CHAPTER 15

UNIVERSITY OF AKRON

College of Engineering
Department of Mechanical Engineering
Akron, Ohio 44325-3903

Principal Investigator

Paul C. Lam (216) 972-7741

Tilted-Sliding Container An Adaptive Blood Vial Assembly Device for the Cerebral Palsy Patient

Designers: Marshelle Nuspl, Donna Oswald and Melinda Csaky
Disabled Coordinator: Norma Henson, United Cerebral Palsy and Services for the Handicapped of Akron (UCPSH)
Supervising Professor: Dr. Paul Lam
Department of Mechanical Engineering
University of Akron
Akron, OH 44325-3903

INTRODUCTION

The focus of this project is to design a tilted-sliding attachment container (figure 1) to assist a particular cerebral palsy client in assembling plastic 2.5 cc blood vials for medical use. The assembly consists of inserting a plastic disk inside the vial to act as the bottom seal for the blood chamber. In the design of the attachment container, several factors are considered. The first concern is that the control mechanism has to be simple to manipulate because the user has less than average manual dexterity and muscle coordination. Another consideration is that the container can slide to various positions providing easy access for the client.

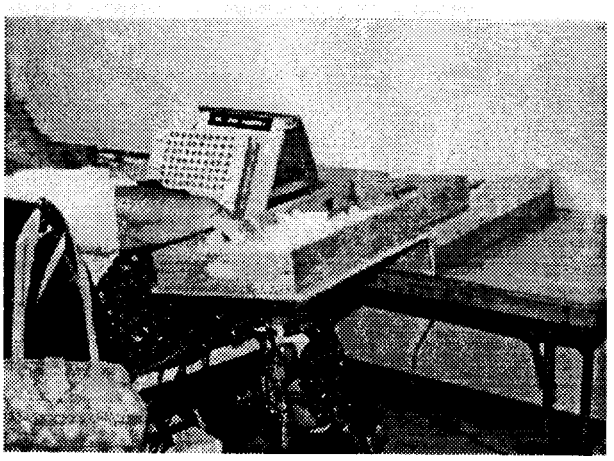

Fig. 1. Client at Work

This is due to the positioning of the client who is seated at a specific distance from the table. The final consideration in the design of all components addresses sturdiness as well as safety of the operation of the mechanism. While sitting in a wheelchair, the client with limited motor co-ordination can use the device to assist the blood vial assembly process.

SUMMARY OF IMPACT

A tilted-sliding container (figure 1) is designed to help a cerebral palsy client in the blood vial assembly process working environment. Before the development of the container, the client depended solely on the United Cerebral Palsy coordinator to place and adjust a cardboard box filled with vials according to the needs of the client. This process not only tied up the coordinator's time, but also decreased the amount of output work done by the client. In addition, the limitation of the client's reach interfered with a satisfactory assembly process. For example, the previous arrangement lacked consistency:

1) the angle of the cardboard box varied throughout the working period
2) the cardboard box could only be pulled out to a certain position before collapsing
3) the cardboard deformed due to the lack of motor coordination on the client's part.

Because of the development of the tilted sliding container, the client's efficiency in the production process increases. The tilted design permits the vials to fall to the closest position for the client's accessibility. Also, the sliding design allows the client freedom of movement in and out of the work station. The total process can be handled independently by the cerebral palsy client.

TECHNICAL DESCRIPTION

The project consists of two developmental phases:

1) angled base/track design
2) sliding container with switching mechanism.

The base is constructed with three triangular shaped 2"x4" wedges that support the metal track and the slotted cover. The three wedges are distributed evenly under the top and side covers that are made of 1/2" plywood, with the angle of incline of the top being approximately 8.3". The bottom assembly is shown in figure 2. The 3/4"x2"x30" right angle aluminum tracks are simply attached by wood screws to the side covers of the base, leaving a 1/2" gap for the container to slide through. Finally, a 1-1/2" wide slot is cut 20" from the back of the base. This assembly is shown in figure 3.

A switching mechanism is pinned to the back of the container, serving as a restricting or releasing device. To limit the extension of the container, the switch is placed in a vertical position thus allowing the container to be pulled out a maximum distance of 20".

