FABRICATION OF METAL PANEL DOOR

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Declaration

I, OLAFIMIHAN SAMUEL OLUWAPAMILERIN, hereby declare that this project titled "Fabrication of metal panel door" was carried out by me in the Department of Mechanical Engineering, Kwara State Polytechnic, under the supervision of ENGR. ABDULWAHEED SHAKIRUDEEN I

This Project is original and has not been previously submitted, either in part or whole, for any degree or diploma at any other institution of higher learning. All sources and references have been duly acknowledged.

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Supervisor's Name & Signature
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Student's name
Date

Certification

This is to certify that the project titled:

"Fabrication of metal panel door"

Was carried out by:

OLAFIMIHAN SAMUELOLUWAPAMILERIN

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Department: Mechanical Engineering

Institution: Kwara State Polytechnic, Ilorin

In partial fulfillment of the requirements for the award of National Diploma (ND) in Mechanical Engineering.
This work was successfully completed under my supervision and is hereby approved for submission.

Institution: Kwara State Polytechnic, Ilorin

In partial fulfillment of the requirements for the award of National Diploma (ND) in Mechanical Engineering.

This Project was successfully completed under my supervision and is hereby approved for submission.

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ABSTRACT

Privacy and security are major essential human needs in their various homes and offices, etc. which thereby gives rise to the need for doors among other security devices. Ability to have access to door of quality and high long span at low affordable price to an average Nigeria has been a problem. The project hereby aims at construction of a metal door with a peep hole are capable of giving maximum securities to life and properties. The locally available materials [e.g mild steel] of different shapes, forms and formats were with available indigenous technology without compromising the standard. The door constructed was subjected to different test and it was found efficient and also has the strength to provide adequate security at affordable price. The dimension of the overall door is 7ft x 3ft and the total weight of the door is 279.6N. The metal door consists of the frame unit the door panel, the bolt, the stopper as the major units.

Dedication

This project is wholeheartedly dedicated to the Almighty God, whose grace, wisdom, and protection have guided me through every stage of this academic journey.

I also dedicate this work to my loving parents(MR AND MRS OLAFIMIHAN), whose sacrifices, support, and prayers have been the foundation of my success. Their unwavering belief in me continues to inspire my pursuit of excellence.

A special dedication also goes to everyone who believed in me, motivated me, and stood by me in one way or another during this academic journey. Your encouragement truly made a difference.

Acknowledgement

First and foremost, I express my profound gratitude to Engr. ABDUL WAHEED SHAKIRUDEEN I, my supervisor, for his tireless guidance, expert advice, and constant encouragement throughout this project. His mentorship made this work achievable and meaningful.

My sincere appreciation goes to the Head of Department (ENGR. AYANTOLA WAHEED A.), Mechanical Engineering, for providing an enabling academic environment and ensuring that students have all the resources needed to succeed. I would also like to appreciate the Part-Time (ENGR. ISSA ABDULGANIYU) Coordinator for his support and effective coordination that helped keep us organized and focused.

To my lecturers, classmates, workshop technicians, and everyone who played a role—whether through academic input, technical assistance, moral support, or friendship—thank you for contributing to the success of this project.

Lastly, I thank Kwara State Polytechnic for giving me the platform to learn, grow, and apply practical knowledge in engineering. Your impact on my academic and personal development will always be remembered.

TABLE OF CONTENTS

Page

CHAPTER ONE

1.1 INTRODUCTION

A door is a movable structure used to close off an entrance, typically consisting of a panel that swing on hinges or that slides or rotates. [www.meskerdoor.com/panel-door.html, 2024. It can also be referred to as a frame or barriers of boards or other materials usually turning on hinge by which an entrance way into house or apartment is closed and open. [www.meskerdoor.com/panel-door.html, 2024]. Doors is universally used in building of all kind and it can be controlled [open and close] manually or automatically and it is usually constructed for security purpose.

There are many varieties of doors which are classified based on the construction mechanism, purpose or types of material from which the doors is produced. Some of these various classifications are discussed in the subsequent chapter.

For the purpose of this project, a metal panel door which is otherwise known as Rails and Stiles door is embarked upon.

