DESIGN AND FABRICATION POWER WINDOW APPARATUS (BOWDEN CABLE TYPE)

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ABSTRACT

The main purpose of this Power window apparatus project is to train final year student for hands on experience and to work by themself. The study of manufacturing is very important in order to ensure that student understand on what are the needs to do in this project. This project is about designing and fabricating the Power Window Apparatus for experimental use to help the students in a Automotive course for easy understanding the basic system of power window and how it works. This project involves the process of designing the test panel by considering the shape and also the advantages for student to use in their learning process. After the design has been completed, it was transformed to the real product by fabricating process where the design is used for guideline. This project also required analysis to test the power window operation failure factor. Numerous methods and process involve in this project for instance joining using welding process. After all the process had been done, this power window apparatus help us to understand the fabrication and designing process that involved in this project.

ABSTRAK

Tujuan utama projek 'power window apparatus' ini ialah memberi pelajar pengalaman bekerja dan bekerja dengan sendiri . Pembelajaran di dalam bidang pembuatan adalah sangat penting untuk memastikan pelajar memahami apa yang harus dibuat di dalam projek ini. Projek ini adalah mengenai merekabentuk dan menghasilkan peralatan 'power window' untuk tujuan eksperimen bagi membantu pelajar di dalam kursus Automotif untuk mudah memahami sistem asas bagi sebuah 'power window' dan bagaimana ia beroperasi. Projek ini melibatkan proses merekabentuk sebuah 'test panel' dengan mengambil kira bentuk dan juga kelebihannya dalam membantu para pelajar di dalam proses pembelajaran mereka. Setelah rekaan yang ingin dihasilkan siap, ia akan ditukarkan kepada produk yang sebenar di dalam proses penghasilan dimana rekaan tadi akan dijadikan sebagai panduan. Projek ini juga merangkumi analisis keatas faktor kegagalan 'power window' beroperasi. Banyak cara dan proses yang terlibat dalam proses penyambungan, sebagai contoh menggunakan proses welding. Setelah kesemua proses yang terlibat di dalam projek ini selesai, peralatan 'power window' ini membantu kita memahami proses mereka dan menghasilkan yang terlibat di dalam projek ini.

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CHAPTER 1

INTRODUCTION

1.1 Project synopsis

This project concerned on design a test panel of a power window, fabricate and test the platform as an experiment apparatus. In order to fabricate the test panel, this project required a lot of machining process in mechanical such as metal cutting, and grinding. This project also required a skills in manufacturing process such as MIG welding to joint the parts and etc. Basically the main processes that involved in this entire power window apparatus project are the fabrication of the frame panel, the base and the T beams ,assembly the panel frame and the wiring of motor on the power window system.

1.1.1 Specific Project Synopsis

My project title is Design and Fabrication Power Window Apparatus (Burden Cable type).Panel will work to test the power window failure factor and easy to understand how power window work. This project also involved the analysis of the cable strength, durability and the adjustment of the system itself. It is fabricated as an experiment Equipment/Material to assist the learning process of automotive class in Faculty of Mechanical Engineering. Overall, this project will acquire the skills of design, analysis, fabrication and testing.

1.2 Objectives of Project

(i) To design the power window test panel.
(ii) To fabricate the power window test panel.
(iii) To test the test platform as an experiment apparatus.

1.3 Scope of Work

Fabrication of the power window test panel requires special coordinated scope of work. As this is a new project, special scopes of works have to be determined so that the main objective and goal can be achieved.

These scopes help the team to be focused and knew about his or hers job. These scopes are:

(i) Literature Review: Valuable data are searched and gathered. Considering the design of the test panel in terms of its complexity and method to produce.

(ii) Sketching & Designing: Sketching and designing using Solid works software in creating the design of the test panel for power window (Bowden cable type only).

(iii) Fabrication: Fabricate and produce the test panel by using all necessary manufacturing process such as welding, cutting, grinding and etc.

(iv) Testing: Test the design system that works like an actual power window.

(v) Analysis: Analysis the power window failure factor according to :

  (i) Load (attached the load at the regulator).

