in an extension arm which is connected to the frame by a mounting bracket. This shown in Figure 4.9. The brakepads have a hole near the top in which a small diameter cable is attached. Each cable then extends a few inches towards the middle of the walker where it attaches to a spring. The springs act to reduce the sensitivity of the adjustment mechanism. The other ends of the springs are connected to another set of cables. These cables are then connected to the shaft of a worm gear. The worm gear has an adjustment knob that can be turned to the left or the right to either add or reduce the amount of friction on the wheels.

The second aspect of the modification of the walker involves changing the geometry of the support mechanism. The straps, spring, seat, and connecting bar were all interconnected by a 13" piece of C-channel. The geometry was altered by replacing the C-channel by a similar piece that is 21" long. In addition, the channel has a slot milled in the middle where the straps and seat are bolted in. The slot allows the height of the seat to be changed simply be loosening the bolt, readjusting the heights of the respective pieces, then retightening the bolt. This change in the support keeps the user in a more upright position.

The total costs for this project total $289.

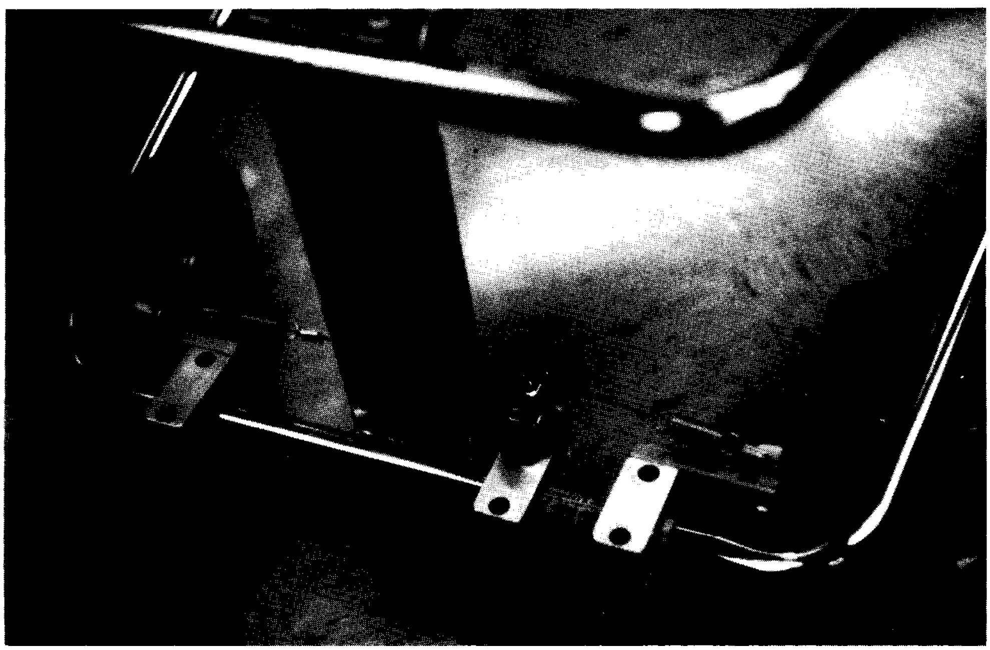

Fig. 4.9. Braking System.

Squeeze Device for an Autistic Child

Designers: Bak Tan, Frank Tavares
Client Coordinator: Marian Dawson,
Hermosa Heights Elementa y School
Supervising Professor: Dr. R. A. Willem
Department of Mechanical Engineering
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INTRODUCTION

A squeeze device, i.e. a device for applying pressure to an autistic child's body in order to relieve aggression and to stimulate a sense of affection, has been designed. The device consists of a pressure wrap, a hammock, and a frame. The frame is a rectangular structure with rings connected in each of the upper corners to support a hammock. The pressure wrap is made out of canvas with a tire tube sewed into a pocket. Velcro strips and belts help hold the wrap closed. The child is wrapped in the pressure wrap and then placed in the hammock. The child is held in the hammock with another belt. Pressure is applied to the child by a foot pump under adult supervision. The unit is portable through the use of lockable wheels.

