DESIGN AND FABRICATION OF HOME DRAIN COVER

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ABSTRACT

My final year project is about to design and fabricate a home drain cover. Home drain cover is important equipment because it protects and prevents someone from fall into the drain. Furthermore, the drain cover can help us to cross the drain easily. However, former home drain covers existing in the market do not have security features that can prevent any pets from come in through the front yard of the drain into our home area. It also can easily break because it cannot stand a heavy mass object for a long time. However, the reason we need a new concept for a home drain cover. The main features of home drain cover can prevent pets coming through the front yard of the drain to our home area. This idea emerged because of the lack of modification is available on the product time. The idea to form home drain cover is based on the students own creativity. The selection of materials suitable for the formation is based on the weight of a suitable material, durable and ability to withstand load. Material proposed for the formation of home drain cover is mild steel. Several processes are necessary and when they form a home drain cover contained in this report.

TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION

1.1 Project Synopsis

On this chapter, it explained about the project objectives, project background, project scope, and the problem statement of the project. Besides that, this chapter also covers the project flow of this project.

1.2 Project Background

Nowadays, the home drain covers are made of plastic or polymer to decrease the cost on producing it. However, as the cost decrease, the quality of home drain cover also decreases because it can withstand load as it is made of plastic. Then, the existing home drain cover only covers the top of the drain. So, anything can get in from the front yard of the drain especially pets. Therefore, we need to develop a design of a home drain cover to overcome this problem.

This final year project allocates the duration of one semester to be finished. The fabrication of the home drain cover inquires me to have skills in handling several machines such as welding machines, cutting machines, drilling machines, riveting, grinding machines and many more to make the product.

1.3 Project Problem Statement

(i) Home drain cover is only cover the top of the drain.

(ii) Home drain covers have easily broken.

(iii) Home drain cover cannot stop the trash from going into the main drain.

1.4 Project Objective

(i) To design a new concept of home drain cover that can prevent pets from coming through the front yard of the drain into the home area.

(ii) To produce a home drain cover that can withstand a heavy load for a long time.

(iii) To design and invent a home drain cover that can decrease the drain pollution.

1.5 Project Scope

The scope of the project is limited to the below parameter and material:

(i) Material

- Mild steel (Round Hollow Bar 2.5 mm thickness)
- Aluminum (Square Hollow Bar 2 mm thickness)
- Steel (L Shape 50 mm x 50 mm with 3 mm thickness)

(ii) Sketching and Drawing

- SolidWorks software

(iii) Fabrication

- Vertical Saw
- Grinder
- SMAW
- Press drill

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Importance of this chapter is to provide a review of past research efforts related to home drain cover. This chapter will explain about the research of the project that had been chose and explained about home drain cover features and specifications. A review of other relevant research studies is also provided. Substantial literature has been studied on history, types of material needed, techniques and machines use in fabrication and many other things that are related to this project.

2.2 History of Home Drain Cover

Home drain cover is a gadget that covers the drain to prevent anything from fall into the drain. The existing home drain cover in the market today are using plastic as the main material to prevent the rusting process. But, this act will also reduce the quality of it. The best material to produce the home drain cover is mild steel. This is because, mild steel is hard steel and it is heavy. To produce the home drain cover, we can use several ways to do it. For example, we can use casting process, injection moulding process and welding process. If we use the casting and injection moulding process, it will take much time to done.

2.3 Material

2.3.1 Introduction to Round Hollow Bar

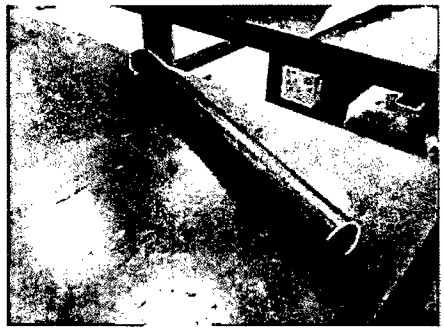

Figure 2.1: Round Hollow Bar

Sources: UMP Mechanical Lab

Round Hollow Bar is a metal formed into cylinder. It is one of the fundamental forms used in metalworking, and can be cut and bend into a variety of different shapes. There are many different thickness of round hollow bar. Aluminum, brass, copper, cold rolled steel, mild steel, tin, nickel and titanium are just a few example of metal that can be made into round hollow bar. Round hollow bar has applications in car bodies, and commonly use for the chassis of an object or product.

