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Master of Fine Arts

MetroMax:
A Multifunctional Storage Unit Furniture Design

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Introduction

It's hard to say when human beings discovered the need for furniture; it is equally difficult to find out when the first piece of furniture was made. However, we do know that furniture has long been a substantial part of human daily life. Well designed, or say, adequate furniture can always reduce the tenseness and increase the convenience and comfort in everyday life, and thus make our life to be more enjoyable.

Furniture design has been one of my favorite subjects for some time. To me, the first thought of this project originated in my own life experience.

Fifteen years ago when I was a senior high school student, I wanted to purchase a new shelf for my increasingly crammed books and other personal belongings. The ideal shelf in my mind was a kind of shelf with a certain degree of "flexibility" so that I could install it into my small room easily. It had to be flexible enough that I could rearrange it whenever it

was necessary. However, I couldn't find one.

Before I came to America, my wife and I had spent a great amount of time on planning the furnishings of our new home. We decided to obtain most of the furniture from the stores instead of hiring a carpenter to make cabinets and other things for us as most of the other people in Taiwan usually do. Our new apartment was small, therefore the furniture we were looking for was compact in size. We hoped that we would be able to easily manipulate the furniture, especially the cabinets, for our future needs. Unfortunately, none of the things we found in the stores met our goal.

The problem we had encountered does not stand alone in Taiwan, especially in the city of Taipei. Taipei has the largest population in all of Taiwan. The common residential space is tight. The same situation exists in many other countries such as Hong Kong and Japan.

Consequently, I was compelled to choose "mul-

multifunctional storage unit furniture” as the subject of this project. In the first chapter of this thesis, I will define the problems of inappropriate storage furniture, and the specific task and requirements of multifunctional storage unit furniture. During the early stage of concept development, I had developed two preliminary concepts. These two concepts, the form development, and the final concept will be described in the second chapter. In the third chapter, in addition to depicting the dimensions, shapes, and operating procedures of the major components, the colors as well as the main features will be described. Then, I will conclude this thesis in the last chapter.

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The Need for A Multifunctional Storage Unit Furniture System

Problems of Inappropriate Storage Furniture

My homeland, Taiwan, is a small island. Its total area(35,535 square kilometer or 13,720 square mile) is smaller than that of New York State(122,763 square kilometer or 47,379 square mile). There are more than twenty million people that dwell on this island. The population density is as high as about 590 persons per square kilometer and 2,400 persons per square kilometer of cultivated land.¹ Under the pressure caused by the high population density, the cities in Taiwan are very crowded. Naturally, most of the people who live in the cities live in small houses or apartments. As a matter of fact, insufficient living space is becoming a problem to many people in many crowded cities around the whole world.

People who have little residential space can not

¹Republic Of China 1992 Year Book (Taipei: HILIT Publishing Company Ltd., 1992)

afford to have a separate piece of furniture for every purpose. Otherwise, their houses would become warehouses for furniture, not homes for people. No matter what size their home, people are likely to have the same demand for all sorts of things to meet their desire for a pleasing life. As a result, it is quite common for people to feel as if they were being “flooded” with objects.

Proper storage furniture offers people an efficient way to organize their possessions. We will define “proper storage furniture” later in this chapter, but before that, let’s discuss several problems that may be caused by inappropriate storage furniture.

1. Each member in a family has his or her own hobbies and activities, requiring a variety of possessions and equipment, such as books, computers, stereos, fishing rods, and cameras, just to name a few. Where should they be placed? How should they be organized? It is unrealistic to expect that single or fixed function storage furniture can achieve the goal of storing everything needed, as the aspects for

every equipment are different.

2. For people who live in cities, moving is normal. Especially for those who rent houses or apartments, moving is almost inevitable. The interior space will change after they move. To reinstall their old furniture into the new space, some modification may be necessary. However, if the furniture does not offer the flexibility for modification, the furniture becomes inappropriate.

3. Heavy furniture can be a strain on people who do their own moving as the heavy furniture is hard to maneuver. Storage furniture for use in a home can be very large. Appropriate furniture should be able to be disassembled and organized as pieces by the users to ease the job of moving.

The Major Functions of Storage Unit Furniture

All the objects needed in a house should be integrated with the usable spaces; hence they no longer ought to be called furnishings but “equipment.”²

In this context, the term “equipment” is something needed for particular activity. Since furniture is certainly needed in a home, it is properly called equipment. However, this does not mean that furniture should be exclusively concerned with efficiency; aesthetics should be equally important to the design of the equipment of a home.

Defined by functions, storage unit furniture can be classified into two groups.³ The first group is for use as open shelving units. It includes:

- (1) closet organizers (for clothing only)
- (2) general purpose shelves as well as space dividers (for books, objects of display, etc.)
- (3) specific purpose storage equipment (for music equipment, computers, etc.)

The second group is for the needs of closeable storage space. It includes:

²Ignazia Favata, Joe Colombo And Italian Design Of The Sixties (Cambridge: The MIT Press, 1988), 6.

³George Nelson, Storage (New York: Whitney Publications, Inc., 1954), 9.

(1) chests (for use with drawers, doors, etc.)

(2) Dressers and file cabinets.

Hooks and hangers can be added onto any of these groups for hanging purposes.

General Characteristics of Current Products

Currently, there are numerous storage unit furniture products on the market. It is impossible for a person to analyze every product and determine its advantages and drawbacks. Even so, a brief and general analysis of the products is still necessary. After performing a general analysis, I found that most of the products have several common characteristics which are essential to storage unit furniture. The following is the list:

(1) The products are designed for mass production. Therefore, the manufacturers are able to reduce their manufacturing cost.

(2) The products are designed for the consumers to assemble by themselves. The benefits for the manufacturers are exemption of the labor cost of assembly, reduction of storage space for stocks, and re-

duction of shipping freight. Thus, the retail prices are more competitive. For the consumers, advantages are lower cost and more convenience in carrying their commodities home from the stores.

(3) Adjustability is a common quality among these products. Under most occasions, users can determine the placement of shelves within a unit. Nevertheless, this kind of adjustability is limited.

(4) The products are expandable. They could be expanded either by adding more components or by acquiring more single units.

However, these attributes are insufficient to solve the problems with versatility, flexibility, and portability as I mentioned earlier. Most of the existing products are not versatile and flexible enough. Once the customers set up a system for some initial purposes, besides adjusting the shelves, to modify the furniture for different needs later would be difficult. A multi-functional storage unit furniture system would be an effective solution to these problems.

The Requisite Conditions

The chart on page 14 describes the requisite conditions that a competent multifunctional storage unit furniture system should meet.

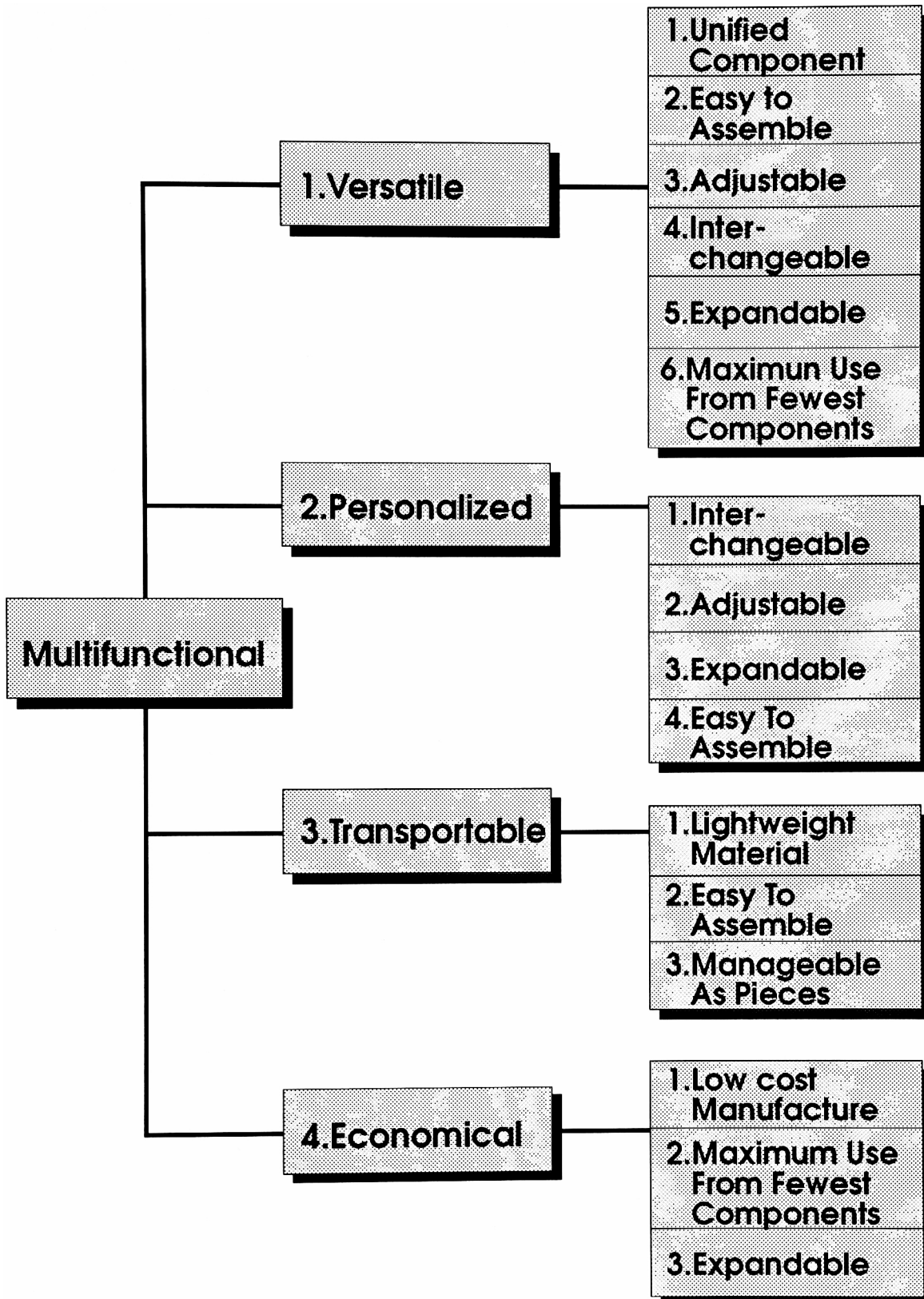


Fig.1-1 Chart of Requisite Conditions

Design Development

Concept Development

There is a great variety of storage furniture already on the market. They all offer solutions for storage problems(needs). However, to avoid repeating what other designers have done and to find appropriate answers to the problems I had defined, I decided to start with the basic concept of storage. I began the concept development with a very basic form of storage—boxes. The word “boxes” here does not necessarily mean a solid box as we usually perceive it, instead, it is more a potential volume.