1.2 The Needs for the Project

In construction of a building, the most essential aspect is entrance in which doors are used to give access from entering or leaving the building. The crave for the fabrication of the project (Metal Panel Door) arises from the urge to produce a more reliable and economically justifiable doors from the locally available materials, as well as improving on the existing designs that are available in our markets.

1.3 Objectives of the Project

The following are the aims and objectives of this project:

1. To improve the local method of design of door to modern design
2. To reduce the risk of danger to human lives and properties which might occur with the use of modern or grass doors.
3. To give the student the opportunity to put their theoretical class works into actual industrial life.
4. To make students realized that they can bring new idea to engineering fabrication or develop on what they are been taught in engineering industries and get better in the world of economy.

1.4 Literature Review

Door date back from the ancient Egyptian era, there are painting which serve as historical records or doors architecture. The climate in Egypt was hot and dry enough, that there was not any fear of war print that the wood used for doors were just that, slaps of wood on hinges.

In most places, due to change of temperature and humidity, doors usually have to be framed. Other historical records of door include King Solomon's temple doors. They were made of olive wood, as were many doors of the past. In India, there were ancient stone doors found. These had pivots on each end, which then fit into sockets. These doors swung open and sheet, similar to saloon doors of old west but not as quick. The Greeks and Romans used many styles of door: single, double, sliding or folding.

These doors are as well as many others found throughout Europe's past, were made of bronze. This seemed to be the going of today can be made from any material just found on earth, word, plastic, metal, glass, paper and even fabric. They usually serve the pUrpose of keeping something in and/or out.

There are interior and exterior doors, animal and people doors, automatic and manual doors, plus real and false doors. [Wikipedia, 2024]

1.5 Interior and Exterior Doors

Household are usually divided into interior and exterior groups. An interior door is one found inside of a house, while exterior exposed to outer elements on at least one side. Interior doors are found in the bathroom, bedroom, and base room (as long as it is not an outside entrance), closet Exterior doors are generally the front and back doors, and there might be the door for entering the garage as well. [Wikipedia, 2024]

1.6 Animal and People Doors

People and Animal both use doors but animal doors are usually simpler than the ones for people. Doors for people, most of the time, handle or knobs to open them with Animal doors generally are in the form of flab, such as in a dog or cat door. There are cut into larger people door, sometime, the wall of a house. [Wikipedia, 2024

1.7 Automatic and Manual Door

There are usually manual doors found in houses, there are the ones that need to have lever lifted or curb turned, then pushed or pulled by hand in order to open. Automatic doors are a feature that has only been around since 1954, but was not at first installed until 1960. These were doors for building and a mat on the ground which activates the opening. Today most automatic doors have sensors which trigger the opening. Electric garage door opener were first sold in the year 1926, today these also have sensors. Some revolving doors of today are automatic instead of traditional manual style. [Wikipedia, 2024].

1.8 Real and False Doors

For the most past, doors are able to be seen, yet sometime there are doors that lead to nowhere, they do not open. These are known as false doors. The Egyptian was big on putting these in tombs, in order for the family to have a place to lay offerings.

There are even doors made not to look like doors, these are known as real, but are called “secret” or “hidden” doors. Secret doorway can look like a book case in the wall, or a part of the wall itself.

Whether it is pet door, hidden/secret door, revolving door, these portals, will always be a necessity. Unless human decide to start leaving gaping holes in their home, doors are not something that will likely disappear with changing time. [Wikipedia, 2024]

CHAPTER TWO

2.1 ANALYSIS OF ALTERNATIVES TO PANEL DOOR

In a household, there are different kinds of doors depending on their purpose. All doors are classified as either exterior or interior models. These two types are differentiated by their construction.

An interior door is one found inside of a house, while exterior door is exposed to outer elements on at least one side. Interior doors are found in the bathroom, bedroom, and base room (as long as it is not an outside entrance). Exterior doors are generally the front and back doors, and there might be the door for exiting the garage as well. Other classifications of doors based on their constructional features and purposes include the following.

2.1.1 Sliding Glass Door

It is a door made of glass that slides to open and close. It is sometimes called an Area chin door and it is sometimes has a screen.

2.1.2 Garden Door

It is door that slides on rails, rather than sampling on hinges and when open, slides into an open cavity within a wall.

