CHAPTER 12
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Component Sorting Table
An Adaptive Table for Sorting Electrical Elements by the Cerebral Palsy Client

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INTRODUCTION

The objective of this project is to design two tables each having four work stations in which clients can quickly separate six electrical components of a lucilite bulb. These components range from a plastic disk having a 1/4" diameter to a 1" in length metal wire. Because of the small size of the elements, the sorting process is relatively slow since the pieces have to be placed into containers by clients whose grasping ability and motor coordination is limited. This problem is eliminated by allowing the clients to drop the pieces into six holes that are cut into the top of the table. The individual components slide down chutes and fall into drawers that are suspended underneath the table. During the design process, several factors are taken into account:

- The table had to provide sufficient leg room and wheelchair accessibility in both depth and height, while maintaining a comfortable working level for the client.
- The angle of the chute is also minimized to permit adequate leg room and yet allow the components to slide continuously.
- The position of the holes enables the components to be pulled forward or pushed into the respective holes, depending on the clients' capabilities and/or preferences.
- The table must provide ample support when subjected to the maximum weight of the cumulative elements contained in the suspended drawers.
- The size of the drawers are limited in order to simplify the coordinator's task of removing and emptying the cumbersome load.

The sorting tables are practical and enable the tedious chore of separation to be accomplished more fluently by the client.

SUMMARY OF IMPACT

The component sorting table greatly simplifies the task of separating electrical elements. Previously, the clients were required to manually sort the pieces by picking them up off the table and placing them into cardboard bins, as opposed to simply dropping them into a pocket. The cardboard bins weakened over a period of time causing the components to spill; and because of their small size, the containers often had to be emptied by the United Cerebral Palsy coordinator. The newly designed drawers are sturdy and have twice the volume capacity allowing the clients to depend less on the coordinator. Also, by suspending the drawers underneath the tables, each table provides sufficient work space for four, rather than two, clients. Most importantly, the sorting table eliminates the time consuming burden of having to pick up each piece by allowing the client to slide the components into the appropriate hole. Finally, a smooth plygem panel covers the table to ensure a clean, unabrasive working surface. Since the development of the table, the sorting process can be performed easily by the clients; thus, not only increasing efficiency of the process itself but also relieving the clients of some of the frustration of having to pick up the pieces.

TECHNICAL DESCRIPTION

The component sorting table is constructed of 3/4" plywood having dimensions of 6-1/2' x 3-1/2' and standing 31" in height. The table is divided into four work stations, each station contains a row of six sorting holes with a diameter of 1-1/2". The holes are placed 6" from the edge of the table, and equally spaced over an 18" range (Figure 12.1). The tubular chutes are made of 1-1/4" diameter plumbing line and are attached to the table by wood screws. Based on experimental data, the minimum angle of inclination for the components to slide down the chutes is approximately 30 degrees. The chutes are curved inward to allow maximum leg room while making an angle of 34 degree with the table (Figure 12.2).