  (ii) Surface contact (effected by door structure part).

It is the time where the soft skill e.g. punctuality, self discipline, time management and problem solving been practices because the project is highly depends on the effectiveness of all the skill as much as the knowledge the student has learn.

1.4 Project planning

This project began with investigation and research literature review via internet, reference books, supervisor and other relevant academic material that related to this project. To make this project more accurate and suitable, I study more about related

topic and spent more than two weeks doing a literature review. Every week, improvement of knowledge needed to make sure this project will be completed very well.

At the same week I do some schedule management for this project which included schedule management. This is done using Microsoft Office Project using Gantt chart system. This also takes a week to accomplish.

Then, discuss with supervisor about the title and continue detail research about the power window (Bowden cable type). After research already finish, decision making a design should be applied to choose a design that suitable among engineering student.

The sketching of the model takes about 1 week to be done. The sketching done using manual sketched at A4 size paper and the engineering drawing is done using Solidwork software. The sketching of the design are detail discussed and the best design that suits are selected. The design are selected based on concept selection that have been learned in the Industrial Design subject.

The next task is preparation of progress for mid-presentation and progress report writing, both of these tasks takes two more week to be done. After that comes the progress presentation week and progress report submission. On this particular week I have to prepare the speech for the presentation and double checked the presentation slide and report that has to be submitted. The student also receives a comment and correction from the supervisor about the presentation.

The next week is the fabrication week where the project parts start to be fabricated. The frame panel, T base and other parts are fabricated according to the selected design. The fabrication process is schedule to finished by two week but because of fabrication process is have a lot of part to cutting and fabricated, then this process is scheduled to take about four weeks.

Next the assembly process of power window regulator and motor on the test panel that already finished, then testing and analysis, correction, and finishing of the model. This task scheduled to take time about two weeks.

Next task is the final report writing and final presentation preparation. This take about three week to complete. The report is done with the supervisor's guidance. Due to all problems, the project the management has agreed to extend the time to submit the report and the presentation. All the task is scheduled to take about sixteen weeks overall.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Power windows or electric windows are automobile windows which can be raised and lowered by depressing a button or switch, as opposed to using a hand-turned crank handle. The power moonroof, a transparent, retractable sunroof, may be considered as an extension of the power window concept. The first electric power windows were introduced around 1946 by Lincoln. These are driven by a small electric motor inside the door and have come to be universal in the industry. Prior to that date, in the few vehicles offering this feature, the windows were driven by hydraulics or off the engine vacuum. In the 1950s, electric power was also applied to the tailgate window, in many station wagons. In a typical installation, there is an individual switch at each window and a set of switches in the driver's door, so the driver can operate all the windows. However, some models have used switches located in the center console, where they are accessible to all the occupants. In this case, the door-mounted switches can be omitted.

2.1.1 Working Principle

2.1.1.1 The Lifting Mechanism

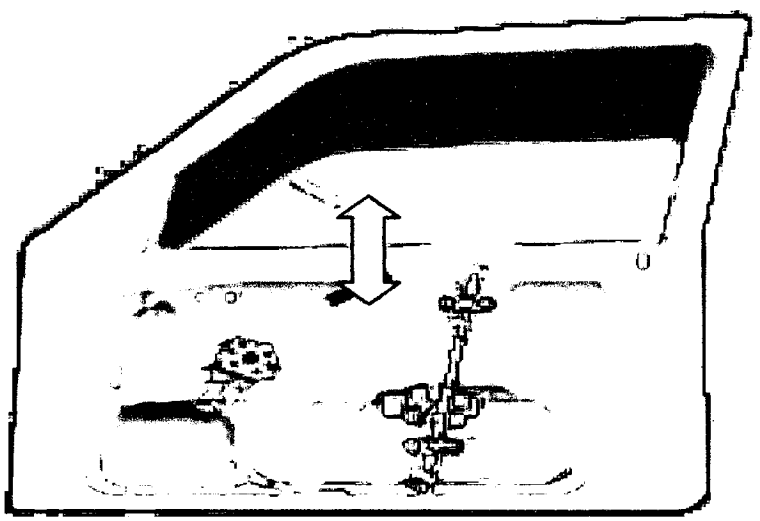


Figure 1.0 : Power window work

This cool device is the heart of a power-window system. The window lift on most cars uses a really neat linkage to lift the window glass while keeping it level. A small electric motor is attached to a worm gear and several other spur gears to create a large gear reduction, giving it enough torque to lift the window.