2.1.3 Automatic Doors

These are powered open and close a door fitted with a spring to close it e.g. door used in the banks.

2.1.4 Ledge and Brace Door

This is a door made from multiple vertical planks fixed together by two horizontal planks (the ledges) and kept square by a diagonal plank (the brace).

2.1.5 Pocket Door

This is any door that opens to a garden or back garden.

2.1.6 Blind Door

This is a door with no visible trim or operable components. It is designed to blend with the adjacent wall in all finishes, and visually to be a part of the wall, a disguised door.

2.1.7 Swing Door

Swing door has special hinges that allow it to open either inwards or outwards, and is usually spring loaded to keep it closed.

2.1.8 UP and Over Door

This is often use in garage. Instead of hinges, it has a mechanism, often counter balanced or spring that allows it to be lifted so that it rests horizontally above the opening. Also know as an overhead door.

2.1.9 Trap Door

This is a door that is oriented horizontally in a floor or ceiling, often accessed through a ladder rests horizontally above the opening. Also know as an overhead door.

2.1.9 Trap Door

This is a door that is oriented horizontally in a floor or ceiling, often accessed through a ladder.

2.1.10 Flush Door

This is a completely smooth door, having plywood fixed over a light timber frame, the how parts of which are often filled with a cardboard core material flush doors are most commonly employed in the interior of a dwelling.

2.1.11 Molded Door

It has the same structure as that of a flush door. The only difference is that the surface material is a moulded skin. It is commonly used as interior doors.

2.1.12 Louver Door

Louver door has fixed or movable wooden firms (often called states or louvers) which permit open ventilation whilst preventing privacy and preventing the passage of light to interiors.

2.2 Analysis of Alternatives Based on the Materials used

Various door designs have been fabricated by different fabricators and designers, but they all have limits at which they can function effectively, to give maximum protection and to satisfy door security requirement and users.

2.2.1 Leather

This is one of the materials firstly adopted as door materials to prevent unwanted access to an apartment and also reduce the crate prevention of direct sunlight.

2.2.2 Wood

Wood soon follows the use of leather as door material. This is obvious that leathers, as door material can not guarantee privacy and unwanted access. As a result, wood gradually replaced the use of leather. The use of wood for door is greatly approached because it possesses good workability. It is easy to construct and it is relatively cheap and readily available in market.

2.2.3 Metal

Metal is a very important engineering material used in almost every field of engineering and technology. The use of metal for door is generally replacing wooden

because of its defect like knots, checks, pitch, pocket holes, shaker etc. which tends to lower it strength thereby making it easy to break through thereby rendering it unsuitable to give adequate protection and strength. Metal door could be painted or coated properly to prevent it from corrosion attack especially in a moisture environment.

2.2.4 Flat Sheet Door

This is a door design with metal frames and the panels are also made of same material. Flat sheet metal is use in an environment or housing where adequate security is needed for life and properties in the house where it is used as door. This is because of ability of metals to withstand relatively high strain and also because of its strength.

2.2.5 Glass Metal Door

This is a very attractive and fascinating door design. The frame is made of metals, usually aluminum with glass as the panel. Though, it is very captivating and appealing in appearance, it cannot be used where adequate and maximum security is required except in advance design and construction because of its glass brittleness and bad ductility.

However, glass metal door is used in tourism centre and in entertainment industry to create a good look for their environment. (Wikipedia, 2024)

2.3 Choice of Alternatives

Metal panel door is a style of door construction that features vertical wooden or metallic stiles and horizontal rails that form one or more frames around thinner recessed inner panels. The doors usually have between one and eight panels, and the door is often referred to by the number of panels it contains. Introduced as a technical improvement over earlier plank-style doors, this method reduced the seasonal expansion and contraction of

wood doors. It came into fashion during the Georgian period in the early 1700's and remains the dominant method of construction today.

[www.historicdoors.com/glossary.html]

Metal Panel door design is mainly of metal fabrication, it can feeds its use in diverse area of human door needs, like house/residence, offices, store, auditorium etc. Despite its strength and high resistance to strain, it can be finished by painting to give it a good and attractive look. This makes it suitable for use even in co-operate buildings. Metal Panel door gives access and protection.