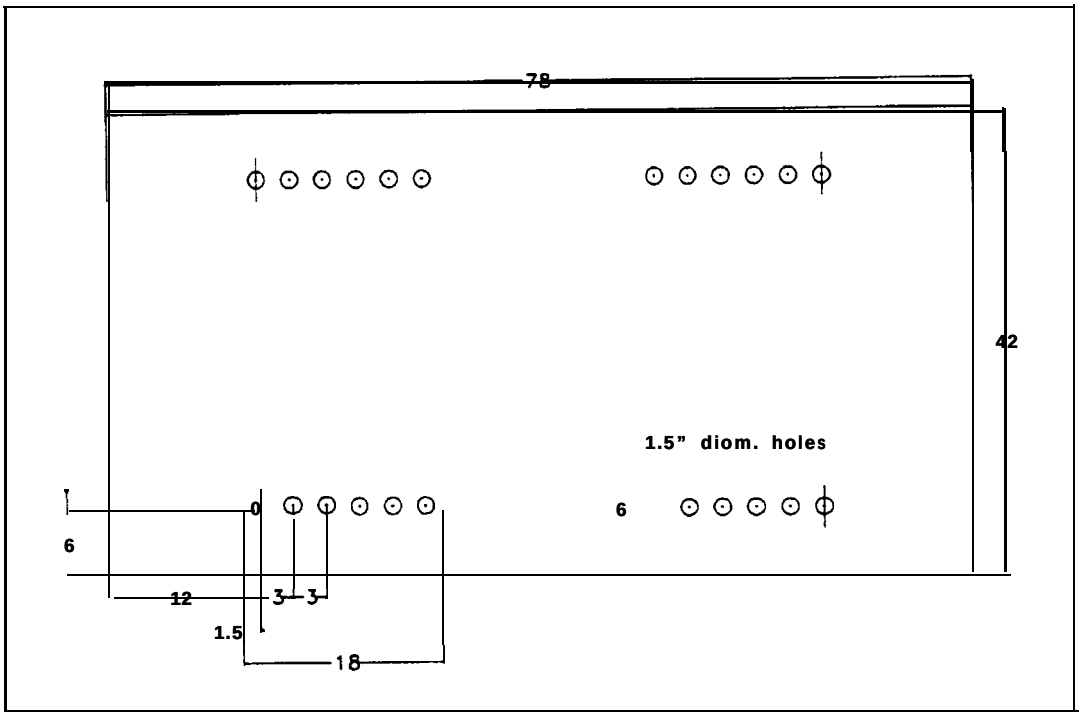

Fig. 12.1. Sorting Table Top View.

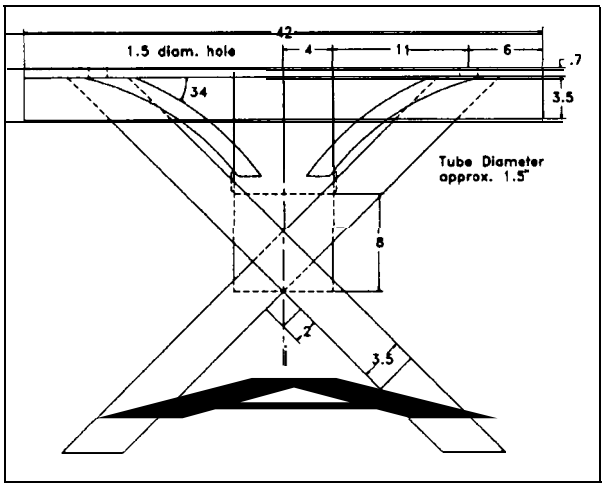

Fig. 12.2. Sorting Table Side View.

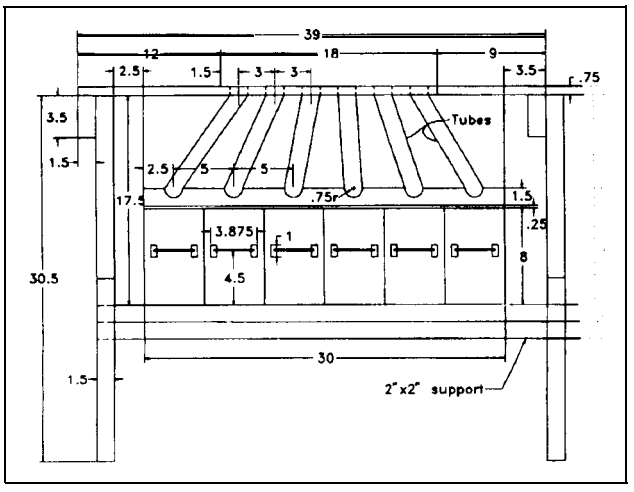

Fig. 12.3. Sorting Table Front View.

Each of the twelve 5" x 8" x 8" drawers are constructed of 1/2" plywood and are suspended by two aluminum slings which are bolted to the table as shown in Figure 12.3. The weight contained by a single drawer ranges from 8 to 25 pounds. One sling holding six drawers will support a maximum weight of approximately 100 pounds. Hanging 17-1/2" below the table, the 8" wide sling supports the chutes by a 1-1/2" attached bracket having six semi-circular holes of l-l /2" diameter aligning the chutes over the appropriate drawer. Three pairs of right angled cross legs are constructed from 2" x 4" premium studs which are stabilized by a 2" x 2" longitudinal support that provides additional reinforcement to the suspended load carried by the aluminum sling.