A box is like a cell. A cell is a complete unit that can perform basic life functions; a group of cells can combine to form different organs. These organs can perform more complicated functions than a single cell does. Like a cell, a box is a complete unit. Nonetheless, it fulfills basic storage needs. It is possible to organize a complex of boxes to perform more complex storage functions as well. However, just

stacking up a pile of boxes would not fulfill the mission of storage. Generating an efficient and elegant way of organizing “boxes” is the real task of this project.

To obtain the maximum flexibility from the “boxes,” I found the need to reduce a “box” into more basic units—boards. A set of boards could be organized into a variety of “boxes.” With these “boxes,” we can build a flexible storage furniture system. Therefore, a simple and handy way to join the boards together would be the key factor to developing a truly versatile storage unit furniture system.

There were two other substantial elements that affect the significant development as well: the manufacturing process and the material. Considering the necessity of light-weight and low-cost, I decided that blow molded polyethelyne would be an appropriate choice.

Based on the idea of “boxes” and “boards,” I developed two preliminary concepts. The following two paragraphs are contributed to describe these

two concepts.

The first concept consists of four types of major components(fig. 2-1). They are L-shape parts, square boards, poles, and stands. The L-shape parts act as side panels. The jointing of one L-shape part with one square board on the top and another square board at the bottom would give us a single shelving unit(fig.2-2). There is one open corner in this unit, the poles could be added to the corner for additional support. The positions of the stands are underneath the bottom unit. To acquire more space between the top and the bottom boards of a unit, the users could stack up several L-shape parts together(fig.2-3). By stacking up the units or arraying them horizontally, the users could build a storage unit furniture system(fig.2-4). The advantages of this concept are:

1. It is economical because it has only four types of components, which could reduce the manufacturing cost.
2. It is expandable.

However, its disadvantages are:

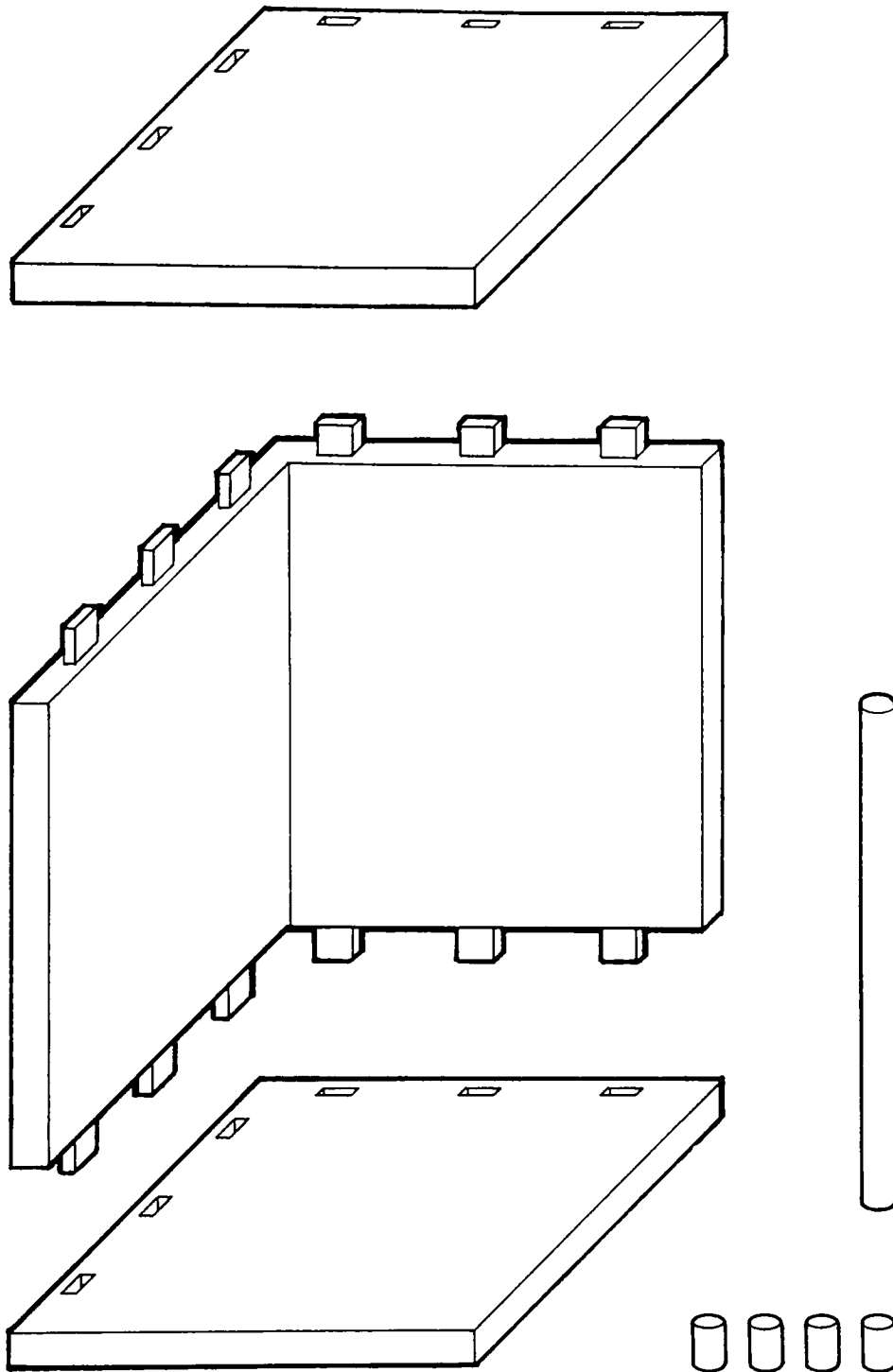


Fig.2-1 Major Components of Concept One

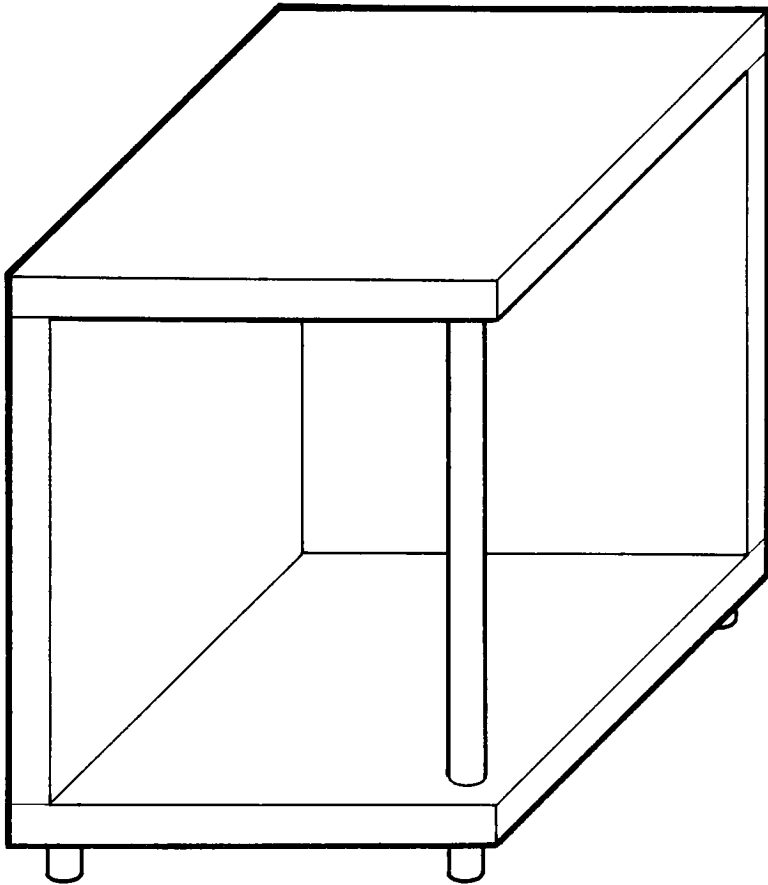


Fig.2-2 The Basic Single Unit of Concept One

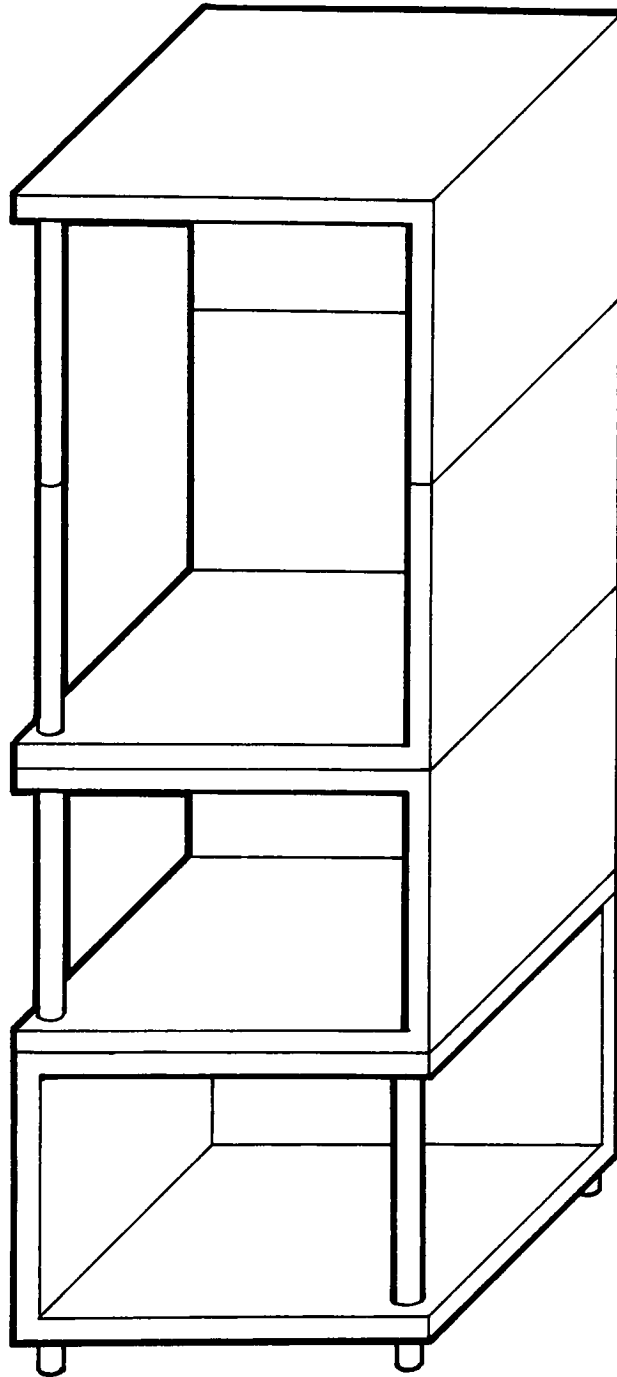


Fig.2-3 Stacking Up the L-Shpaed Part in Concept One

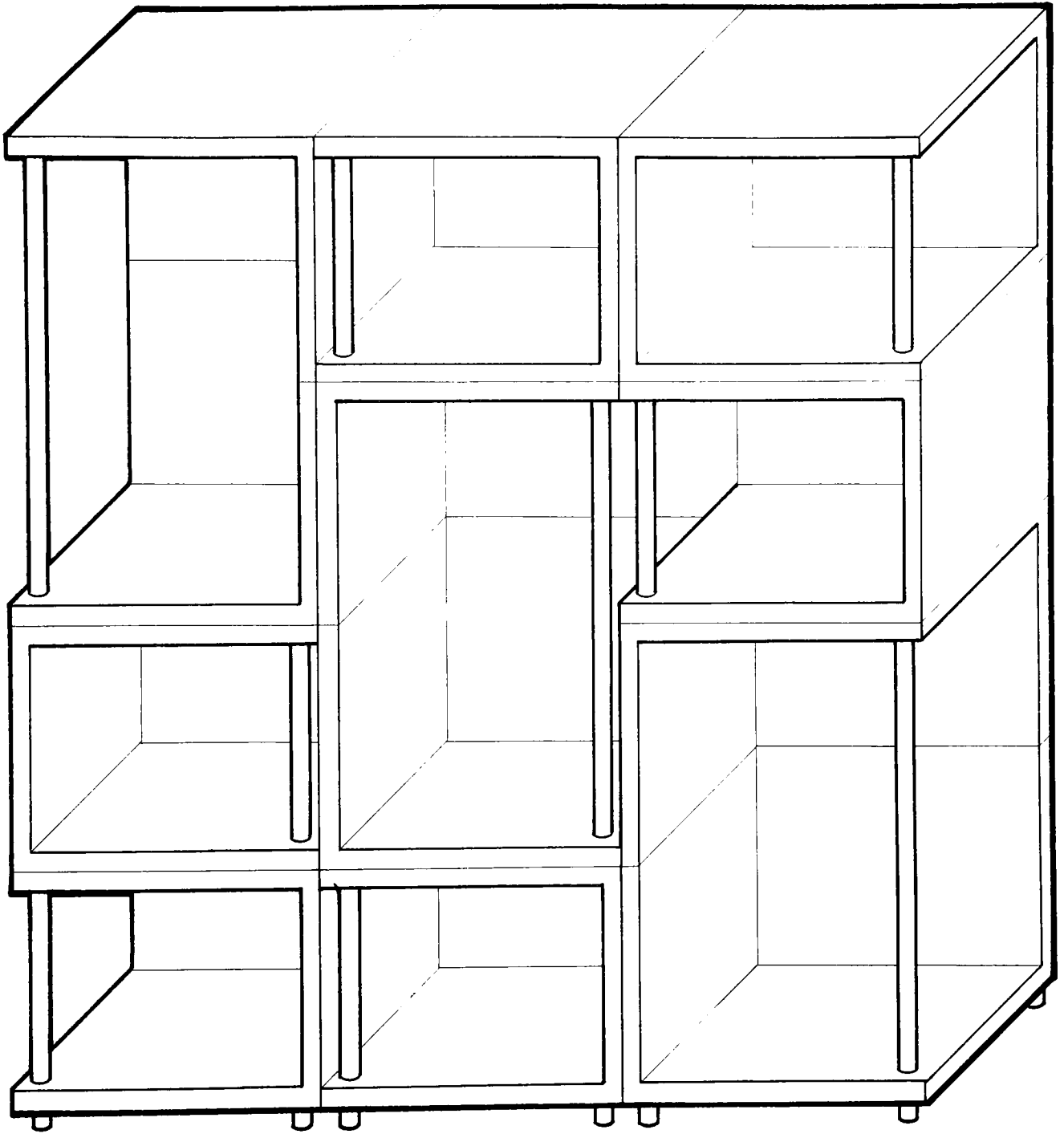


Fig.2-4 Setup Example of Concept One

1. Its adjustability is pretty limited as the only element that can be adjusted is the number of L-shape parts.
2. It is not interchangeable.
3. When it becomes a system, which contains more than one shelving unit, every unit has both the top and the bottom boards. This means that different units can not share the same boards and thus consume more material.

The second concept consists primarily of five types of major components(fig. 2-5): Two are square boards, two are vertical panels, and one is a base. One type of the square boards forms the top of the units. It has three slots along three of the four edges. Each panel has slots on one side. The base has slots corresponding to the top. The procedure of assembling a single unit is simple: First, insert three vertical panels of same length into the base with their slots facing inside. Second, place the square board with slots on top of the panels. Finally, slide the square boards(the ones without slots) into the slots on the