The linkage has a long arm, which attaches to a bar that holds the bottom of the window. The end of the arm can slide in a groove in the bar as the window rises. On the other end of the bar is a large plate that has gear teeth cut into it, and the motor turns a gear that engages these teeth. The same linkage is often used on cars with manual windows, but instead of a motor turning the gear, the crank handle turns it. In the next section we'll learn about some of the neat features some power windows have, including the child lockout and automatic-up.

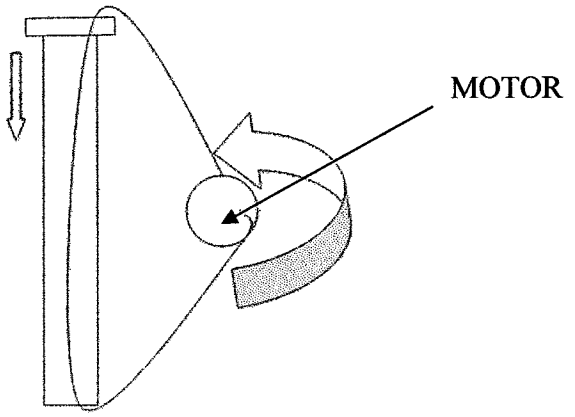


Figure 1.1 : Motor direction

2.1.2 A Basic System

On this system, the power is fed to the driver's door through a 20-amp circuit breaker. The power comes into the window-switch control panel on the door and is distributed to a contact in the center of each of the four window switches. Two contacts, one on either side of the power contact, are connected to the vehicle ground and to the motor. The power also runs through the lockout switch to a similar window switch on each of the other doors.

When the driver presses one of the switches, one of the two side contacts is disconnected from the ground and connected to the center power contact, while the other one remains grounded. This provides power to the window motor. If the switch is pressed the other way, then power runs through the motor in the opposite direction.

2.1.3 An Advanced System

On some cars, the power windows work in a completely different way. Instead of the power for the motor going through the switches directly, the switches are connected to one of the many electronic modules in the car (the average car contains 25). Some cars have one in the driver's door, as well as a central module called the body controller. Cars that have lots of controls on the door are more likely to have a setup like this. Some cars have the power-window, power-mirror, power-lock and even power-seat controls all on the door. This would be too many wires to try to run out of the door. Instead of trying to do that, the driver's door module monitors all of the switches. For instance, if the driver presses his window switch, the door module closes a relay that provides power to the window motor. If the driver presses the switch to adjust the passenger-side mirror, the driver's door module sends a packet of data onto the communication bus of the car. This packet tells the body controller to energize one of the power-mirror motors.

2.2 Type of power window

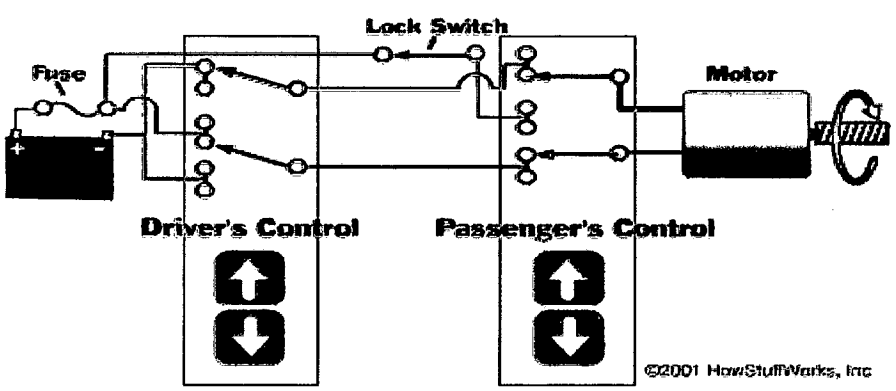
2.2.1 Existing Power Windows type

Automatic Up/Down - The automatic-down feature is fairly common on cars with power windows. You tap and release the down switch and the window goes all the way down. This feature uses a circuit that monitors the amount of time you hold the switch down. If the switch is down for less than about half a second, the window will go all the way down until it hits the limit switch. If you hold the switch down for longer than that, the window will stop when you release the button. Automatic-up windows are less common.