CHAPTER THREE

3.0 GENERAL DESCRIPTION COMPONENTS AND WORKING PRINCIPLE

3.1 DESCRIPTION OF ITS COMPONENTS

The metal panel door comprises of the following component parts:

3.1.1 Main Frame Unit

This is the unit which is mounted into the wall and also holds the movable door. It consists of the jambs, the sill-support and door-stop.

3.1.1.1 Jambs

These are the vertical posts that form the sides of a door frame, where the hinges are mounted and with which the bolt interacts.

3.1.1.2 Sill

This is horizontal beam below the door that supports the frame.

3.1.1.3 Door-Stop

This is a thin slat built inside the frame to prevent a door from swinging through when closed, which might break the hinges

3.1.1.4 Hinge

These are the component that attaches one edge of a door to the frame, while allowing the other edge to swing from it. It usually consists of a pair of plates, each with set of open Cylindrical rings (the knuckles) attached to them. The knuckles of the two plates are offset from each other. A hinge pair is their placed through the two sets of knuckles and usually fixed to combine the plates and make the hinge a single unit. One door usually has about three hinges, but it can vary.

3 1.1.5 Crash Bar (Handle)

A spring — loaded bar that is mounted horizontally on the door, opens outward when pushed upon, the bolt is released.

3.1.1.6 Doorknob (Handle)

A knob is a lever on an anile that is rotated to release the bolt.

3.1.1.7 Door Handle

This is a fixed handle, usually accomplished with a latch to release the bolt, on some doors the latch is incorporate into a hinges handle that releases when pulled on.

3.1.1.8 Latch

This is a device that allows one to fasten a door, but does not necessarily require an external handle.

3.2.1.9 Lock

This is the mechanical device that prevents access by those without a key or combination. It attached to the stiles of the door and has a switch that projects into the main frame when locked with the key.

CHAPTER FOUR

4.1 CALCULATIONS FOR THE METAL PANEL DOOR

By considering the factors for the selection of materials and dimension of the door fixture or installation, the volume, mass and weight of each component that made up the metal panel door is calculated as follow:

4.2 Derivation of Formulae

Weight (w) = pvg ……..(i) (Anyakoha, 2001)

Where p = Density (kg/m3) which is 7840kg/m3 for mild Steel

v = Volume (m^3)

g = gravity (m/ s^2)

But volume (V) = length (L) x Breadth (b) x Thickness (t)

V = L x b x t ……. (ii) (Stroud K. A. 2007)

Density (p) = $\frac{mass\,(kg)}{volume\,(m)^3}$

p = $\frac{m}{v}$ …… (iii) (Anyakoha, 2001)

Mass = Density x Volume

m=p × v …… (iv)

But Weight (w) = Mass x gravity

w = Mg (Kgm/s2) ……. (v)

Data provided:

For the frame unit, L = 2.lm, b = 0.9m and t = 0.OOlm

For the hinges (2 pieces), 1 = 0.05m, b = 0.025m, T = 0.003

For the lockset, length = 0. 125m, breadth = 0.09m, thickness =

0.03m

4.3 MASS CALCULATION OF THE COMPONENTS

For the frame unit

Volume = L x b x t (Stroud K. A,2008)

= 2.1 x 0.9 x 0.00 1

= 1.89 x 103m3

Using Mass = Density x Volume

•'. Mass Frame = Density of frame x Volume (Anyakoha, 2001)

= 7840 x 1.89 x 10-s

= 14.8176kg(14.82kg)

For the Panel Door Unit

Volume = l x b x t

= 2.0 x 0.7 x 0.001

= 1.4 x 103m3

Mass = Density x Volume

= 7840 x 1.4 x 10^{-3}

= 10.976kg

For the Hinges (2 pieces)

Volume = l x b x t

= 0.05 x 0.025 x 0.003

= $3.75x\ 10^{-6}$m3

Mass of 2 Hinge = p x v

= 7840 x 3.75 x 10^{-6}

= 0.0294kg

Mass of 2 pieces = 0.0294 x 2

= 0.0588kg

5.88 x 102kg

For Lockset

Volume = 1 x b x t

= 0. 125m x 0.09 x 0.03

= 3.375 x 10^{-4} m3

Mass = Density x Volume

= 7840 x 3.375 x 10^{-4}

= 2.646kg

Total Mass = 14.82 + 10.976 + 0.0588 + 2.656 (kg)