Excluding machinists' fees, the entire component sorting table unit (Figures 12.4 and 12.5) costs approximately $175 to build. Two units were built. Additional drawings and information can be obtained from the principal investigator.

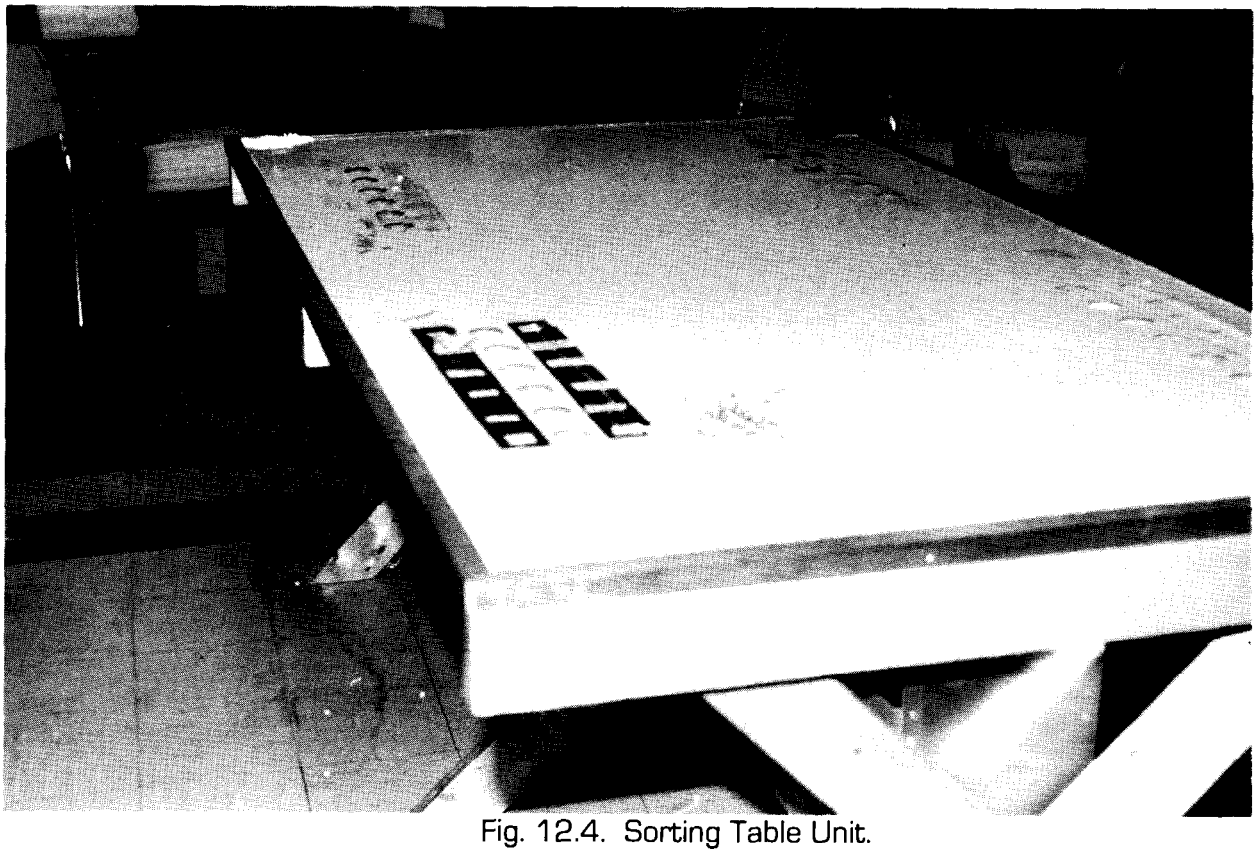

Fig. 12.4. Sorting Table Unit.

Fig. 12.5. Sorting Table Unit With Draws.