2.3.2 Square Hollow Bar

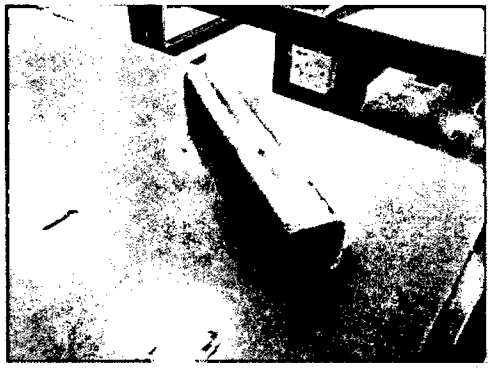

Figure 2.2: Square Hollow Bar

Sources: UMP Mechanical Lab

Square Hollow Bar is a metal formed into blocks with a hollow. It is commonly use for metalworking. It can be cut and but cannot be bend. However, we still can make many shapes by using the joining process such as welding. Aluminum, brass, copper, cold rolled steel, mild steel, tin, nickel and titanium are just a few example of metal that can be made into square hollow bar. Square hollow bar has applications building a table stand, chair and many more.

2.3.3 L-Shape Steel

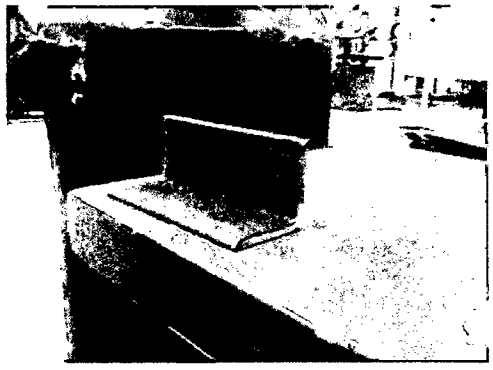

Figure 2.3: Square Hollow Bar

Sources: UMP Mechanical Lab

L Shape Steel is a metal formed into L shape. It is commonly use for metalworking. It can be cut and but cannot be bend. However, we still can make many shapes by using the joining process such as welding. There are many sizes of L Shape Steel. Aluminum, brass, copper, cold rolled steel, mild steel, tin, nickel and titanium are just a few example of metal that can be made into L Shape Steel.

2.4 Fabrication process

2.4.1 Cutting

Cutting process can be done in various ways from hand tools called handsaw. We even can use the electrical saw that is more accurate and easy. With the advances in technology, the cutting process has become easy to handle and the process is faster than before.

2.4.2 Drilling

A drill or drill motor is a tool fitted with a rotating cutting implement used for drilling holes in various materials. The drill bit is gripped by a chuck at one end of the drill and rotated while pressed against the target material. The tip of the drill bit does the work of cutting into the target material, either slicing off thin shavings (twist drills or auger bits), grinding off small particles (oil drilling), or crushing and removing pieces of the workpiece. Specially designed drills are also used in medicine, space missions and other applications.

A drill is a tool with a rotating drill bit used for drilling holes in various materials. Drills are commonly used in woodworking, metalworking, and construction.

The drill bit is gripped by a chuck at one end of the drill, and is pressed against the target material and rotated. The tip of the drill bit does the work of cutting into the target material, either slicing off thin shavings (twist drills or auger bits), grinding off small particles (oil drilling), or crushing and removing pieces of the work piece.