The switching mechanism and the fully extended container is shown in figure 4. For reloading purposes, the switch rotates into a horizontal position that permits the container to be completely removed. The configuration of the container is shown in figure 5. The entire tilted-sliding container is bolted into a workbench (figure 6) where the client can effectively perform the blood vial assembly process as part of the regular UCPSH workshop task. Excluding machinist's time, the entire unit costs less than seventy five dollars ($75) to build. Detailed drawings of the tilted-sliding container can be obtained from the principal investigator.

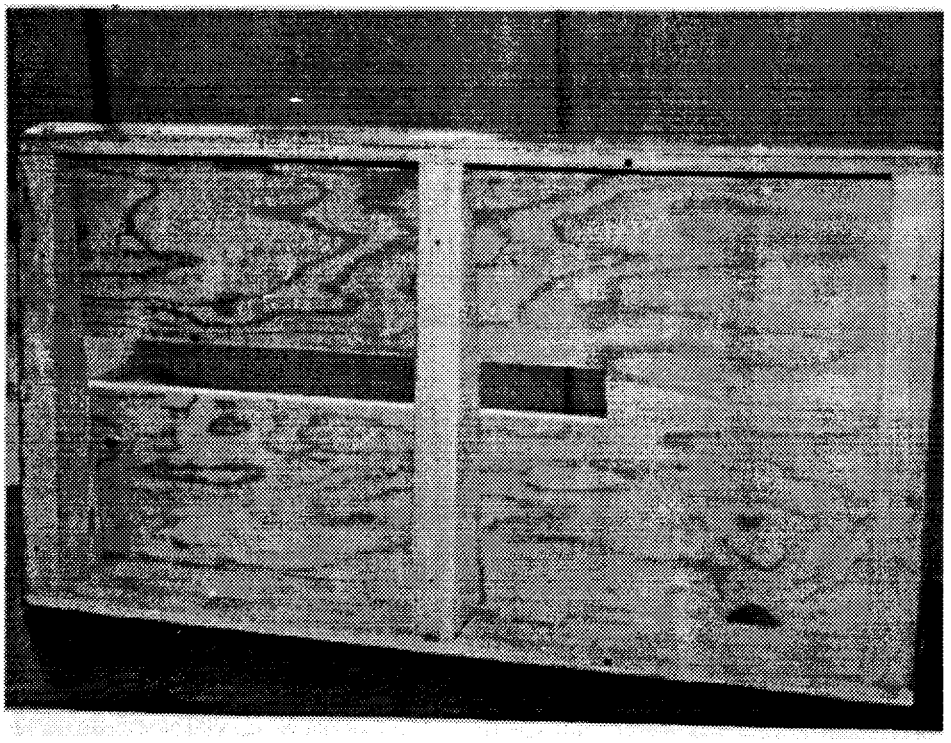

Fig. 2. Bottom of Support Structure

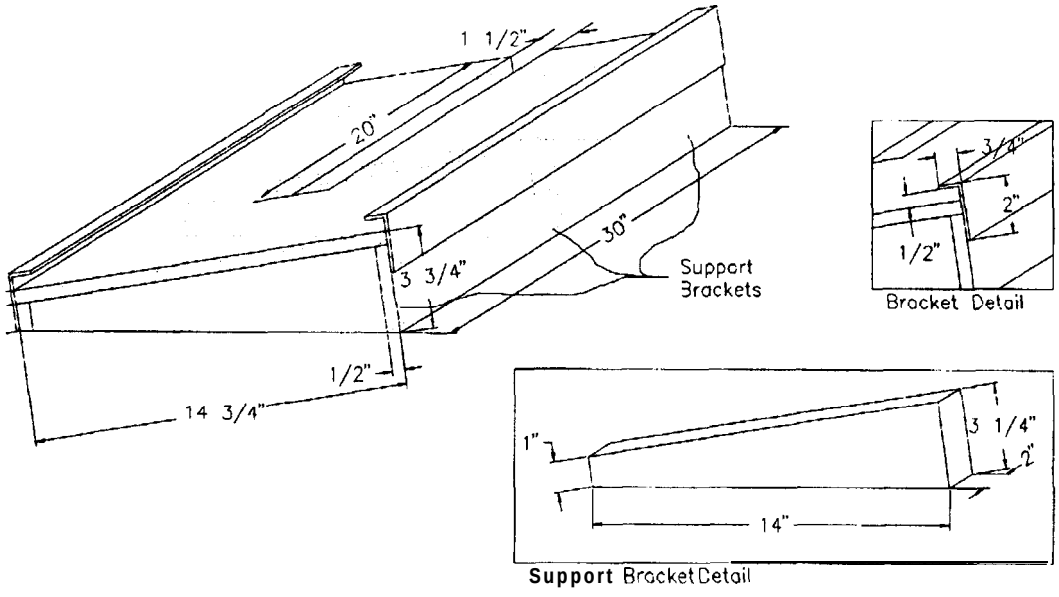

Fig. 3. Angled Base/Track Assembly (front view)