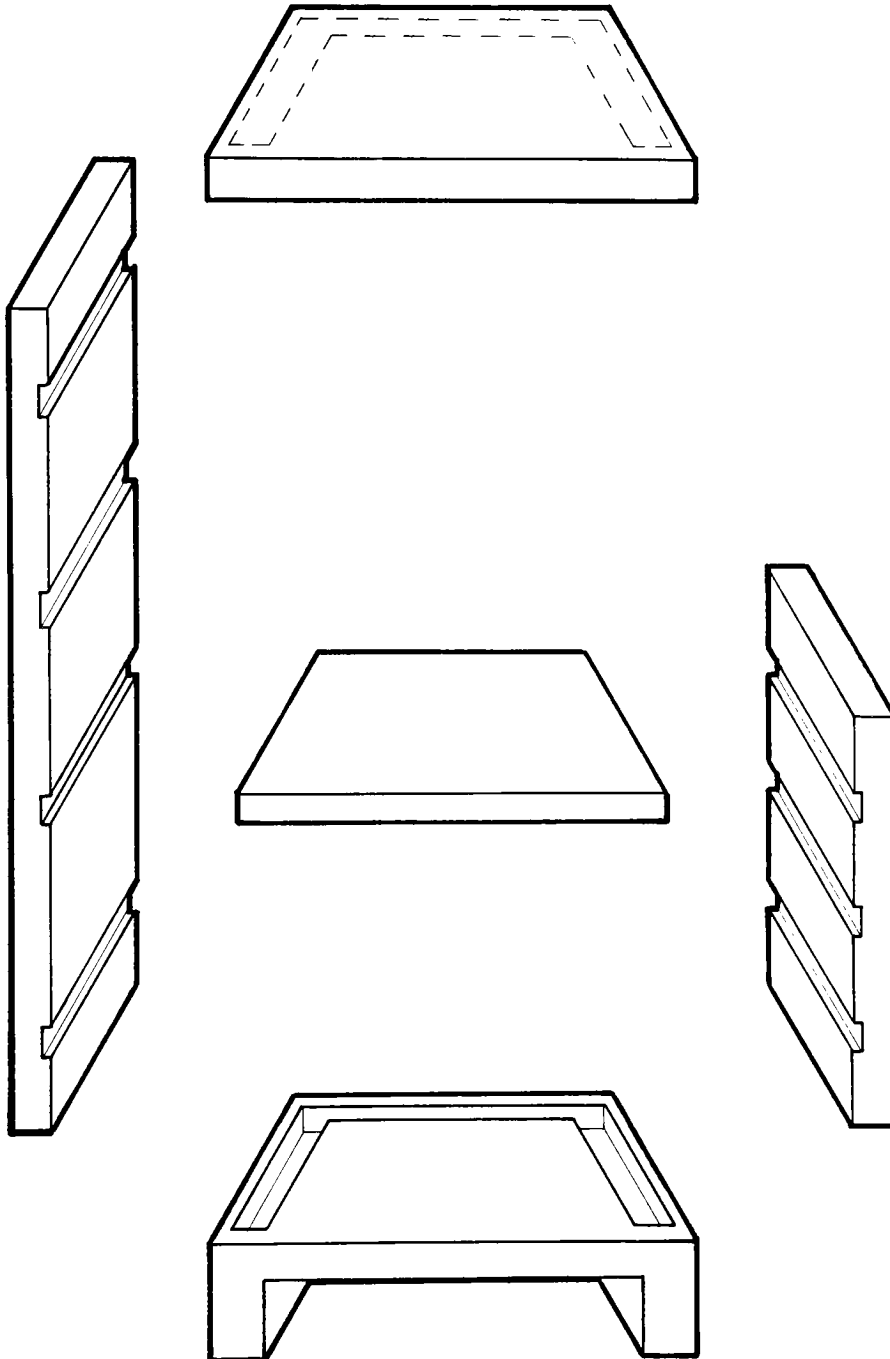


Fig.2-5 Major Components of Concept Two

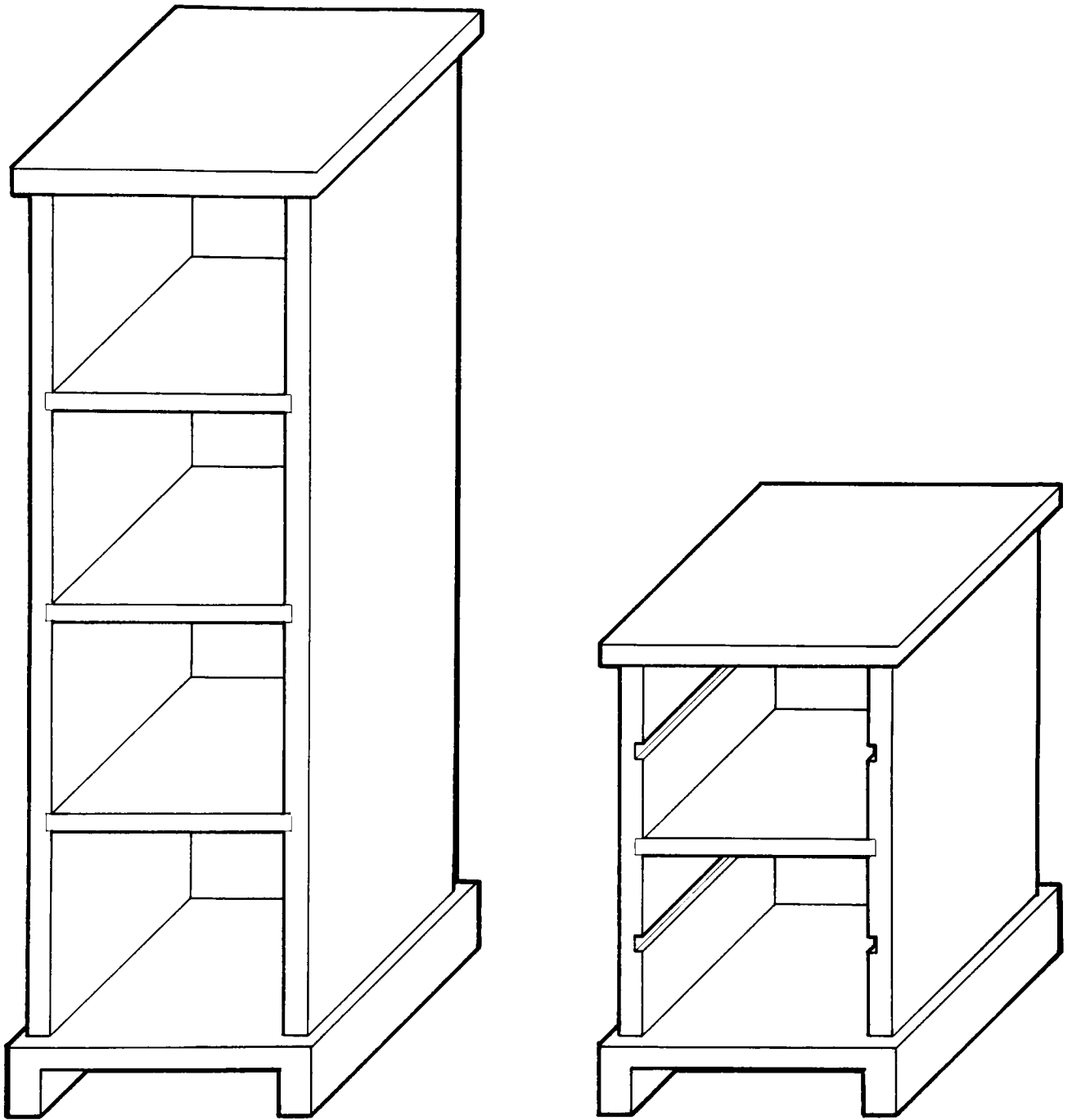


Fig.2-6 Setup Example of Concept Two

panels(fig.2-6). These square slotless boards are for use as shelves. The number and heights of these shelves could be adjusted as needed. The advantages of this concept are:

1. The assembly is easy.
2. It offers better adjustability.
3. It is expandable.
4. The construction is stable.

On the other hand, this concept has the following disadvantages:

1. It is hardly interchangeable.
2. This system can not be expanded by adding more components; it has to be expanded by increasing individual units, and that gives it the same disadvantage of over-consuming material as the first concept.

After evaluating these two concepts with the requisite conditions, I found the second concept had more advantages and better potential. Therefore, I chose the second concept as the baseline for further concept development.

Form

Modern furniture can look very fancy, and a great percentage of modern furniture does look fancy. However, in view of the intention that this product is to be used in many different residential spaces, and for a long period of time, it was my intention to keep the form simple so that this product would not become obsolete easily. I also made great effort to keep the form interesting, even when I tried to maintain its simplicity.

Final Concept

In the final concept, the furniture system has six major components: three types of panels and three types of shelves. This product could be used in any place within residential houses. With the fewest number of components, people could set up a single unit to perform the most basic storage functions. By adding more components, people could build a system to fulfill more complicated storage needs: book shelves, closet organizers, desks, multi-purpose

cabinets, beds, space dividers, and many more. The whole assembly does not require any tools. As this product intends to obtain the maximal usage from the fewest components, and is especially appropriate for urban living, I named this product "MetroMax."

Product Description

This chapter is dedicated to describing the details of the final design, MetroMax, including the dimensions, functions, and colors of the six major components. The main features will be described in this chapter as well.

There are six major components of MetroMax: Three vertical panels of different lengths, and three horizontal shelves of different shapes. Joining three vertical panels of the same length and two horizontal shelves of the same shape together will form a “box,” which is the most basic single unit of this system (fig. 3-1). I will describe the details of these panels and shelves in the following paragraphs.

Panels and Shelves

The only difference between the three types of panels is their length. The lengths of the small, medium, and large panels are 20, 38, and 80 inches respectively (fig. 3-2-a,b). There are slots on both sides