SUMMARY OF IMPACT

Many observers have reported that children raised in institutions from birth fail to thrive unless they receive cuddling. Research has shown that tactile and kinesthetic stimulation has a beneficial effect on premature infants. An autistic child lacks social skills and therefore refrains from physical contact with other people. The squeeze device was designed to simulate a sense of affection. It applies pressure to the subject's torso, thereby simulating a hug or an embrace. The stimulation that the squeeze device provides are an invaluable therapeutic tool for individuals to apply soothing pressure and an embracing simulation.

TECHNICAL DESCRIPTION

The squeeze device was designed with one autistic child in mind, but adaptable to others. The main design criteria of the squeeze device are given as follows.

- The device must be safe and compact due to limited classroom space.
- The device must be transportable because it will follow the child to high school.
- The device had to meet the objective to simulate a sense of relief and affection.
- The device must support the child in the prone position and be adaptable to different children.

The squeeze device has three main components, the pressure wrap, the frame, and the hammock. The frame is a rectangular structure constructed out of 3/4" galvanized pipe and joined at the comers by pipe fittings with set screws. Connected to the corners of the frame are metal rings. These support the hammock via nylon rope. The rope is tied to the hammock through the grommets in the canvas. Lockable wheels are located on the bottom of the frame to allow for mobility and stability when necessary. The frame is wrapped in foam rubber pipe insulation to make it safer for child use.

The pressure wrap is made out of canvas. It is 60" long and 24" wide. Three Velcro straps, 26" long and spaced 3" apart are sewn to the canvas to hold the wrap in place. Two belts 60" long are added for additional security. A 10" x 10" x 24" pouch is sewn in middle of the wrap to house the air bag. A motorcycle tire tube was used in this case. The stem extruded through a 1/2" hole in the back of the wrap and was taped to prevent it from falling back through the hole. Tests of the pressure wrap, hammock, and frame support ability were implemented. One design modification was to increase the pressure wrap size. The frame and hammock held without any signs of failure for loadings that we do not expect the children to apply.

The final cost of the autistic child squeeze device was $438.

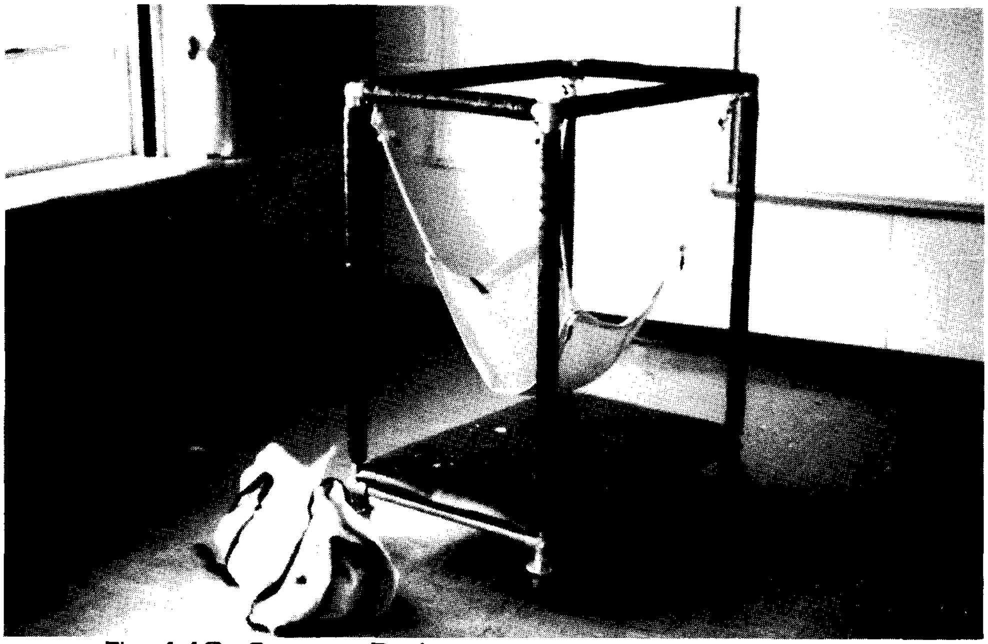

Fig. 4.10. Squeeze Device.