= 28.5008kg

4.4 WEIGHT OF THE METAL PANEL DOOR

Weight = Mass x gravity (Anyakoha M. W. 2001)

= 28.5008 x 9.81
= 279.59kgm/s2
= 279.6N

CHAPTER FIVE

5.1 FABRICATION PROCEDURE FOR SELECTION OF MATERIALS

5.1.1 Door Frame Unit

This is the part of the door which receives the force acting on the door members. It must be made of such material which will enhance its strength and easily workable, though, mild steel is not the only materials which must be used. Bronze, Wood, Silver, Brass etc are those materials which may be substituted. But, for cost consideration, availability and affordability of a material, mild steel was employed by the users.

5.1.2 Door Panel Unit

The panel unit, being the most significant structure, is directly exposed to atmospheric conditions which determines the behavior of such material in service, thus, it must be made of such material with high tensile strength, less sonorous and weightless. Bronze, shelter and aluminum are the best material to be used, but for cost implication and availability of materials, mild steel which is enhanced with anti — rusting are used in order to improve its durability in services.

Stiles and Rails: Stiles are the vertical metal units which hold panel member together and give shape for the required width of the door.

Due to its direct involvement in the closure and opening of the doors, it experiences forces of various magnitudes which could deform the materials used in services. Therefore, it must be made from a metal with high impact strength. Mild steel was then selected, because it is discovered that, it is a material that could give the required property.

On the other hand, Rail which is used to divide panel members into various sizes which could enhance aesthetics. It gives room for the expansion and the contraction of the panel members in time of hot and cold weathers. These, they must be made from material which can absorb and release heat in time of variable condition, good appearance to enhance aesthetic, alloy metal to enhance workability and design.

In view of the expected properties, the best material which are most suitable are rarely available, and costly and only little will be able to afford the cost of final production thus mild steel was used and tested against such alternatives and it was observed, it compete in service.

5.2 Consideration for Material Selection

Engineers always face problems when it comes to selection of materials that satisfy their requirements. The factors considered before the selection of material for the metal panel door are:

i. Impact strength

ii. Aesthetic quantity

iii. Availability

iv. Physical properties

v. Workability

vi. Economic

vii. Environmental reaction

viii. Cost of material

5.2.1 Impact Strength

It is mainly concerned with the resistance of the material to fracture and is one of the most important factors to practical application of materials. The materials used are highly of good strength and can be malleable into different shapes and size without fracture.

5.2.2 Aesthetics

Aesthetic quality is the material that gives design of an attractive and beautiful look. Good work and design finishing also improves material aesthetic qualities. Aesthetic qualities also include the shapes pattern, surface texture, colour etc.

52.3 Availability of the Materials

This is the ability to get the material at anytime it is required. This is very important especially when the same material with the same characteristics and properties is needed to replace a worn and broken point. Unavailability of a broken part can result in total abandonment of the whole work piece.

The material selection for the metal door is readily available in the market and the material (mild steel) is widely used in engineering work.

5.2.4 Physical Properties

Physical properties were also considered in the selection of material during the project work physical properties are very important in finding the metals that are good conductors of heat and electricity. More so, some materials are very corrosive.

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By considering the above factors and properties, the major part of the door is made of the door frame, door panel, the hinge and so on, are made of mild steel.

Properties of Mild Steel include: -

i. Ductility

ii. High malleability

iii. Good Tensile Strength and

iv. Light weight

The material used is light in weight for easy transportation during different operation. Also it is highly malleable, in the sense that it can be easily bent to the required

shape and size. Equally, it is of good tensile strength, hence it can withstand operations carried out on it e.g. bending, drilling of holes etc.

5.3 Fabrication of the Metal Panel Door

5.3.1 Sequence of Operations

Different forms of operations were carried out during the fabrication of the metal panel door. The operations taken are sequentially tabulated below.