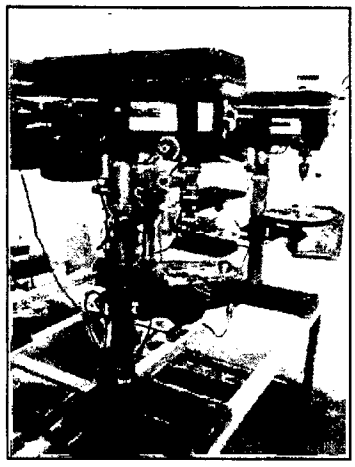

Figure 2.4: Press Drilling Machines

Sources: UMP Mechanical Lab

A drill press Figure 2.4 (also known as pedestal drill, pillar drill, or bench drill) is a fixed style of drill that may be mounted on a stand or bolted to the floor or workbench. A drill press consists of a base, column (or pillar), table, spindle (or quill), and drill head, usually driven by an induction motor. The head has a set of handles (usually 3) radiating from a central hub that, when turned, move the spindle and chuck vertically, parallel to the axis of the column. The table can be adjusted vertically and is generally moved by a rack and pinion; however, some older models rely on the operator to lift and reclamp the table in position. The table may also be offset from the spindle's axis and in some cases rotated to a position perpendicular to the column. The size of a drill press is typically measured in terms of swing. Swing is defined as twice the throat distance, which is the distance from the center of the spindle to the closest edge of the pillar. For example, a 16-inch (410 mm) drill press will have an 8-inch (200 mm) throat distance.

A drill press has a number of advantages over a hand-held drill:

- less effort is required to apply the drill to the workpiece. The movement of the chuck and spindle is by a lever working on a rack and pinion, which gives the operator considerable mechanical advantage.
- the table allows a vise or clamp to position and lock the work in place making the operation much more secure.
- the angle of the spindle is fixed in relation to the table, allowing holes to be drilled accurately and repetitively.

Speed change is achieved by manually moving a belt across a stepped pulley arrangement. Some drill presses add a third stepped pulley to increase the speed range. Modern drill presses can, however, use a variable-speed motor in conjunction with the stepped-pulley system; a few older drill presses, on the other hand, have a sort of traction-based continuously variable transmission for wide ranges of chuck speeds instead, which can be changed while the machine is running.

Drill presses are often used for miscellaneous workshop tasks such as sanding, honing or polishing, by mounting sanding drums, honing wheels and various other rotating accessories in the chuck. This can be dangerous on many presses, where the chuck arbor is held in the spindle purely by the friction of a Morse taper instead of being held securely by a drawbar.

2.4.3 Rivet

A rivet is a permanent mechanical fastener. Before it is installed it consists of a smooth cylindrical shaft with a head on one end. The end opposite the head is called the buck-tail. On installation the rivet is placed in a punched or pre-drilled hole. Then the tail is "upset" (i.e. deformed) so that it expands to about 1.5 times the original shaft diameter and holds the rivet in place. To distinguish between the two ends of the rivet, the original head is called the factory head and the deformed end is called the shop head or buck-tail.

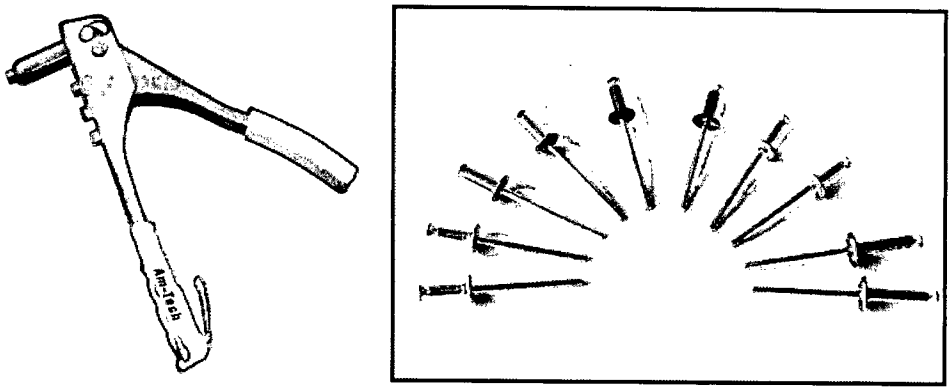

Figure 2.5: Rivet Gun and Blind Rivet (POP Rivet)

Source: www.neathtools.co.uk and www.ayaji.com

Blind rivets are tubular and are supplied with a mandrel through the center. The rivet assembly is inserted into a hole drilled through the parts to be joined and a specially designed tool is used to draw the mandrel into the rivet. This expands the blind end of the rivet and then the mandrel snaps off. (A POP rivet is a brand name for blind rivets sold by Emhart Technologies.) These types of blind rivets have non-locking mandrels and are avoided for critical structural joints because the mandrels may fall out, due to vibration or other reasons, leaving a hollow rivet that will have a significantly lower load carrying capability than solid rivets. Furthermore, because of the mandrel they are more prone to failure from corrosion and vibration. Unlike solid rivets, blind rivets can be inserted and fully installed in a joint from only one side of a part or structure, "blind" to the opposite side.