The problem with automatic-up windows is that if anything gets in the way of the window, such as a child, the window has to stop moving before it hurts the child. One way that car makers control the force on the window is by designing a circuit that monitors the motor speed. If the speed slows, the circuit reverses the power to the motor so the window goes back down.

Window Control From Outside - On the Volkswagen in the TV commercial, the windows can be lowered by inserting the key in the driver's door, turning and holding it. This feature is controlled by the driver's door module, which monitors a switch in the door lock. If the key is held turned for more than a set amount of time, the driver's door module lowers the windows.

Courtesy Power-On - Some cars maintain the power to the window circuit after you turn your car off, which saves you from having to stick your key back in the ignition if you forget to roll your window up. The power-window circuit will have a relay on the wire that provides the power. On some cars, the body controller keeps this relay closed for an extra minute or so. On other cars, it stays closed until you open a door.



A simple power-window circuit

Figure 1.2: Wiring system during window going up on driver control.

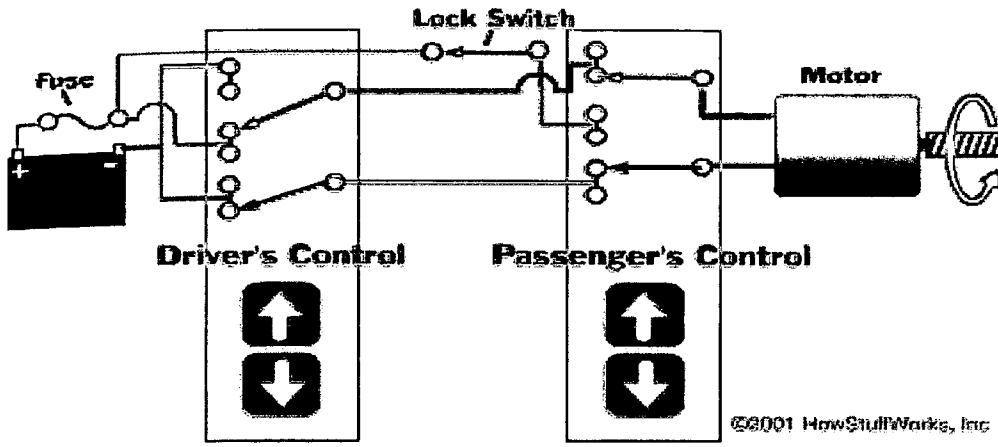


Figure 1.3: Wiring system during window going down on driver control.

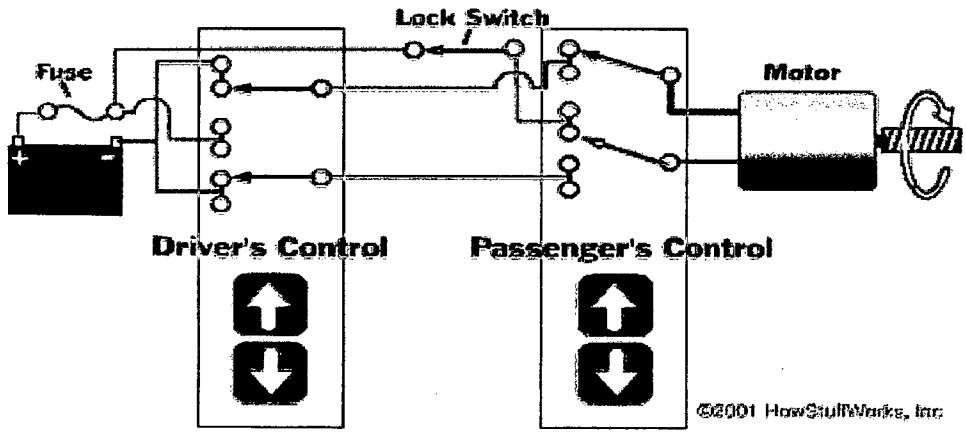


Figure 1.4: Wiring system during window going up on passenger control.