Pump Suction Assembly Manufacturing Process for the Cerebral Palsy Clients

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INTRODUCTION

The United Cerebral Palsy Center in Akron provides support services for handicapped clients from Summit, Medina and Portage counties. One of these services is the availability of work projects for the clients so they can experience a feeling of involvement in our society. Assembling plastic 2.5 cc blood vials (Figure 12.6) for medical use is one of the major workshop tasks. The assembly consists of inserting a plastic disk inside the vial to act as the bottom seal for the blood chamber. This seal is dropped inside the funnel-like opening and pressed down the cylindrical cavity with a wood or brass rod. The difficulty is that the user has less than average manual dexterity and muscle coordination when attempting to pick up the disk and place it in the test vials. The focus of this project is to design a pump suction assembly line system to assist several Cerebral palsy clients in assembling plastic 2.5 cc blood vials for medical use.

SUMMARY OF IMPACT

The pump assembly system and lines shown in Figure 12.7 has been used for the past year at the United Cerebral Palsy Center in Akron. Many clients have used the suction assembly system successfully. In particular, the client who only has manual dexterity and muscle coordination with her feet **can now** hold a suction tube with her toes, lift a white disk, and insert it into a blood vial. Because of the pump suction process, many clients have increased their level of productivity by three-fold. This assembly process will provide increased independence for many clients. In addition, this assembly line work station is easy to implement and is cost effective. This summer, some minor adjustments are being incorporated to meet various needs in the manufacturing process.

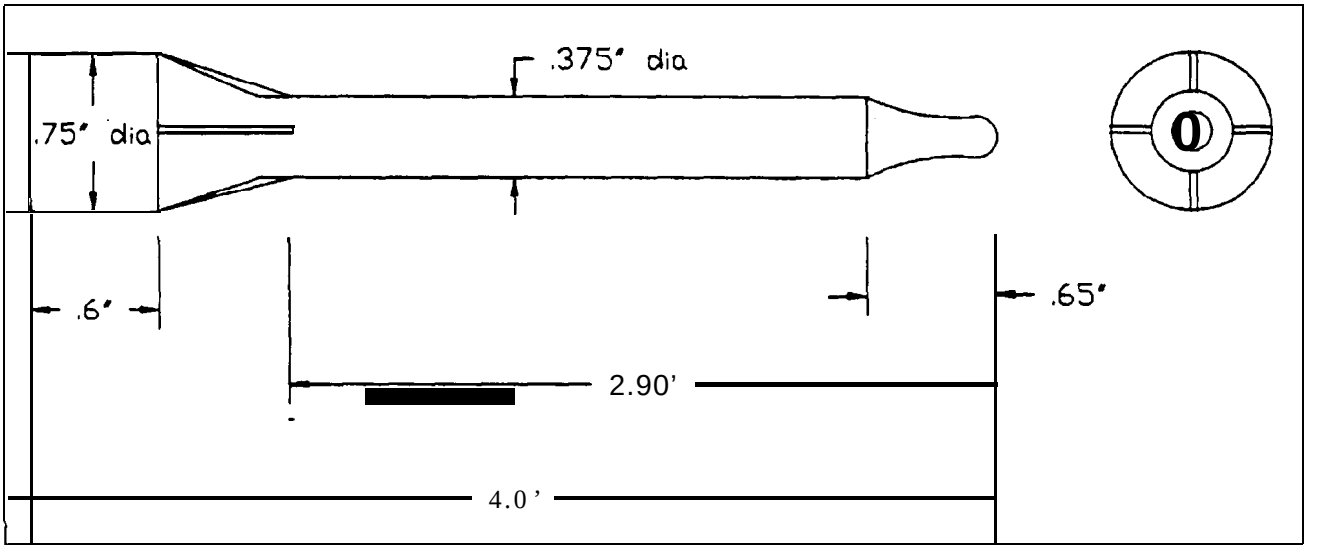

Fig. 12.6 2.5 CC Blood Vial.

TECHNICAL DESCRIPTION

The pump suction assembly system consists of a 1/4 horsepower pump. The main line consists of 1/2 inch PVC plastic pipes. Five individual lines branch from the main line. These lines are 1/4 inch clear plastic tubes that connect to 1/8 inch diameter copper tubes. In the design of the pump assembly system, the following factors are considered:

- A loss of suction exists as the workday progressed.
- A cutoff stitch has to be designed on each individual line such that the suction would release and the vial cannot be lifted from the user.