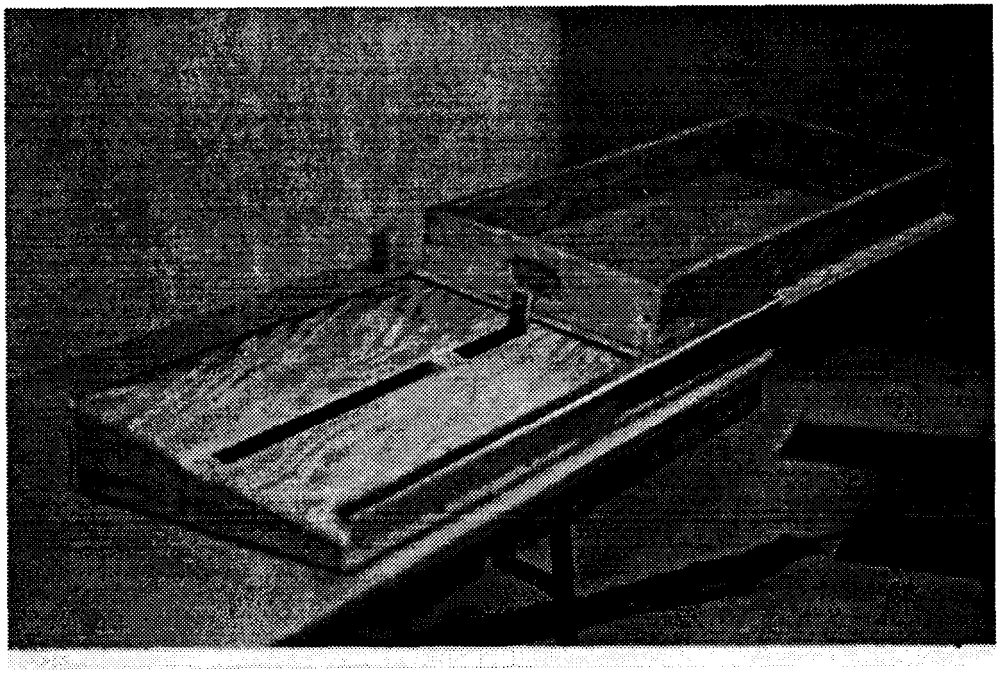

Fig. 4. Container in Full Extension

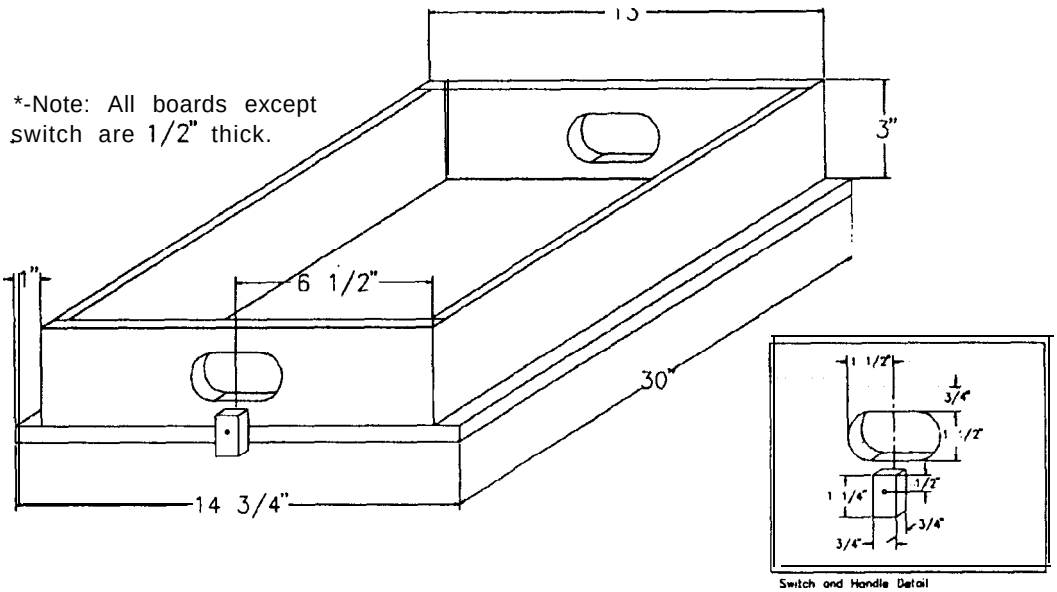

Fig. 5. Sliding Container **(rear view)**

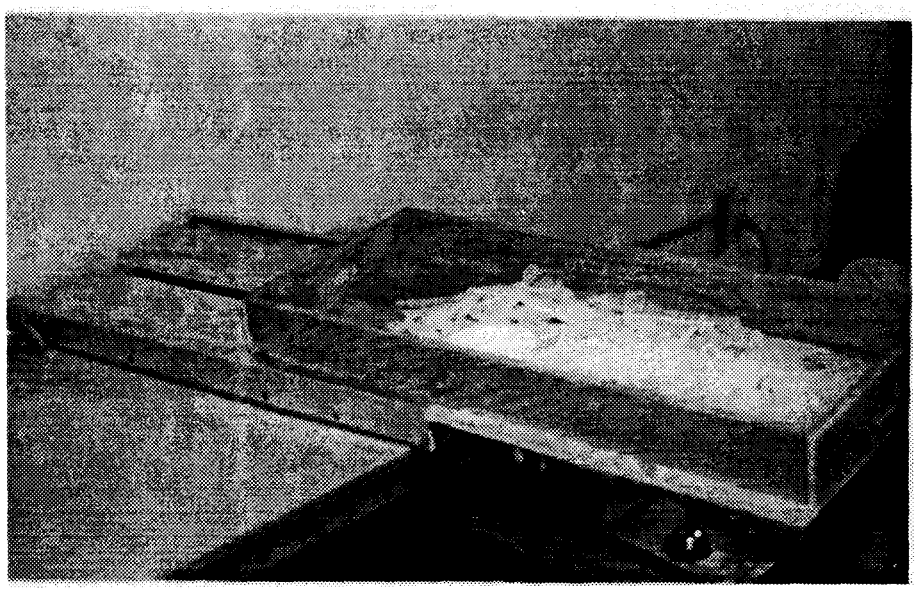

Fig. 6. Final Assembly

Foot Oriented Assembly Unit
An Adaptive Blood Vial Assembly Device for the Cerebral Palsy Patient

Designers: Marshelle Nuspl, Donna Oswald and Melinda Csaky
Disabled Coordinator: Norma Henson, United Cerebral Palsy and Services for the Handicapped of Akron (UCPSH)
Supervising Professor: Dr. Paul Lam
Department of Mechanical Engineering
University of Akron
Akron, OH 44325-3903

INTRODUCTION

The objective of this project is to design an adjustable blood vial assembly unit (figure 1) to assist a particular cerebral palsy client in assembling plastic 2.5 cc blood vials using her foot. The assembly consists of inserting a plastic disk inside the vial to act as the bottom seal for the blood chamber. By holding a suction tube with her toes, the client lifts a white disk and inserts it into a blood vial, which is then emptied into a container. In the design of the foot oriented work station, the following factors are considered:

1) the client only has manual dexterity and muscle coordination with her feet,
2) the work unit must be adjustable, both in height and incline, to accommodate the client's specific comfort position,
3) the separation of the vials from the suction tube needs to be easily accomplished.

While sitting in a wheelchair, the client with only foot motor coordination will easily be able to use this device to assist in the completion of her assignment.

SUMMARY OF IMPACT

An adjustable foot oriented work station (figure 2) is designed to help a cerebral palsy client in the blood vial assembly process working environment. Prior to this design, the cardboard base had a tendency to collapse when subjected to the weight of the client's foot. Because of this weakened condition of the cardboard stand, the white disks and vials could not be contained. Thus, an UCPSH coordinator was often needed to assist the client throughout the assembly process by collecting the disks and vials.