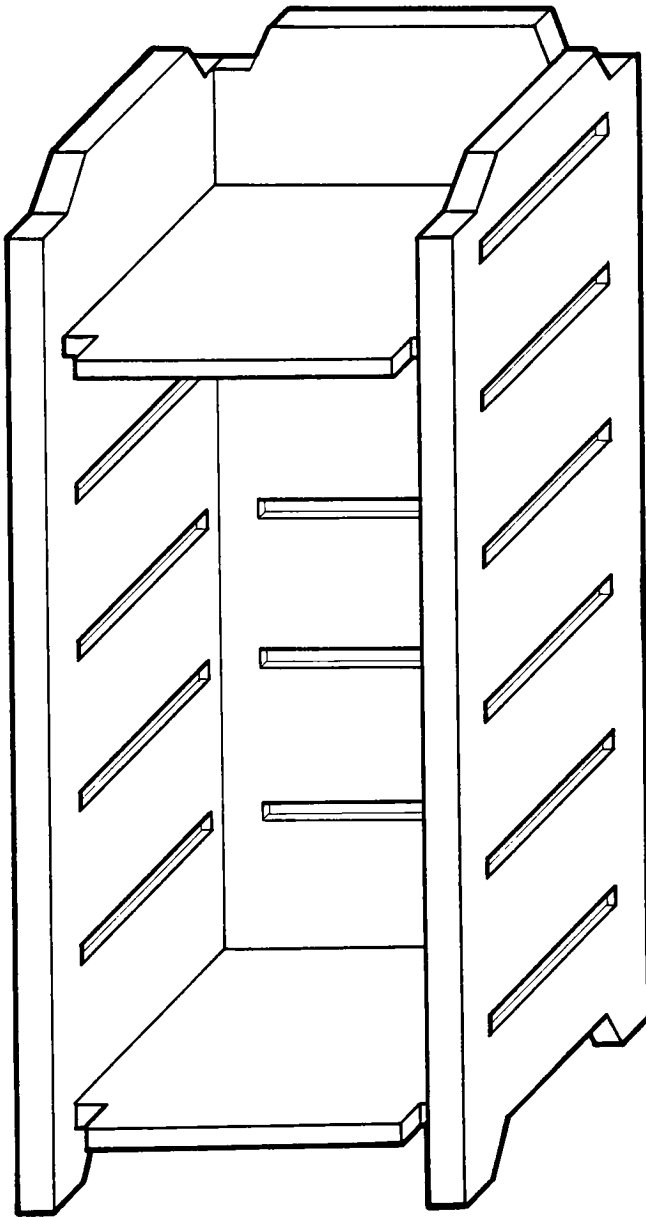


Fig.3-1 The Basic Single Unit of Final Design

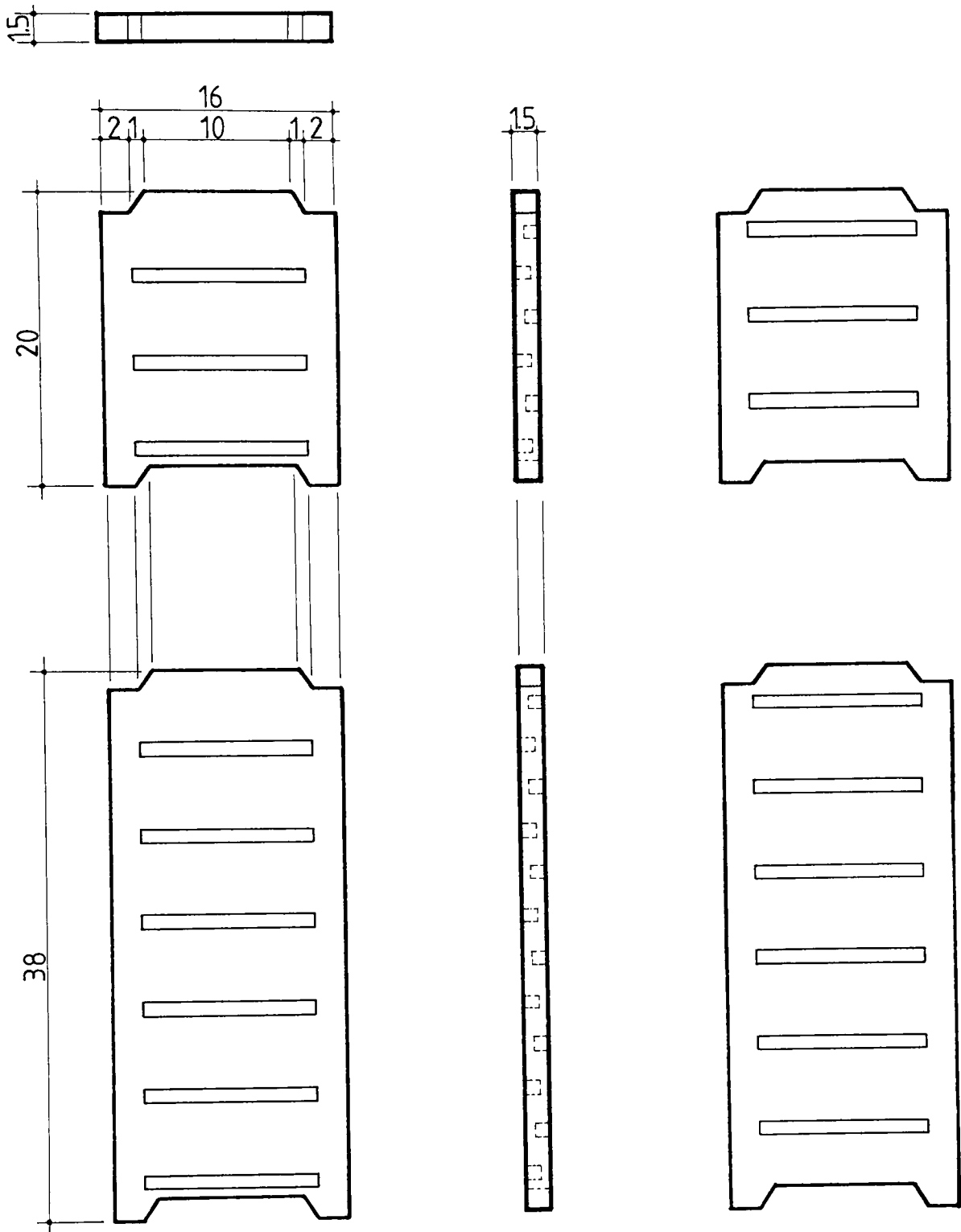


Fig.3-2-a Small and Medium Panels

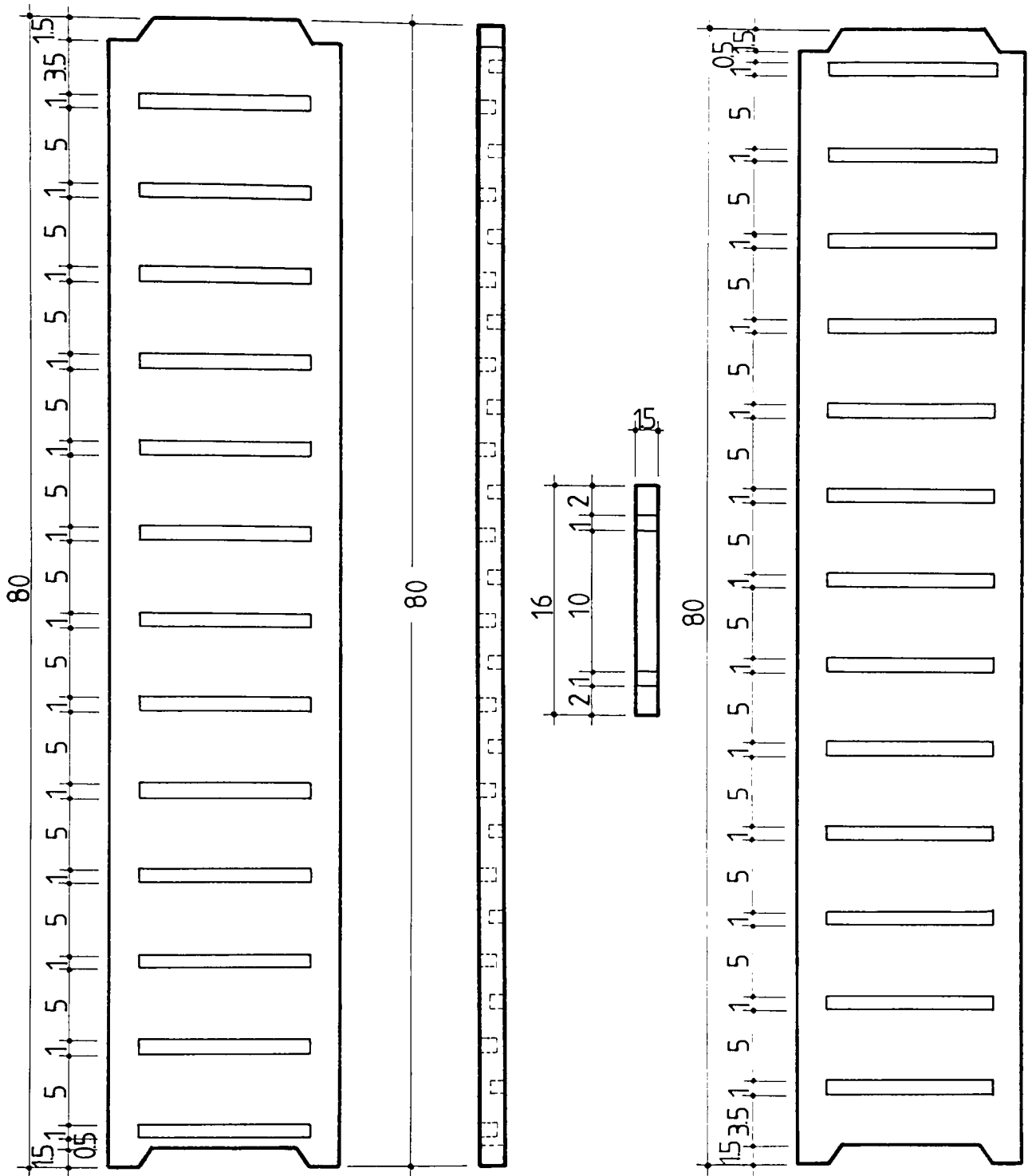


Fig.3-2-b Large Panel

of each panel to allow expandability. They have protrusions on the top and depressions at the bottom to allow stackability. The width-height-depth of the slots is 12 x 1 x 1 inches. The common thickness of all panels is one and a half inches. As I had mentioned previously, it took three panels of same length to build a single unit; the first two panels are the right and left side walls, and the third panel was used at the back to enhance the stability of the whole construction.

There are three types of horizontal shelves (fig. 3-3). The thickness of all shelves is one inch. The lengths and widths of these three shelves are: (1) The smaller is a rectangular one: 18 x 16 inches. When the users use the longer side of this type of shelf to set up the depth of a unit, the configuration is appropriate for use as closet organizer. Otherwise, this type of shelf is appropriate for book shelves and other storage purposes. (2) The larger one is rectangular: 34 x 18 inches. This type of shelf is suitable for the needs of storing larger and wider objects. (3) The triangular one is 17 x 16 inches. This triangular component is designed specifically for use at the corner of a setup

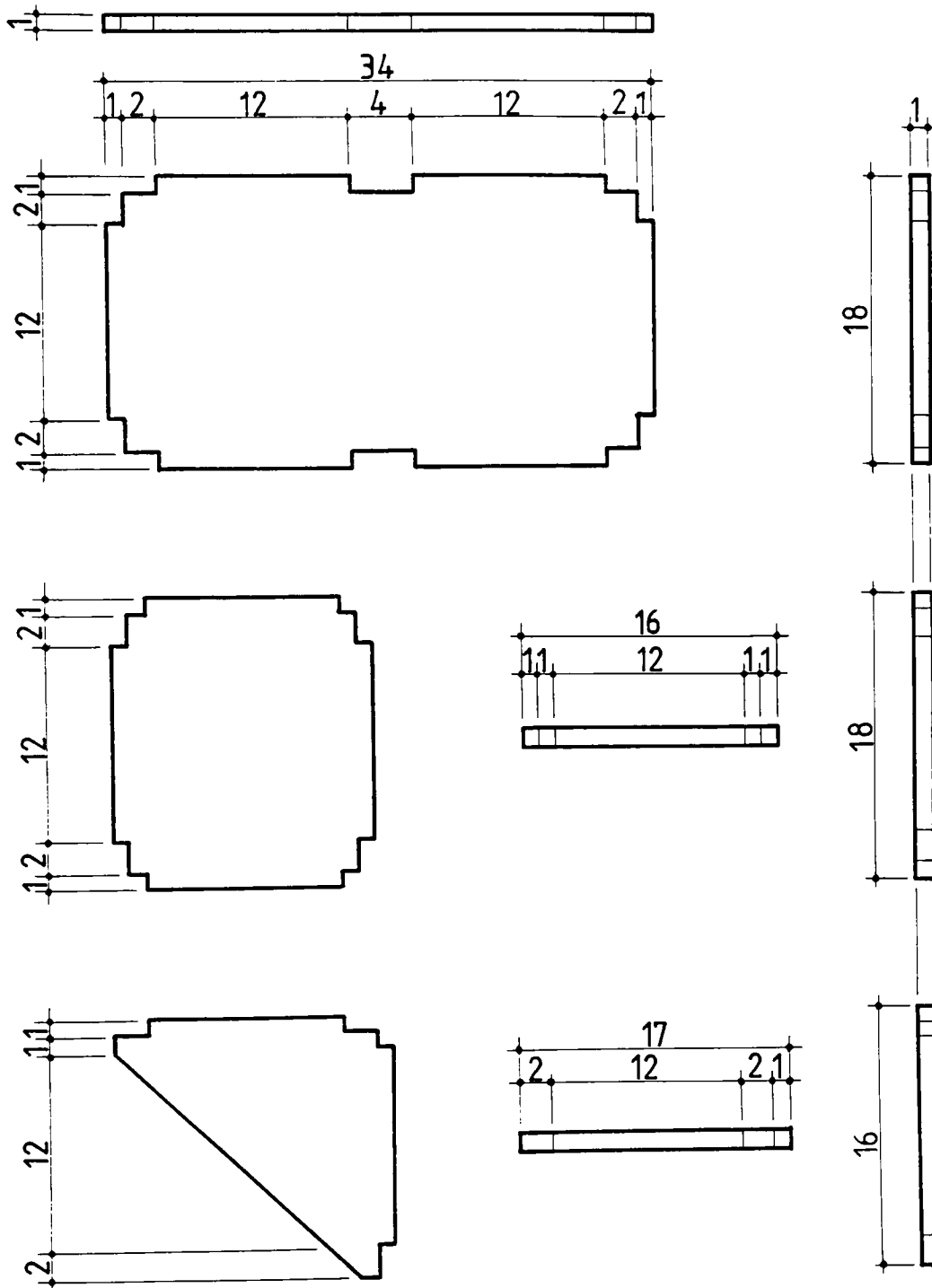


Fig.3-3 Shelves

(fig.3-4). There are one inch pegs that protrude from every shelf. During installation, to assemble the components into different configurations, the users need to plug the pegs on the shelves into the slots on the panels.