2.5 Welding Process

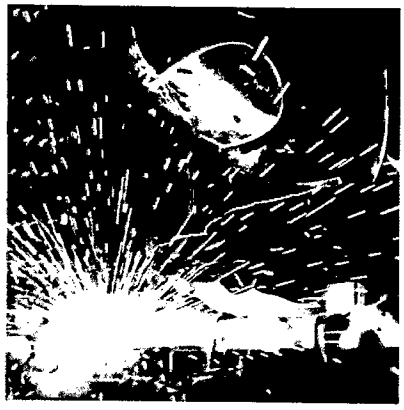

Figure 2.6: Welding Process

Welding is a fabrication or sculptural process that joins materials, usually metals or thermoplastics, by causing coalescence. This is often done by melting the workpieces and adding a filler material to form a pool of molten material (the *weld pool*) that cools to become a strong joint, with pressure sometimes used in conjunction with heat, or by itself, to produce the weld. This is in contrast with soldering and brazing, which involve melting a lower-melting-point material between the workpieces to form a bond between them, without melting the workpieces.

Many different energy sources can be used for welding, including a gas flame, an electric arc, a laser, an electron beam, friction, and ultrasound. While often an industrial process, welding can be done in many different environments, including open air, under water and in outer space. Regardless of location, however, welding remains dangerous, and precautions are taken to avoid burns, electric shock, eye damage, poisonous fumes, and overexposure to ultraviolet light.

2.5.1 Shielded Metal Arc Welding (SMAW)

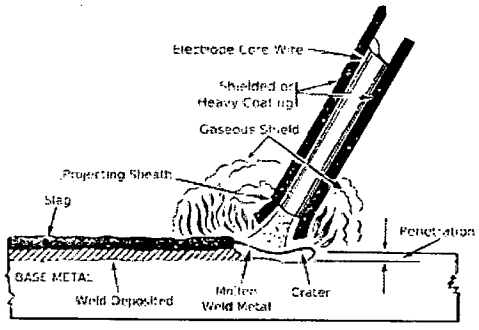

Figure 2.7: Shielded Metal Arc Welding Diagram

Source: Weldacop

Shielded metal arc welding (SMAW), also known as manual metal arc (MMA) welding or informally as stick welding, is a manual arc welding process that uses a consumable electrode coated in flux to lay the weld. An electric current, in the form of either alternating current or direct current from a welding power supply, is used to form an electric arc between the electrode and the metals to be joined. As the weld is laid, the flux coating of the electrode disintegrates, giving off vapors that serve as a shielding gas and providing a layer of slag, both of which protect the weld area from atmospheric contamination.

Because of the versatility of the process and the simplicity of its equipment and operation, shielded metal arc welding is one of the world's most popular welding processes. It dominates other welding processes in the maintenance and repair industry, and though flux-cored arc welding is growing in popularity, SMAW continues to be used extensively in the construction of steel structures and in industrial fabrication. The process is used primarily to weld iron and steels (including stainless steel) but aluminum, nickel and copper alloys can also be welded with this method.

CHAPTER 3

METHODOLOGY

3.1 Project Flow Chart

In fabrication of the home drain cover, there is a planning of the overall progress to assure the project can be finish on a schedule.

From the flow chart in figure 3.1 below, this project started with the literature review and research about the title. The main important of the project is determination the objective. Then, study and make a lot of investigation about home drain cover and machining process involved. This is including a review of types of materials, strength of material, way to produce, and machining process involved. These tasks have been done through research on the internet, books and other sources.

Then the information has been collected and gathered. After that, the project is continued with the design process. In this stage, the knowledge and lessons that have been studied will be applied. It is important to make a suitable design for the project. After several design sketched, design consideration have been made and one of the design have been chosen. The designs have been chosen by using Pugh's selection method. The selected sketch is then transferred to solid modeling and engineering drawing by using SolidWorks software.

After the design was completed, the attention now is to prepare the material. The information about the material was gathered by asking the lab instructor, discussion with the supervisor and lastly from the internet to get the best material to produce a home drain cover. Ability to hold and carry a large amount of load was the first priority in choosing a material. And the material must not too heavy so that wills easier the user to carry it.