In selecting the pump size, flow velocities, as listed in the following table in each line, must be calculated. The assumptions made for these calculations are:

- No leakage in the system.
- Copper end was neglected.
- Neglected height difference between connections to main line and work surface.
- Although friction factor decreases with increasing Reynolds' number, a value of .025 was used for lines 4 and 5.

TABLE

LINE	DELTA P (PSI)	VELOCITY (FPS)
1	.0360	23.230
2	.0438	24.368
3	.0771	31.489
4	.1540	45.711
5	.3560	69.452

On the basis of the calculations, a 1/4 horsepower pump was selected. Filters were installed on each individual line, rather than at the pump inlet, to limit leakage in the system. The cost of the project is approximately $650. Detailed plan layout and flow calculations can be obtained from the principal investigators.

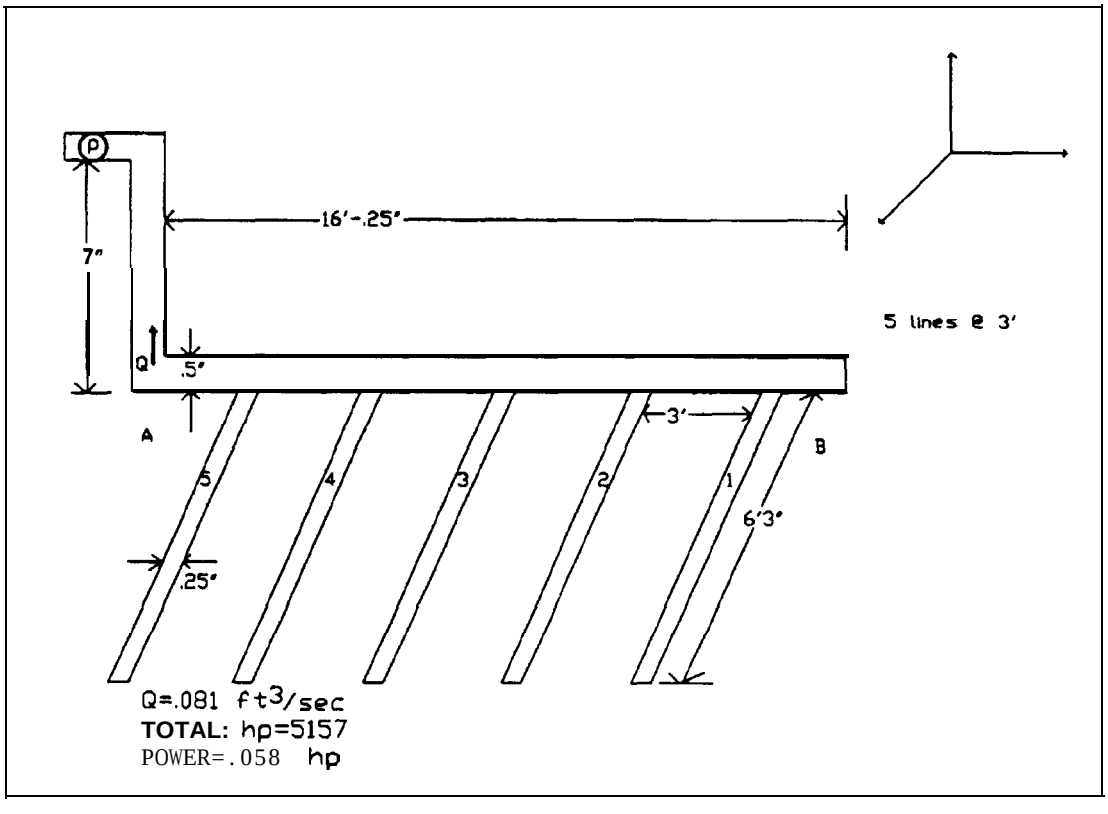

Fig. 12.7. Pump Assembly System and Lines.