This adaptive device has the following advantages:

1) the assembly process can be accomplished independently by the client,
2) the adjustable height and incline of the unit allow the client to perform a diversity of tasks in the UCPSH workshop,
3) a thin metal plate attached to the box at a specific height enables the client to separate vials from the suction tube,
4) early testing of the device indicates a decrease of error resulting in a much higher level of production.

The new model is simple but practical and the hardware used is readily available should repairs be necessary. Also, this work station is easy to implement and is cost effective.

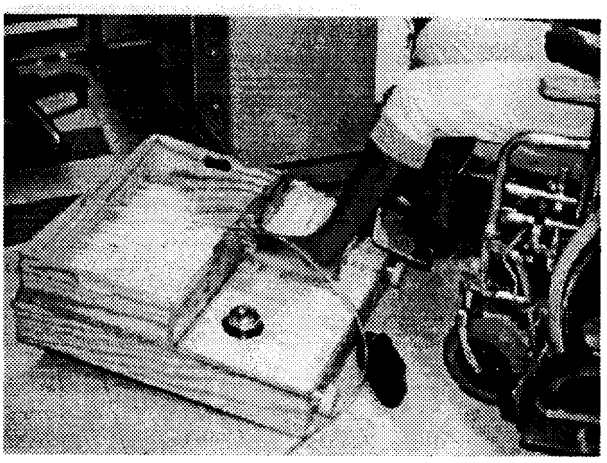

Fig. 1. Working Model

TECHNICAL DESCRIPTION

The schematic drawing of the foot oriented assembly component is shown in figure 3. A 24"x4-1/2"x26" rectangular base is constructed with 1/2" plywood. To adjust the height and incline, two double X legs are tightened against the front and rear panels of the base using four adjustment knobs with diameter of 2".

The knobs slide through reinforced metal slits allowing the unit to be adjusted in three basic positions: (1) the height ranges from 4-1/2" to 12" above the ground, (2) front tilt can be achieved by raising the rear double X legs, with the maximum angle being approximately 16.8°, (3) side tilt can be accomplished by unsymmetrically placing pairs of adjustment knobs. Ledges (1/4") are glued around the perimeter to prevent the components from sliding.

The removable box, having dimensions shown in figure 3, is placed on top of the base and is constrained between ledges. A 12"x6" aluminum plate is nailed to the center of the front panel of the box to aid the client in releasing the vial from the suction tube.

Excluding machinist's time, the entire unit costs less than fifty dollars to build. Other detailed drawings can be obtained from the principal investigator.