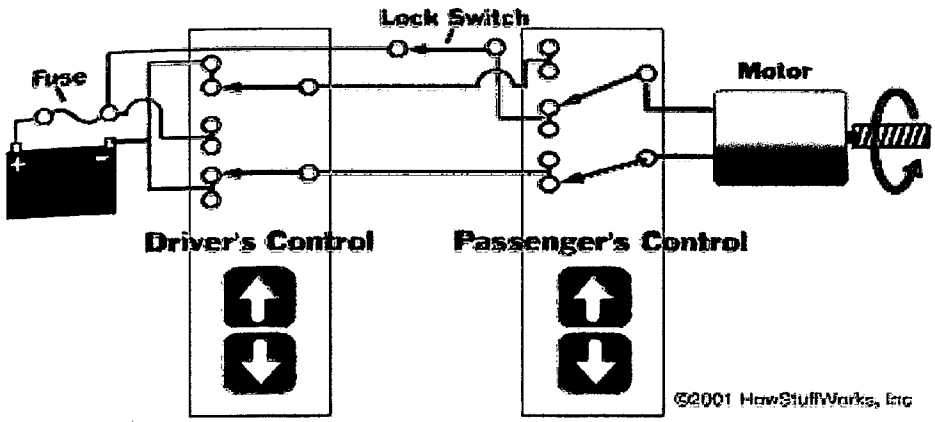


Figure 1.5: Wiring system during window going down on passenger control.

2.3 Motors

2.3.1 Type of motor

2.3.1.1 Direct Current(DC) Motor

The modern DC motor was invented by accident in 1873, when Zenobe Gramme connected a spinning dynamo to a second similar unit, driving it as a motor. The classic DC Motor has a rotating armature in the form of an electromagnet. A rotary switch called a commutator reverse the direction of the of the electric current twice every cycle.

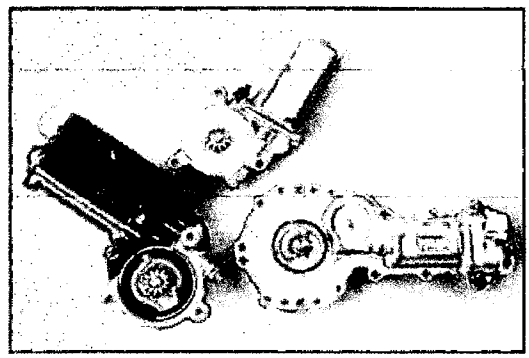


Figure 2.0 : Three of the most popular GM motors

2.3.1.2 Alternate Current(AC) Motor

In the induction Motor, the field and armature were ideally of equal field strengths and the field and armature cores were of equal sizes. The total energy supplied to operate the device equal the sum of energy expended in the armature and field coils.

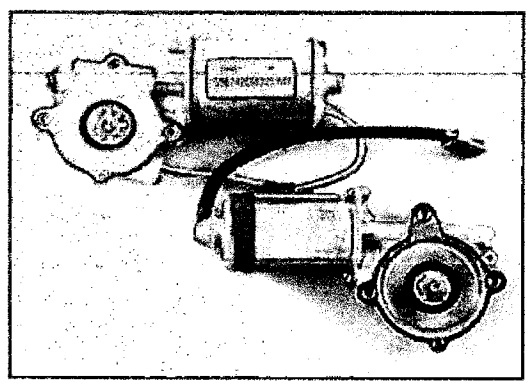


Figure 2.1 : Two popular Ford motors

CHAPTER 3

METHODOLOGY

3.3. Process Flowchart

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