After the chosen material was decided, the drawing was used as a reference for the next process, which it is fabrication stage. This process is consists fabricate all the parts that have design before by following all the dimension using various type of manufacturing process. The manufacturing process included in this process is punching process, bending process, and welding process. During the fabrication process, if there is something wrong occur, such as not balance dimension to the process will be stop and go back to previous step, make a modification against.

After all the fabrication process above is done, all the material for report writing is gathered. The report writing process will be guided by the UMP final year project report writing. This process also included the presentation slide making for the final presentation of the project.

The project ended after the submission of the report and the slide presentation has been present.

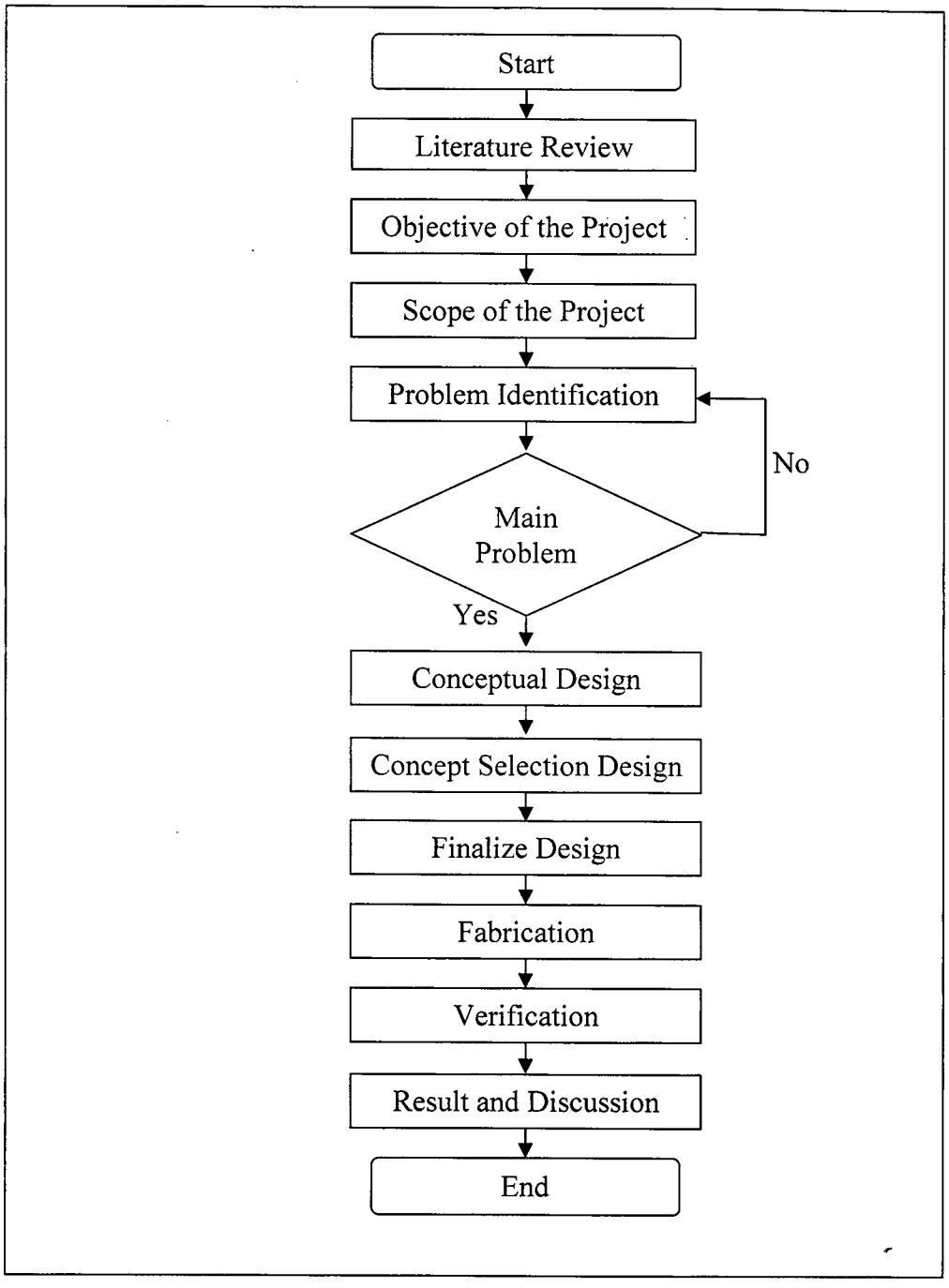

Figure 3.1: Project Flow Chart

3.2 Design and Sketching

3.2.1 Introduction

In this subchapter, the product will be detailed explanation where the design and sketching of the home drain cover need to undergo a several design aspects and the compliance of design need to follow step by step. When doing design process, consideration of design must be done carefully and properly to make sure the design can be applied in fabrication stage and the system are been functioning. This subchapter also will explain about the design and sketching that had been chosen to be as the final idea to be produce or fabricate.