Medical Vial Supporting Tray For the Cerebral Palsy Clients

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INTRODUCTION

The focus of this project is to design a supporting attachment tray to assist several Cerebral palsy clients in packaging assembled plastic 2.5 cc blood vials for medical use. The assembly process consists of inserting medical vials into a plastic tray (Figure 12.8). Each tray holds 50 vials. In the design of the attachment tray, several factors are taken into consideration. The first concern is that the jig has to be simple to manipulate because the user has less than average manual dexterity and muscle coordination. Another consideration is that the supporting tray can easily slide in and out of the plastic container. The support brace must be able to be removed after all the plastic vials have been inserted into position. The final consideration in the design of the unit addresses sturdiness of the operation of the supporting tray.

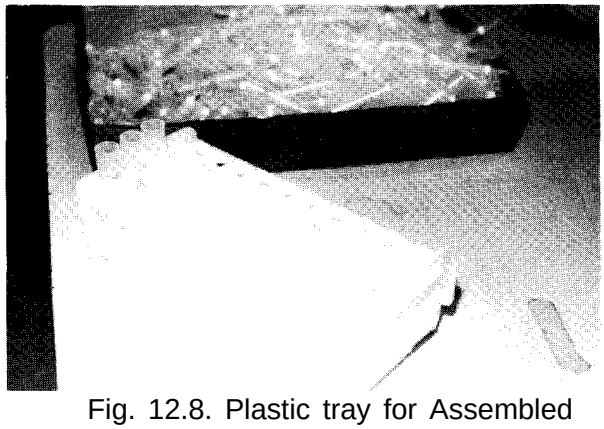

Fig. 12.8. Plastic tray for Assembled Medical Vials.

SUMMARY OF IMPACT

The supporting attachment (Figure 12.9) is designed to help several Cerebral palsy clients in the medical vial assembly process working environment. Before the development of the tray, many clients could not perform the simple task of inserting vials into the plastic tray. Due to the lack of motor coordination on the client's part, they usually ended up destroying the plastic flexible container. With this device, the assembly process becomes very effective and increases the amount of output work done by the clients (Figure 12.10). Also, the clients do not depend as much on the United Cerebral Palsy coordinator to adjust their plastic tray. The total process can be handled independently by the Cerebral palsy client.

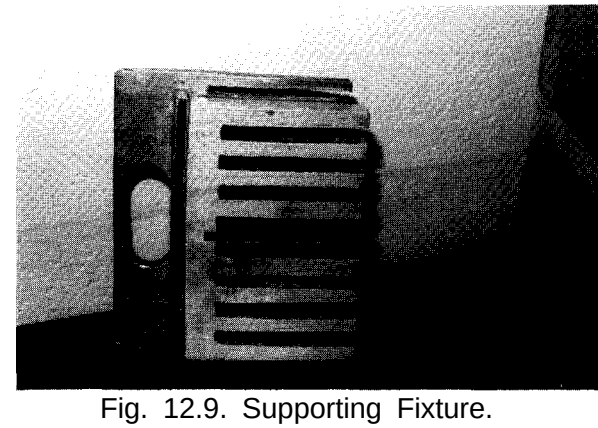

Fig. 12.9. Supporting Fixture.

Fig. 12.10. Client at Work.

TECHNICAL DESCRIPTION

The top and bottom views of the supporting brace are shown on Figures 12.11 and 12.12. Since the vials are placed in straight rows, the design needed to be some type of a "fork-like" layout. A 8.3" x 5.3" top rectangular base is constructed with 1/2" plywood. The bottom base is constructed with a handle so that the supporting tray can easily slide in and out of the plastic container. The entire unit costs less than ten dollars to build. Three support braces were manufactured and have been used by the clients for the past year.