The minimal height of a storage space is five inches. While thinking of storage needs, I considered that the CD(compact disk) is, and will be, a substantial part of human life. CD is becoming the major media for mass data storage. Music CD is a good example. The height of a regular CD case is approximately $4 \frac{3}{4}$ inches. Therefore, I set the distance between two slots on the same side to be five inches. Accordingly, the available storage space heights would be 5 inches plus the multiple of 6 inches(5 inches plus 1 inch—the height of a slot). That means the heights of a storage space could range from 5 inches to 11 inches to 17 inches, all the way up to 71 inches(fig.3-5). When configured to be book shelves, 11 inches is sufficient for storing the average size books, and 17 inches is even sufficient for storing most of the oversized books.

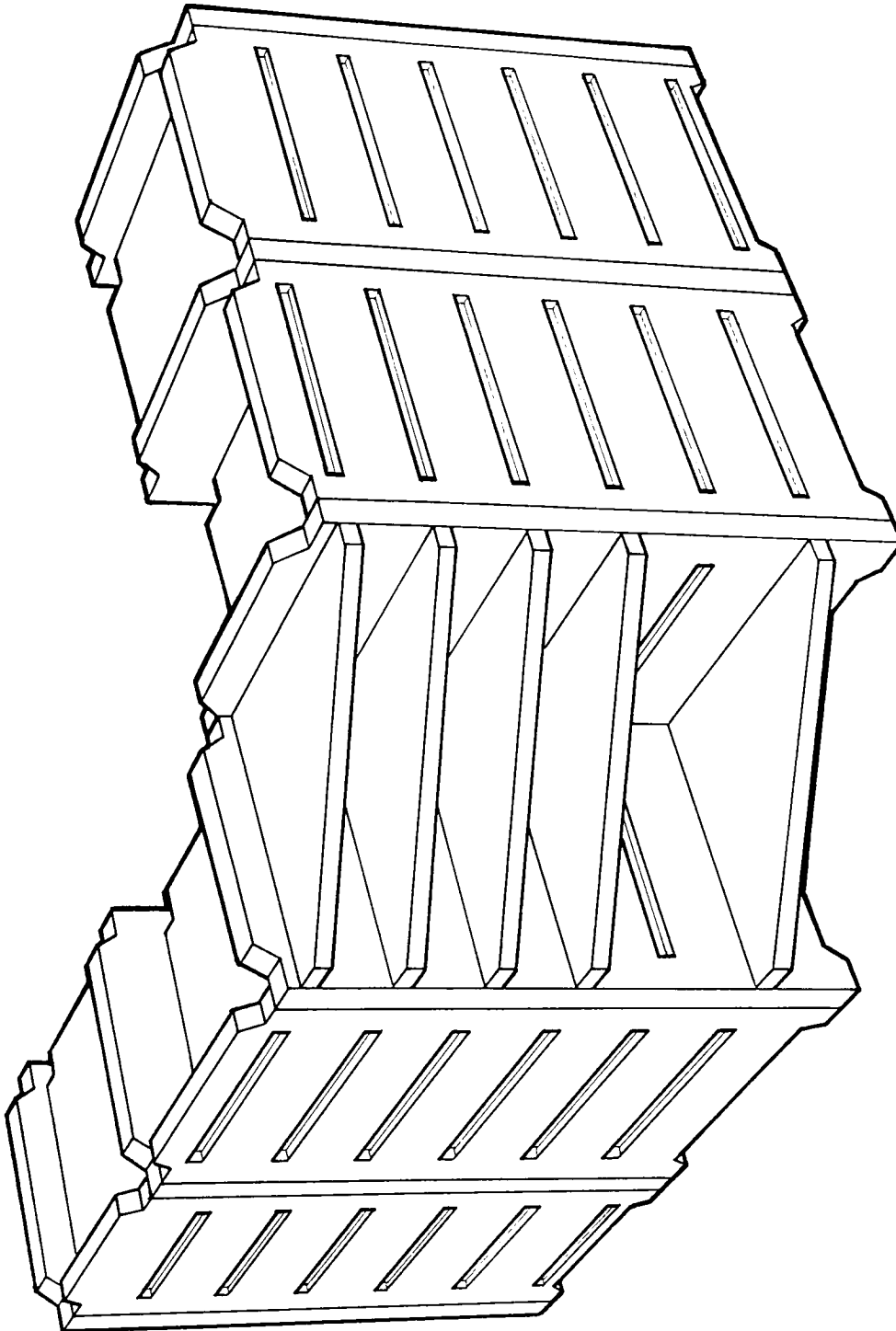


Fig.3-4 The Setup of Corners With the Triangle Shelves

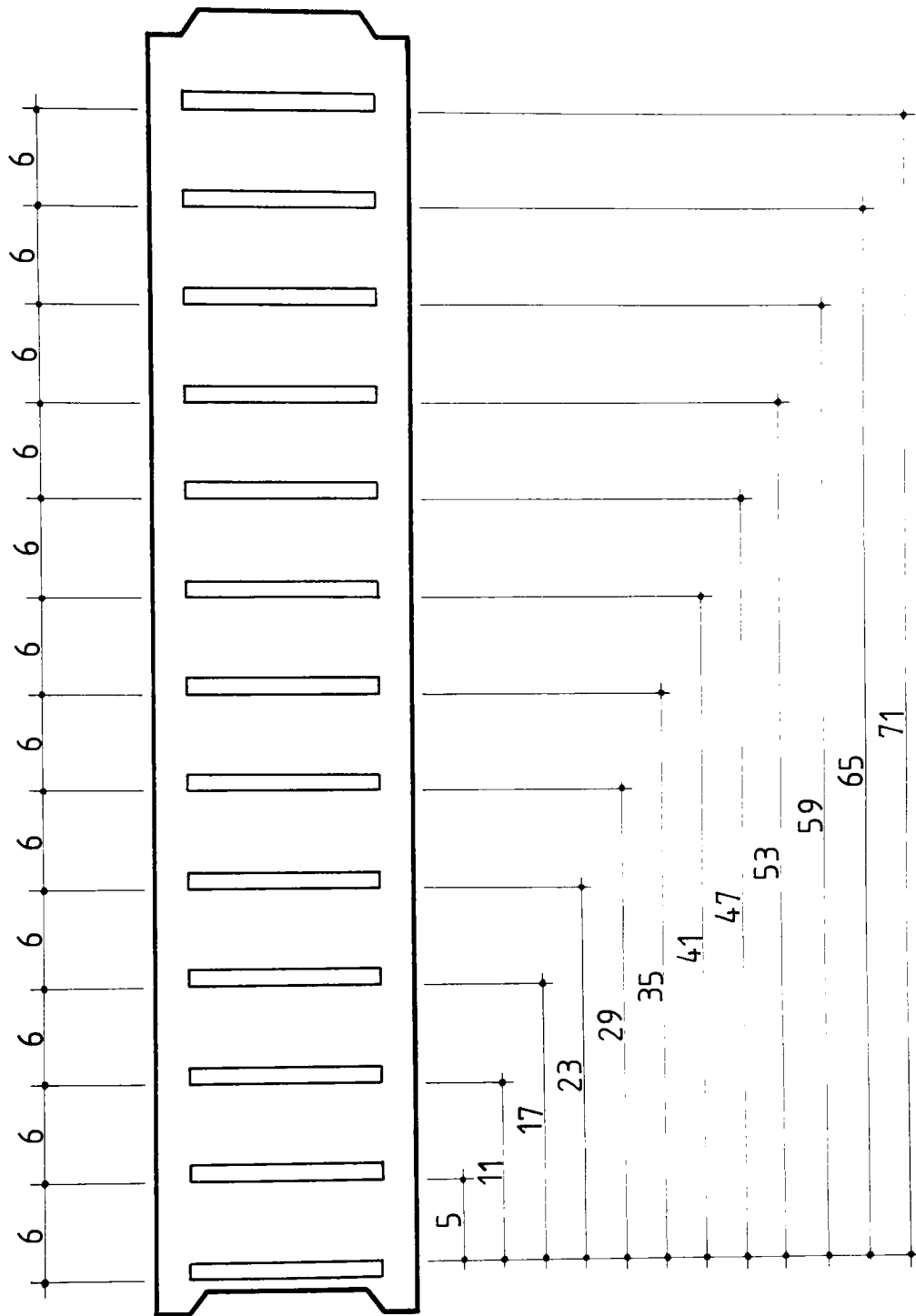


Fig.3-5 The Various Height of Available Storage Space

Fastener

The fastener is made of sheet metal. It was inserted into the middle of the pegs on the shelves to enhance the joining stability(fig.3-6).

Colors

All components are monochrome. The panels are either black or white. As the panels are the most visible part, the major colors of this product would be black and white. There are five color choices for the shelves. Besides black and white, the other three are bright colors—red, blue, and yellow. With all the possible color combinations, this product offers not only multi-configuration, but also a versatile color setup. The users could thus have a more personalized furniture system.