Table 1: Sequence of Operation

S/N	Operation	Procedure	Tools/Machine Used
1	Marking out of the meal sheet	Marking out was the first step taken while doing this project. It was performed on a table called marking out table.	Tape Rule, Steel Rule, T-Square, Divider, Scriber and the marking out table
2	Cutting of the parts of the metal sheet	The square pipes and the metal sheet were cut into a dimension required	Hack saw, bench vice and guillotine machine
3	Bending Operation	The metal sheet used for the frame and the door panel were bent using a bending machine.	Bending machine
4	Joining Operations	Different parts that constituted and made up the metal panel door were joined together by welding.	Electrodes, electric are welding machines shield, Apron and gloves
5	Grinding operation	The surfaces welded are grinding to smoother surface by electric hand grinding machine.	Electricity hand grinding machine
6	Drilling and Biting Operation	The surface in which the lock set will be installed was drilled by an hand drilling machine and bolted up.	Hand drilling machine riveting gun

7	Cully operation	The square pipe and the sheet (plate) used for frame and the door panel were	Bench device and guillotine machine
8	Panting operation	After the construction of the door and finishing operation, the door surface was painted to prevent it from corrosion.	Painting machine

5.4 General Tools/Machine Used

i. Punch

ii. Twist drill

iii. Steel rule

iv. Clamp

v. Handsaw

vi. Welding shield

vii. Goggle

viii. Helmet

ix. Hand glove

x. Engineering overall

xi. Screw driver

xii. Hammer

xiii. Mallet

xiv. Scriber

5.5 Method of Fabrication

The fabrication of metal panel door is comprised of five basic units as listed below:

The door frame unit

ii. The stopper unit

iii. The locking device

iv. The hinges and

v. The handle

5.5.1 The Door Frame Unit

This unit was fastened and hooked to the wall which also hold the movable panel door panel the door frame is made up of sheet metal which was folded by bending machine of consist of two upright vertical frame, two top and bottom brazes and also a square pipe which serve as a built in support to hold the frame into wall. It was made up of the same metal of 1.00mm thick. The marked metal is folded with the use of bending machine and also formed the panel with the use of electric arc welding machine.

5.5.2 The Stopper Unit

This is made of rectangular of 2" x 1" (50.8mm x 25.4mm). The main purpose of this is to stop the panel from moving inward. It is formed to the door frame unit with an electric are welding. The pipe is 30 inches long. It is located at the base of the door.

5.5.3 The Locking Device

This is unit that is used to look the door for safety reason. It is fixed on the door with bolt and it is usually opened with the use of key.

5.5.4 The Hinges

This is the units that hold the door frame unit to the wall frame it allows for easy oscillation of the door panel. It is placed at two strategic positions for easy opening and closing.

The hinges are fabricated by the use of metal plate of size 4 x 2 inches (i.e. 101.6 x 50.8mm). A plate was cut into E. shape and folded at the e edges while the other plate was cut into shape and folded at the two edges. After folding, the two pieces folded were merged together and a rod inserted into the holes after that, two holes were drilled on each sides of the hungers.

5.5.5 The Handle

This serves as a means for easy opening and closing of the door panel. It is made of flat bar of 152.4mm long and welded to the door panel with an electric arc welding.

5.6 Assembling of the Components

After measuring the required dimension with the use of steel rule and try square and the marking out of the pipes is done, using the scriber. The pipes were cut into pieces by of use hacksaw. These pieces were clamped and they were welded together by using gauge — 12 electrode. The Welding machine electrode holds the rod filter and the welding shield for protection.

Then the key ways were cut by using the hand drilling machine, hacksaw, files and screw driver to tighten the bolts of the key to panels. After welding, the dusts were cleaned by using tinnier and wire brush. Then, the welded surface was ground by using grinding machine. Then the job was sprayed using blue paint with spraying machine. The paint was necessary so as to protect the sheet metal from corrosion and to make the door looks beautiful.

5.6 Safety Precaution

1. When fabricating the project, hand gloves is used to protect the hand from been cut by the sharp edges of the sheet metal.
2. While taking the dimensions, the eyes were placed vertically above the steel rule and not oblique to avoid error due to parallax.
3. Protective pit sole shoes were worn in the workshops to protect the feet from being cut by chips of metals in the workshops.