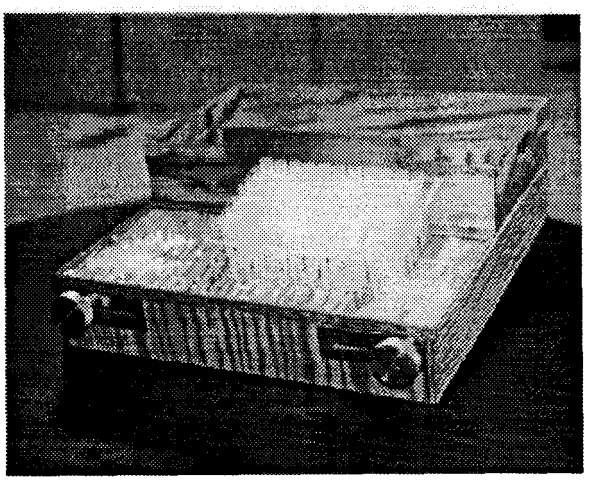

Fig. 2. Final *Unit*

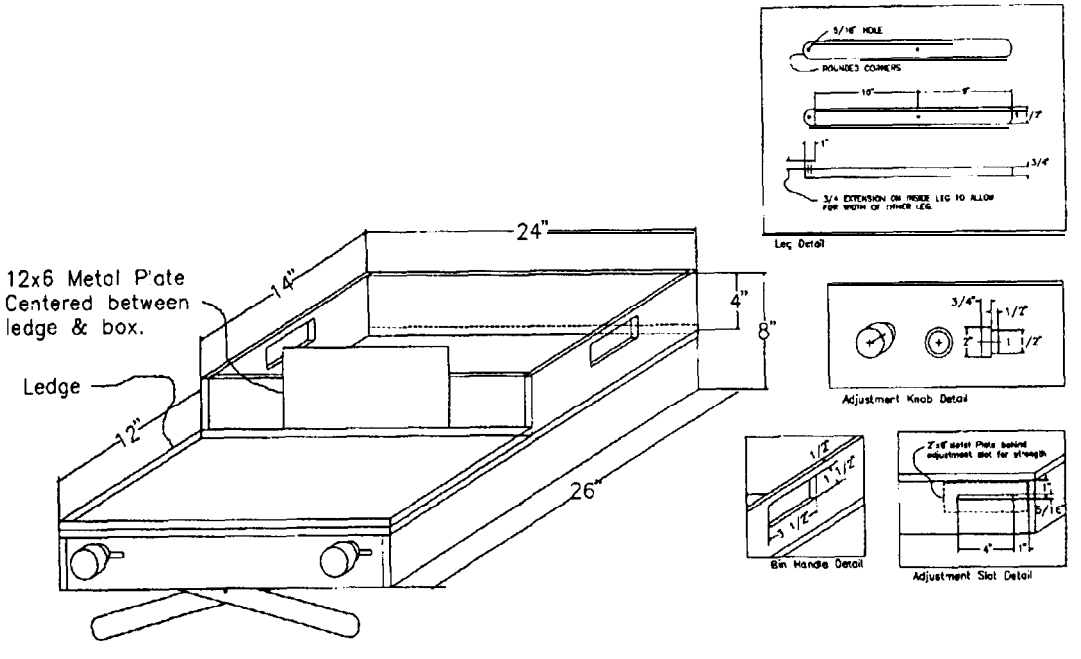

Fig. 3. Foot Oriented Assembly Unit

Adjustable Rotating Silk-Screening Machine An Adaptive Screen Printing Device for the Cerebral Palsy Patient

Designers: Harry Heydorn, Joe Royle and Tracie Neilson
Disabled Coordinator: Norma Henson, United Cerebral Palsy and Services for the Handicapped of Akron (UCPSH)
Supervising Professor: Dr. Paul Lam
Department of Mechanical Engineering
University of Akron
Akron, OH 44325-3903

INTRODUCTION

The UCPSH Center of Akron provides cerebral palsy patients with a variety of work programs to promote community awareness as well as developing independence for the handicapped. The printing of silk screen T-shirts and labels are sub-contract works they received on a constant schedule. Screen printing is a process in which ink is forced through screen mesh openings onto a transfer medium. The procedure is fairly simple and is used commercially for large runs of Tshirts, labels, cardboard notices, and political advertisements. It is also used in the area of printing electronic circuit boards.

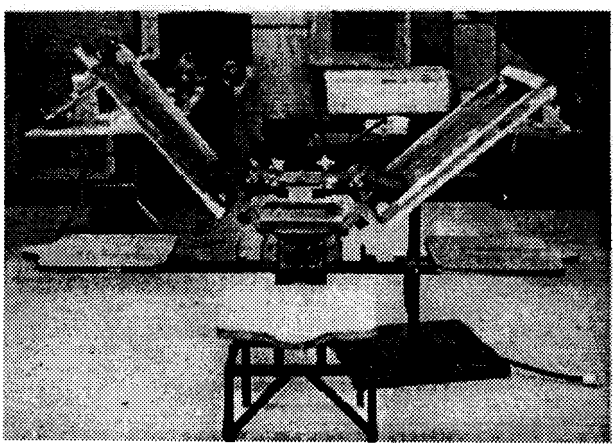

Fig. 1. The Rotating Silkscreen Machine

One of the UCPSH manually operated screen printing machines consists of four standard printing screens and mechanisms that snap textile materials taut and uniformly for single and multi-color printing. The major objectives of this project are:

1) to redesign the base frame of the machine so that it will provide stability during the silk screening operation.
2) to modify the existing rotating silk-screening machine so that the top section of the machine remains stationary preventing the screens from moving simultaneously with the screen supports.
3) to adjust the silk screen support enabling it to move smoothly and lock onto the desired location on the shirt.

The design is to be simple enough so that it is useable by cerebral palsy patients. Safety of all components designed is of primary importance.