Features

From all the aspects of this furniture system, we can conclude eight main features. The following para-

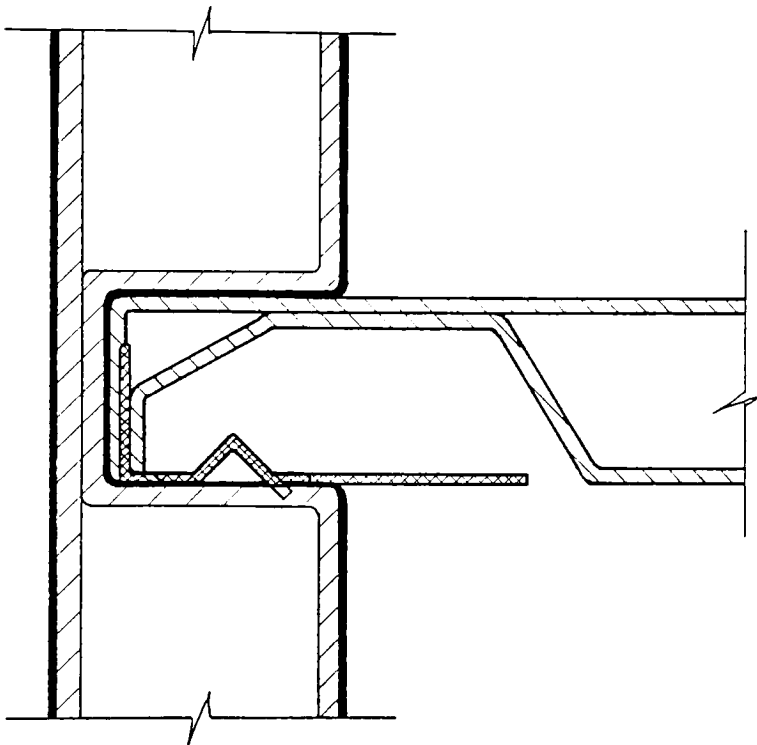
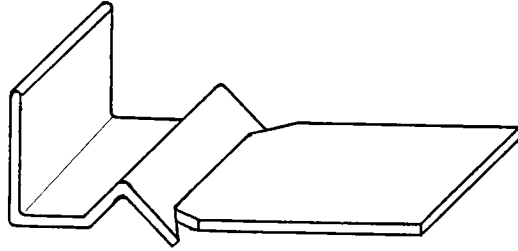


Fig.3-6 The Fastener

graphs depict these features.

1. Easy to Assemble:

To assemble this system, a person does not need any tool. The procedure of assembling a single unit is simple. First, plug all the necessary shelves into a panel. Next, apply the other two panels onto these shelves to complete the installation (fig.3-7). Fasteners can be added to the shelves before installation to enhance stability. The procedure of adding additional shelves and panels can be applied on the whole system as well. Also, it is easy for a user to assemble the system alone since the components are lightweight.

2. Adjustable:

The pegs on every shelf are uniform, and so are the slots on every panel. That is, any peg could be plugged into any slot on any panel. Consequently, this system offers a great adjustability.

3. Interchangeable:

The same components can easily be disassembled and reassembled into a variety of configura-

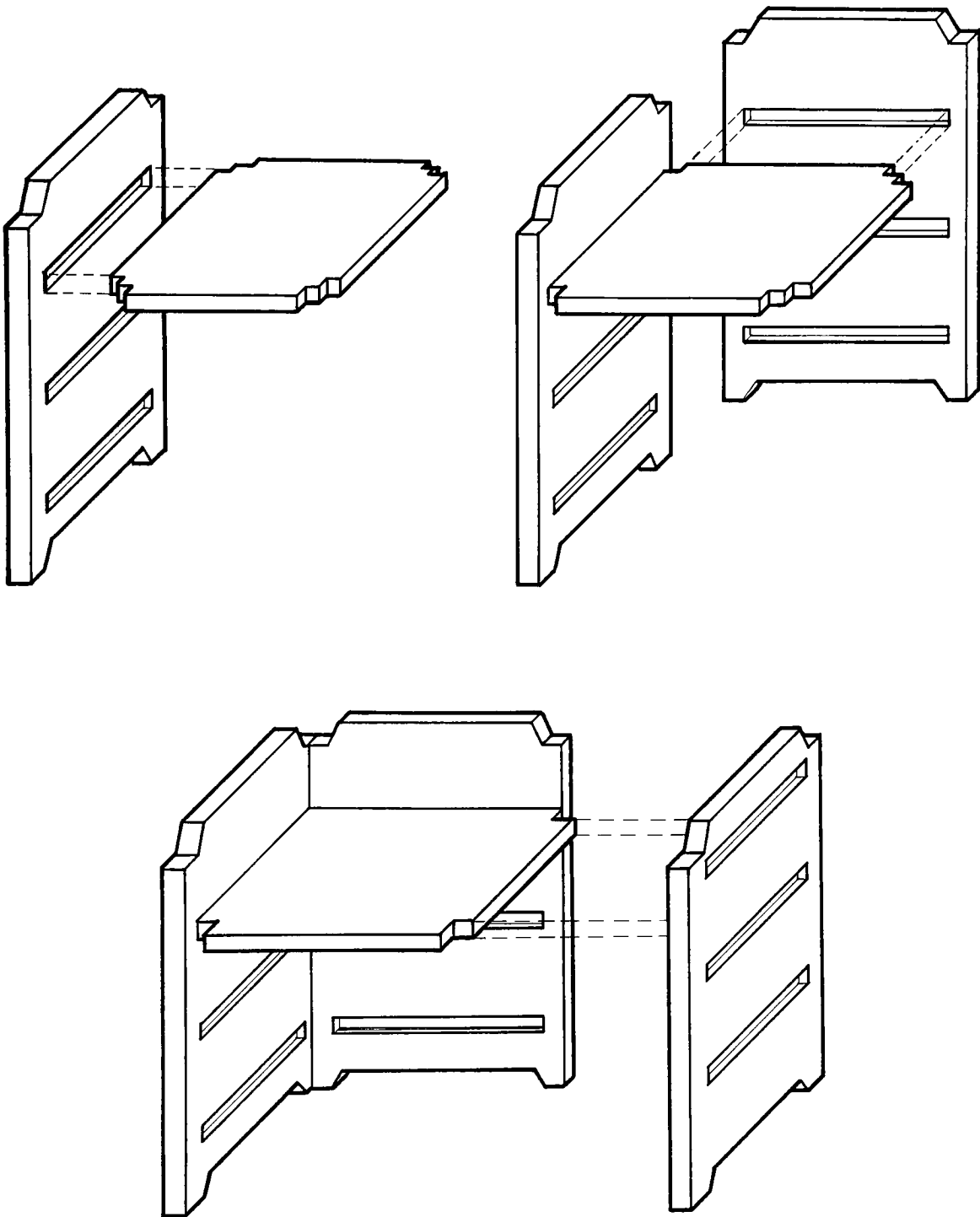


Fig.3-7 The Procedure of Assembling Single Units

rations; they are interchangeable. For example, If a system is used to build bookshelves, desks, and stereo cabinet for a reading room, it is possible to reorganize the same pieces to form closet organizers, bed-end tables, and bed for a bedroom without adding any more components.

4. Stackable:

The panels are roughly rectangular. Yet, with the jutting top and the concave bottom(fig.3-8), the users could stack small units and/or medium units together if necessary. The small panels are approximately half the height of the medium panels, as are the medium panels to the large panels. Hence the whole system would still be in good proportions even after being stacked up.

5. Expandable:

After using the system for some time, when necessary, the users could expand the system simply by adding more components according to their needs. There would not be any problem of compatibility, as every component is standardized.

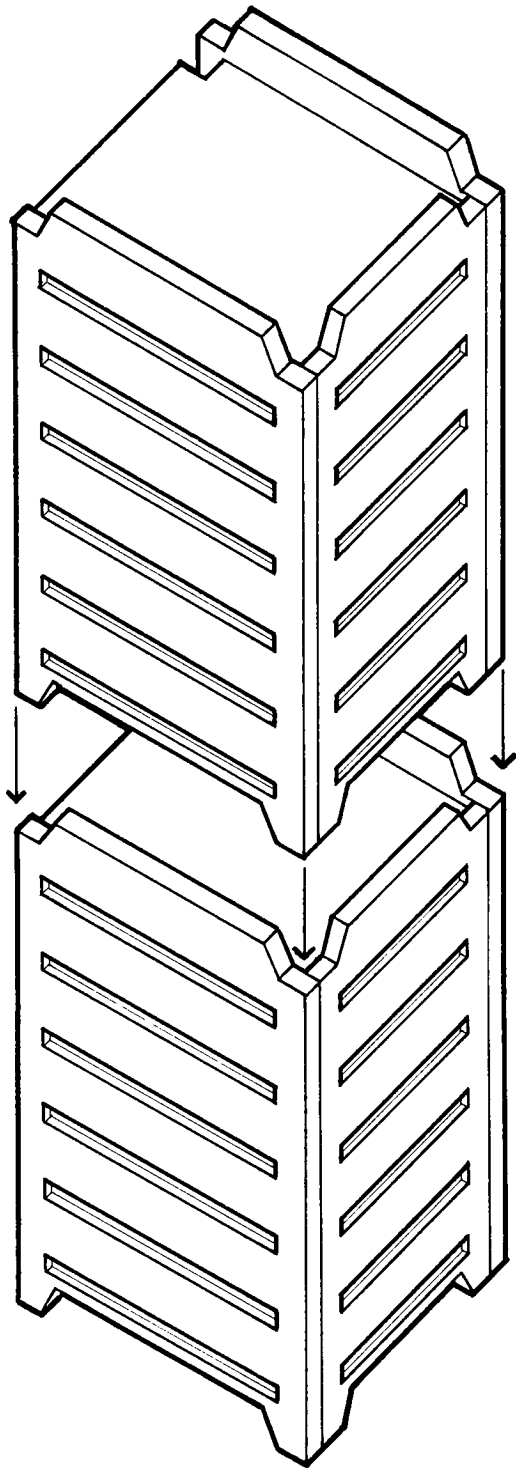


Fig.3-8 Example of Stackability

6. Durable:

Since this system is designed to be used for a long time, durability is a necessary concern. This system is durable because:

1. Blow-molded polyethelyne components are rugged.
2. The simple construction of every component makes this system hard to be damaged.

7. Portable:

Portability and transportation are important concerns for furniture to be used by people who move frequently. This system is portable and easy to be transported because:

1. Blow molding produces light hollow parts(fig.3-9 & fig.3-10).
2. Pieces are manageable size.
3. Part of the system can be assembled to form carrying cases for other components (fig.3-11).