Redesigned Walker
A Walker for a Young Girl

Designer: Patrick Romero
Client Coordinator: Susan Nicks,
Picacho Middle School
Supervising Professor: Dr. R. A. Willem
Department of Mechanical Engineering
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INTRODUCTION

A walker has been modified for a physically impaired student at Picacho Middle School in Las Cruces, NM. The walker components consist of a main unit, adjustable forearm pads, and four adjustable leg extensions. The entire unit folds, making storage and transit of the unit convenient.

SUMMARY OF IMPACT

The student for whom this walker modification was developed suffers from arthro gryposis muliplex congenita. This condition severely limits her ability to bend many of her joints and thus limits many normal body movements. To walk she needs support as her legs are not strong enough to support her. Her elbows are in the bent position preventing her from using a traditional walker the way it was intended to be used. When she tries to use such a walker she must assume a "hunchback" position which shifts most of her weight toward the rear of the walker creating a possible dangerous situation. Because she is unable to grip with her hands, this adds to the danger of the situation. The therapeutic benefits of the walker designed for her are multiple. She is able to walk with a very small amount of supervision, boosting her self confidence and sense of self-reliance as well as exercising her legs and arms. She is also able to interact with her environment more. The Client Coordinator for this project, Susan Nicks, was very pleased with the results.

TECHNICAL DESCRIPTION

The final design of the project consisted of modifying a traditional walker. In the design, the height of the walker was increased primarily in the rear by using longer adjustment legs and modifying them to fit the walker. This leveled the walker height and straightened up the client's back posture, moving the center of gravity toward the center of the walker. Also, arm pads were then placed on the top of the walker, providing the client with more comfort in walking.

Commercially available legs (1" i.d. x 14") were purchased and modified by drilling larger holes where the adjustment pins go. In the design of the arm pads, aluminum plate (.125 in.) was used. This material was bent to form a shallow cylindrical trough in which longitudinal slots were cut to make the arm pads adjustable. Each arm rest, after upholstering, was attached by two carriage bolts (3/8" x 1.5") and lock nuts. The total cost of the project, excluding the cost of the walker, was about $55.

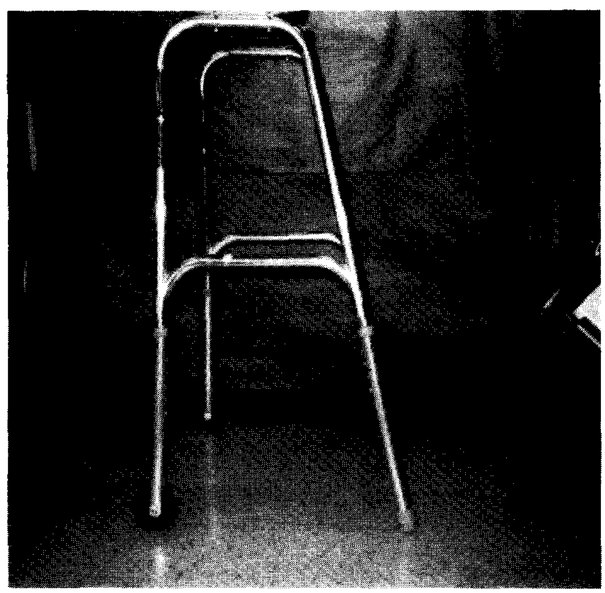

Fig. 4.1 1. Walker After Modification.