SUMMARY OF IMPACT

Due to improper alignment and effects of wear over time, the previous UCPSH rotating silk-screening machine is inefficient and creates many errors for multi-color printing. Also, most of the cerebral palsy clients cannot snap the table and connecting arm on the machine into a precise location during the printing process. The modified rotating silk-screening machine (figure 1) improves productivity of the workshop and eliminates some unstable motions that were inherited from the old apparatus. Also, the quality of printing has improved and the machine is easy to use.

The design is simple but effective, and the hardware used is readily available should repairs be necessary. Many cerebral palsy patients have used this device with satisfactory results. The entire unit

of our rotating silk-screening machine costs less than one-hundred dollars to modify.

TECHNICAL DESCRIPTION

The approach to modify the rotating silk-screening machine is divided into two stages:
1) Design a new base frame to support the frame box, the roller bearing, the four station mechanism arm, and the metal silk screen hold apparatus.
2) To eliminate rocking motion of the four station mechanism arm by reexamining the roller bearing and the bearing plate.

Since only two steel bars are used to support the frame box, the roller bearing, the four station mechanism arm, and the metal silk screen hold apparatus, a large source of the problem that caused the unsteadiness of the machine was the frame itself. The frame box was originally attached to the cross member of the frame by a single bolt that caused the whole top apparatus to sway. New steel members are provided to stabilize the base frame. A 1/4" flat steel bar is cut in a 45 degree angle to provide stabilization of the frame legs. Angled steel is cut and shims are used for the cross members to reduce the rocking effect of the machine. All new members are attached by arc welding. The configuration of the new frame is shown in figure 2.

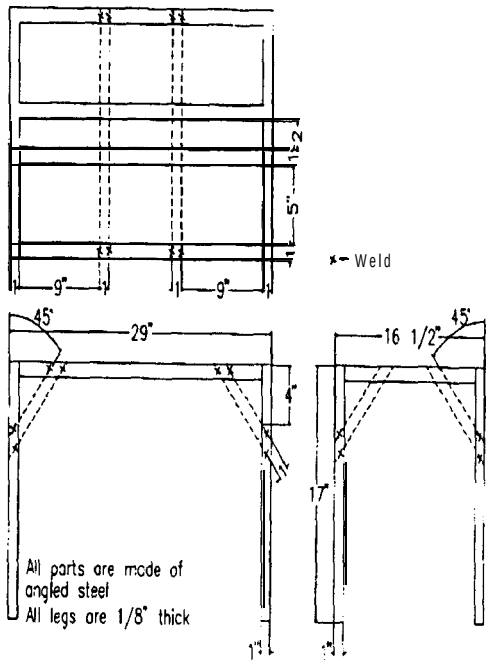

Fig. 2. Silk Screen Frame Design

One of the major problems with the old design is that the connecting arms wobble back and forth during silk screening. This rocking motion is due to a large gap between the bearing and the silk screening holding mechanism. This problem is eliminated by implementing two 1/2" ID steel washers on either side of the bearing.

To eliminate rocking motion due to the gap between the table and mechanism arm, three screws are bolted to the arms and extra washers are used as shims thus stabilizing the table. In the assembly process, a bearing plate is screwed in place to the new improved frame. The roller bearing is bolted into the bearing plate, with the center pin torquing into the proper position. Other components of the machine that are modified are shown in figure 3. Detailed construction of the rotating silk-screening machine can be obtained from the principal investigator.

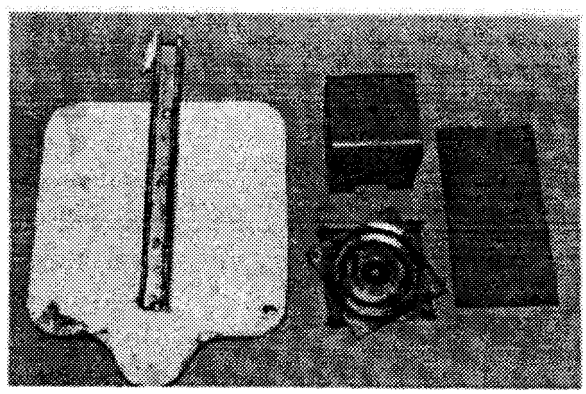

fig. 3. Components of Rotating Silk Screen Machine