8. Economical:

This product is designed for people with a

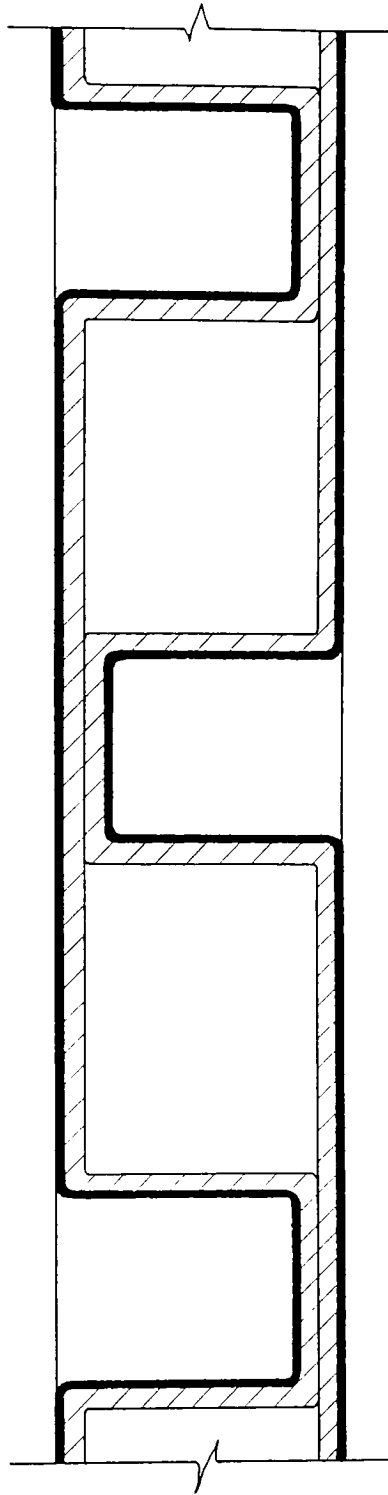


Fig.3-9 The Inner Construction of Panels

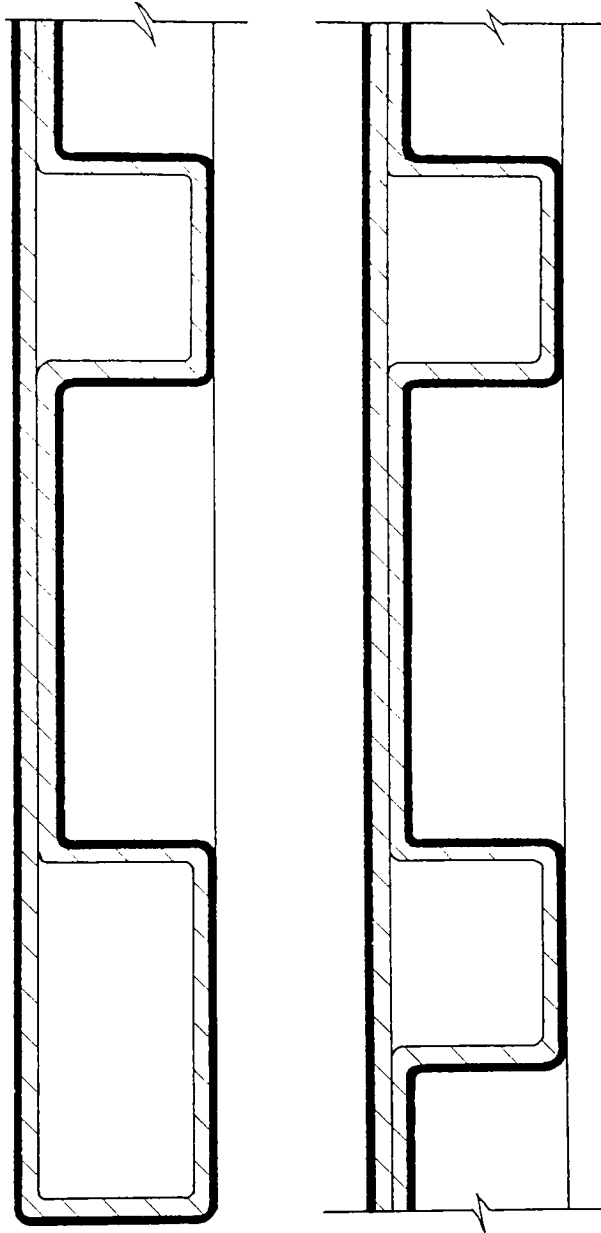


Fig.3-10 The Inner Construction of Shelves

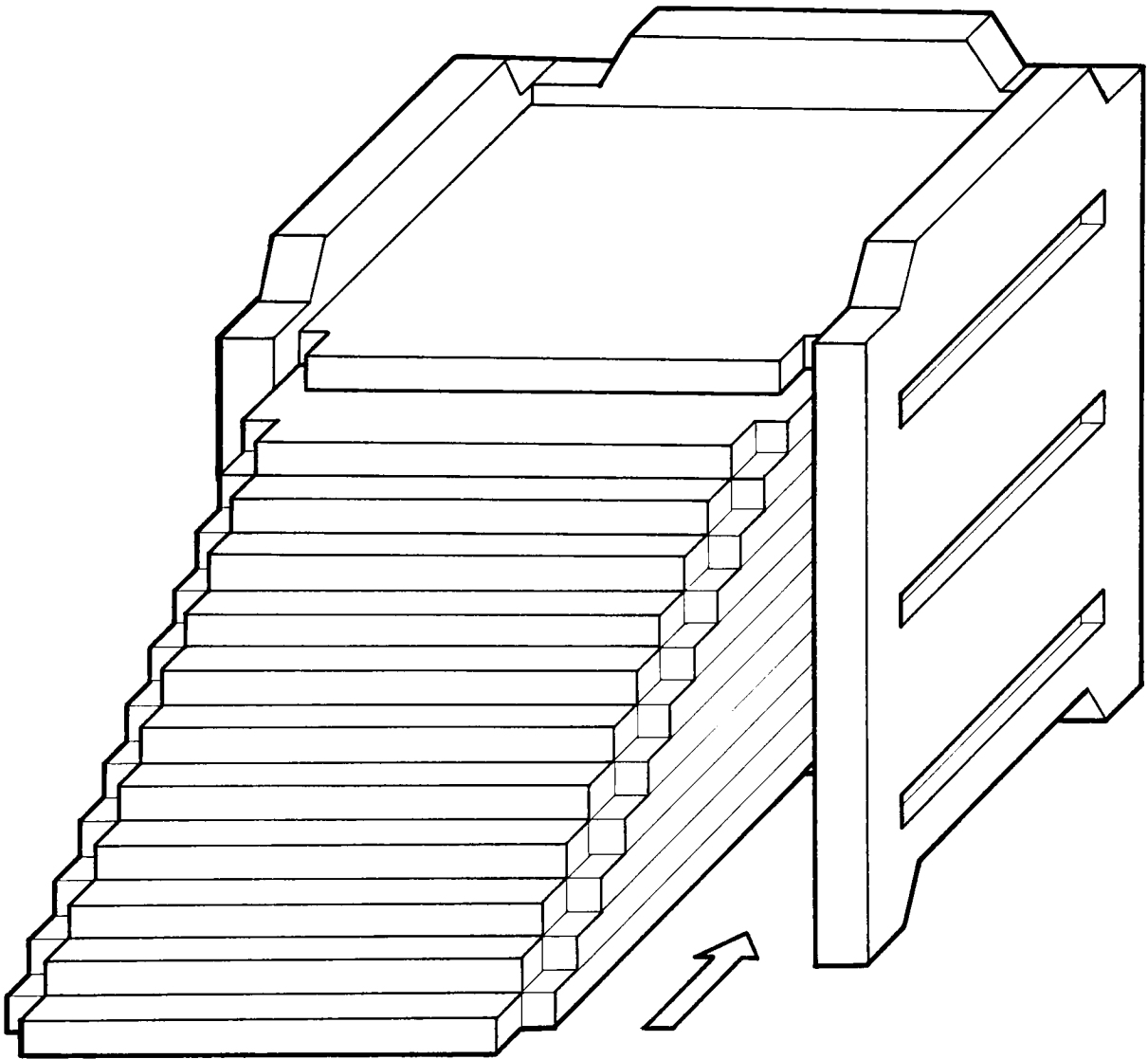


Fig.3-11 Example of Forming Carrying Cases

variety of different income levels. Hence, keeping the price of this system as affordable as possible is essential. The reasons that this system is economical are: 1. Blow molding is an inexpensive process for mass production. 2. For both initial setup and further expansion, the customers need only to purchase the exact quantity of components that are necessary.

Conclusion

Industrial designers often have an attitude when they design products. Some of them design for “manufacturers’ sake”—to choose the appropriate manufacturing process and make products easy to be sold and profitable; some of them design for “designers’ sake”—to make things aesthetically beautiful, original, and prestigious; also, to satisfy the urge for creativity; while some others design for “users’ sake”—to make products functional and beneficial to users. Each attitude represents a viewpoint of value. To me, these three attitudes are coexistent with each other. A successful design, or a successful product, should be valuable in all three ways. My intention on this project was to find a reasonable solution to a common problem.

The result of this project is a multifunctional storage unit furniture system that is ideal for urban living. This system is simple and harmonious. It can respond to the users’ needs and reduces the stress in life.



Fig.4-1 Prototype One



Fig.4-2 Prototype Two



Fig.4-3 Prototype Three

Bibliography

Carman, James A. Studies in the Demand for Consumer Household Equipment. IBER SPECIAL PUBLICATIONS, 1962.

Cleminshaw, Douglas. Design in Plastics. Rockport, MA: Rockport Publishers, 1989.

DiNoto, Andrea. Art Plastic: Designed For Living. New York: Abbeville Press, Inc., 1984.

Dormer, Peter. The Meaning of Modern Design. New York: Thames and Hudson Inc., 1991.

Favata, Ignazia. Joe Colombo And Italian Design Of The Sixties. Cambridge: The MIT Press, 1988.

Nelson, George. Storage. New York: Whitney Publications Inc., 1954.

Norman, Donald A. The Design Of Everyday Things. New York: Bantam Doubleday Dell Publishing Group, Inc. 1990.

Pile, John F. Modern Furniture. New York: John Wiley & Sons, Inc., 1979.

Pile, John f. Furniture, modern and postmodern. New York: John Wiley & Sons, Inc., 1990.

Republic Of China 1992 Year Book. Taipei: HILIT Publishing Company Ltd., 1992.