4. While welding the protective helmet, goggle were worm to protect both the head and the face respectively against from the u-ray light been generated from the welding metal. The use of overall was done to protect the body from the fumes and hot chips.

5.7 Maintenance

To make the door last long, it has to be well maintained and user have to follow the following recommendations.

The hinges of the door must be lubricated with grease or oil at regular intervals to prolong the life of the door. Care should also be taken when locking the door to avoid too much banging of the door and also it avoids hanging of the door.

An important recommendation is the color protection. The paint in the door should not be scratched with any sharp object as this well lead to wearing away of the pain which can lead to rusting of the metal.

5.8 Estimation for the Materials

The feasibility of any project is likely dependent on the total cost required in the process of the project, the cost of materials, however is also depending on certain basic factors which must be thoroughly considered before such a project can start.

Due to the instability of the price of materials nowadays in the market, after the fabrication of this project in terms of

i. Increase in transport fair

ii. Improvement in quality of such material

iii. Cost of the materials

Table 2: BILL OF ENGINEERING MATERIAL AND EVALUATION

S/N	Materials	Qty	Total Cost Unit
1	2” by 2” square pipe	2 Length	N18,700
2	Chaquered plate	1 Sheet	N58,000
3	Lockset key	1	N14,900
4	Hinges	2	N2000
5	¾ square pipe	3	N9,900
6	G12 electrode	½ Pack	N13,800
7	Paint cost	1L	N5000
8	3 ½ ” x 1 ½ “ pipe	2	N54,000
		Total	**N176,300**

5.9 Economic Justification

Due to the economic condition of the country, the prices of the selected material are relatively expensive. With careful selection, we are able to buy the materials within our limited capacity and the grand Total Cost is estimated as above, which is very economical when considering the qualities of the material used and the economic situation of things now in our beloved country.

CHAPTER SIX

RECOMMENDATIONS AND CONCLUSION

6.2 Recommendations

Metal panel door is said to be the major type of door being adopted, the best service of this door can be obtained by adhering to the specified recommendations which are:

- It is also recommended to lubricate the hacking device every week so that the doors can deliver efficient service.
- The locking device must be kept free of moisture in order to avoid corrosion of this device.

6.1 Conclusion

After the completion of the metal panel door, It was subjected to force indeed which the design was based. Strictly adhering to the recommended usage procedure and applying the appropriate maintenance at the prescribed interval, a lengthy lifespan and best service is assured.