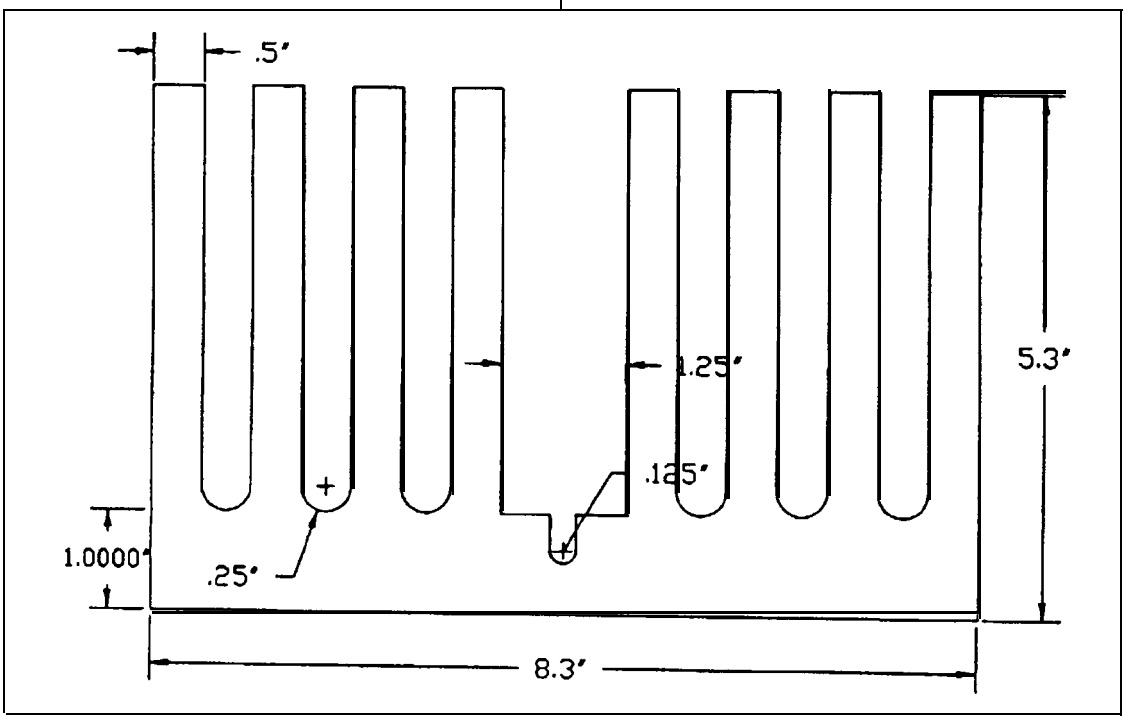

Fig. 12.11. Top View of Supporting Tray.

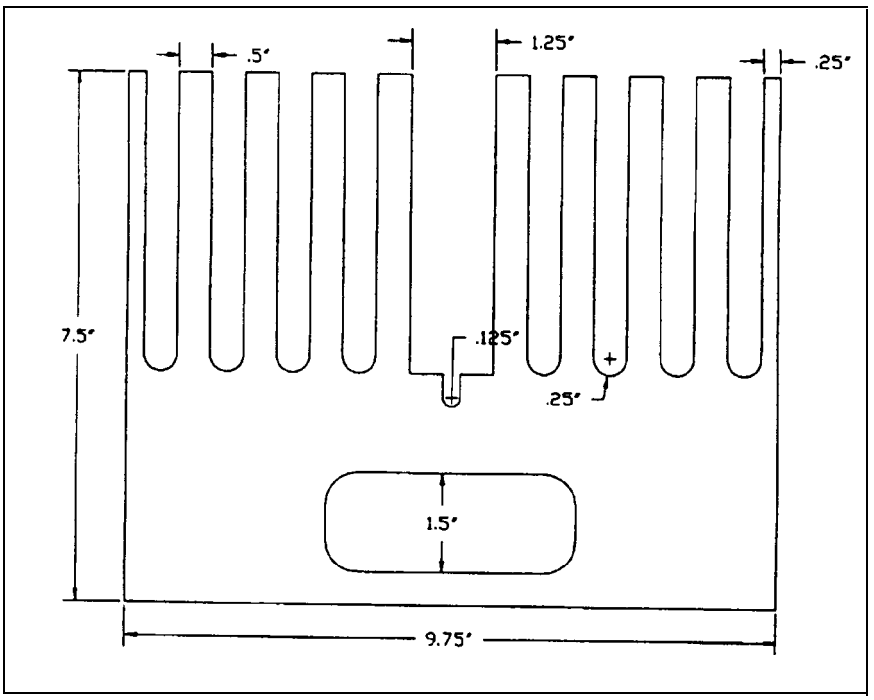

Fig. 12.12. Bottom View of Support Brace.