3.2.2 Design

The Design of the home drain cover must be compliance to several aspects. The design consideration must be done carefully so the design can be fabricated and the parts are all functioning. The aspect that must be consider in designing the home drain cover are:

(i) Material: The suitable material is important to make sure the home drain cover able to endure long.

(ii) Strength: It is one of important criteria in designing the home drain cover and it will show the toughness and durability of the design.

(iii) Machining: The design must be relevant to the machining process.

3.2.3 Concept Generation

3.2.3.1 Datum Concept

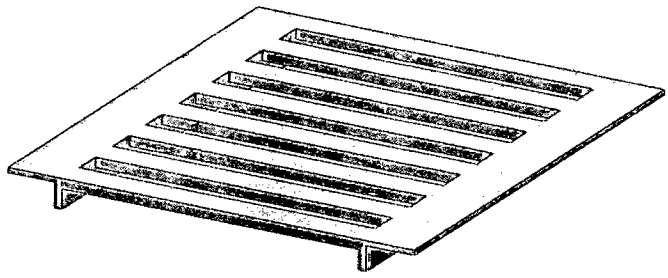

Figure 3.2

This datum concept of home rain cover is the existing product in the market nowadays. It do not has the front yard cover that can prevent pets from entering the drain. It also cannot prevent trash from entering the main drain. It only can cover the top side of the drain. This home drain cover is use by all people nowadays.

3.2.3.2 First Concept

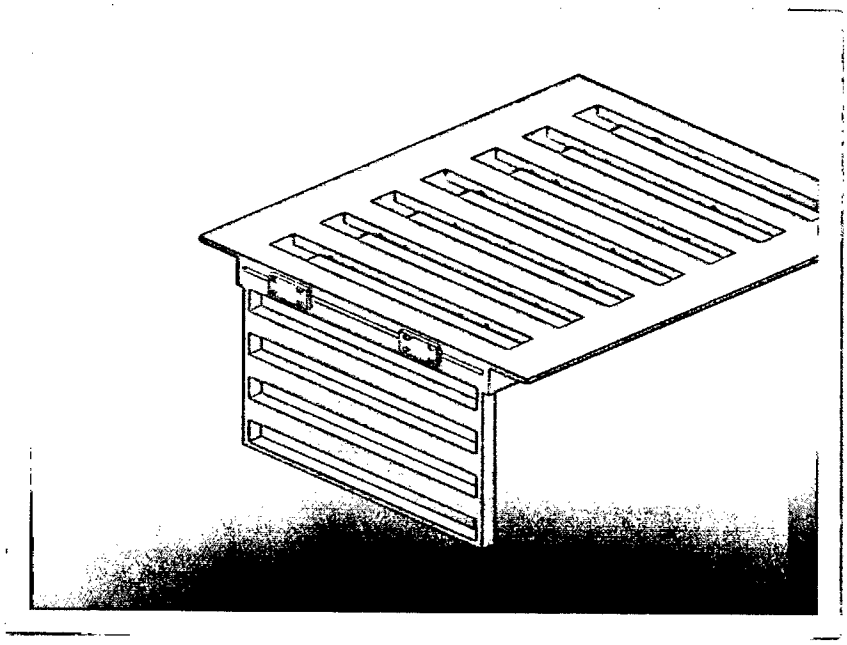

Figure 3.3

This first concept of home rain cover has been developed from the datum concept. It has the front yard cover that use the "ensel" to attach with the top cover. The front cover has hole which same with the top cover. By having many hole here, the water flow will be moved freely.