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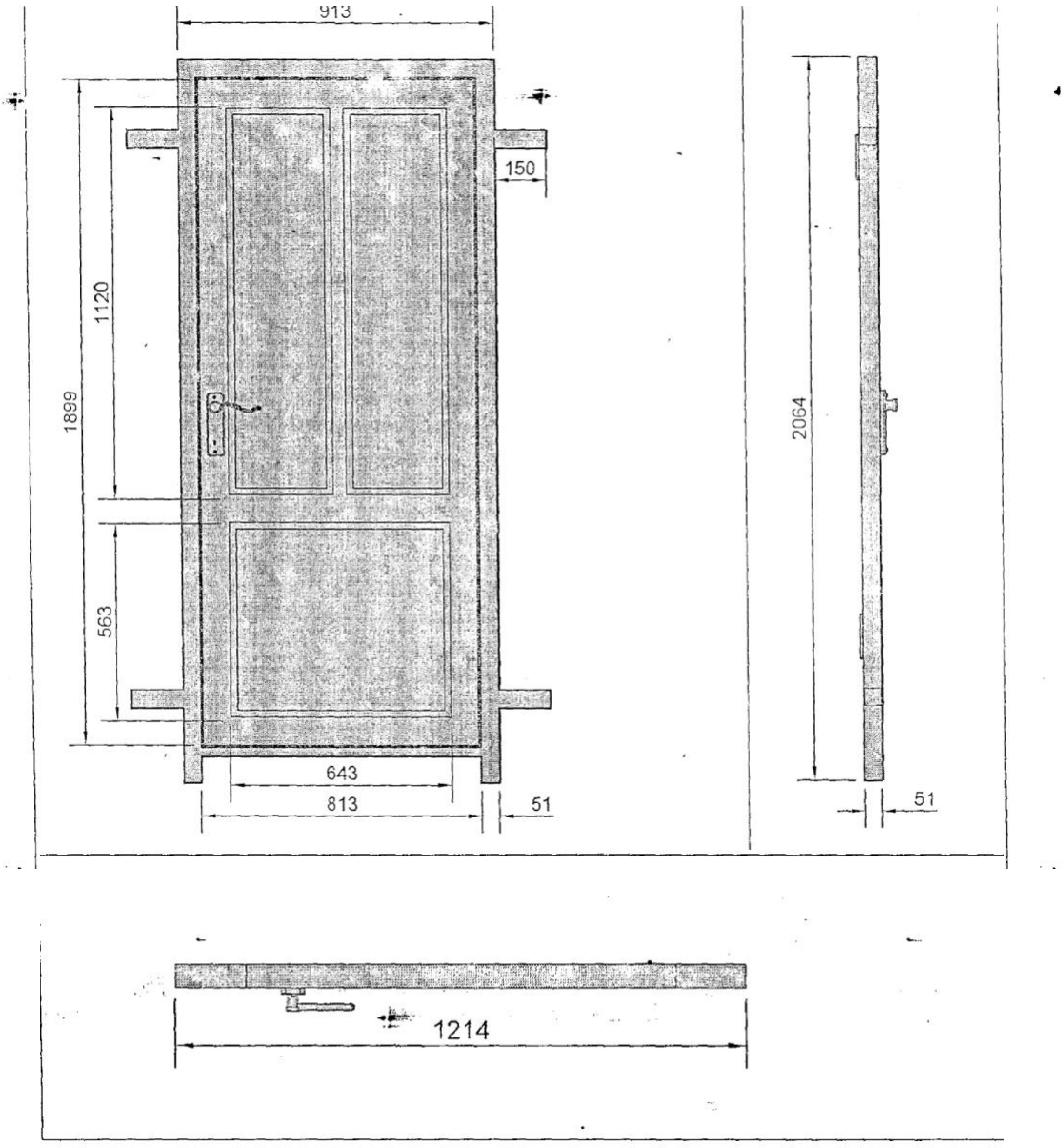
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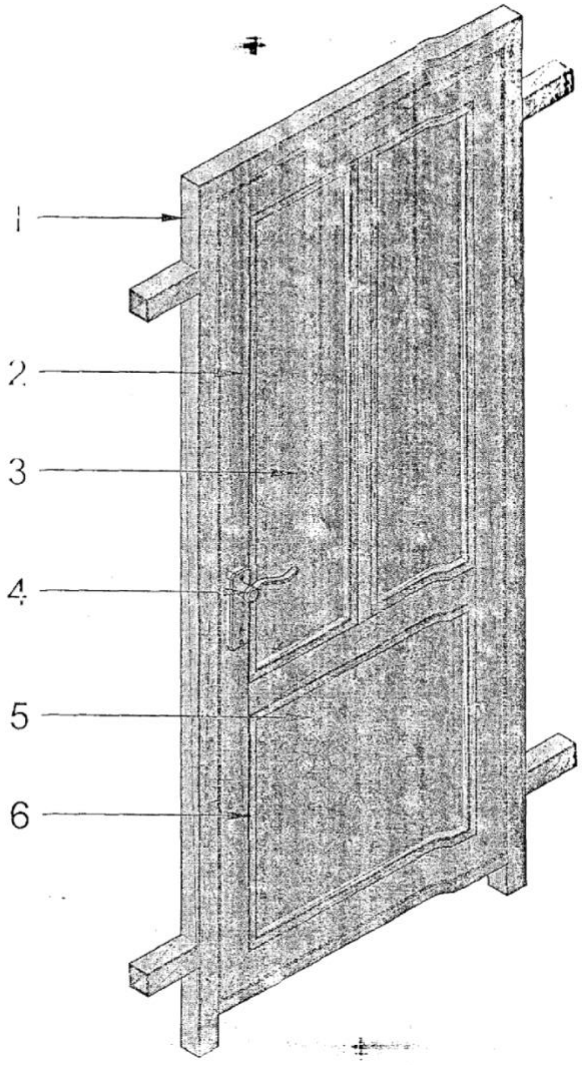
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