



A Design of Concealed Wiring Concrete Cutter for Drawing, Cutting and Drilling Process

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Abstract

There are two types of conduit wiring, name as surface wiring and concealed wiring. Concealed wiring is the most popular due to its beautiful, stronger and common electrical wiring system. The conventional way of doing the concealed wiring need to do the three steps with the different tools. The first step is drawing two line using a pencil as a guide in doing the cutting process. The second step use a grinder machine for cutting process and the third step is using stone breaker to make a groove on the wall that will cause the concrete dust flying in the vicinity. This paper proposed a design of concealed electrical wiring concrete cutter tools for drawing, cutting and drilling process to overcome these problems at a time simultaneously. The laser beam in this machine used as a guide line for the cutting process and several disc cutter used to cut as well as to break the stone. Furthermore the dust protection used to avoid the dust flying around. The result shows that the time taken can be shorten in average between 50% to 70% depends on the length of the installation polyvinyl chloride (PVC) conduit of electrical wiring. This special tools will provide the wiring contractor to do their job efficiently.

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Key-word: - Concealed wiring, PVC conduit, electrical wiring, concrete cutter

1. Introduction

Malaysia is a developing country that cause the demand for construction development sector increase rapidly. Increasing the construction development sector will increase the demand of wiring system. To meet the demand, the wiring contractor needs a sophisticated tools that can install the PVC conduit pipe in the wall to make the beautiful appearance of electrical wiring system (Arora, 2008). Amongst types of electrical wiring, conduit wiring is evidently the most favourite wiring used by residential and official buildings (Chukwuedo, 2014). Surface wiring and concealed wiring are types of PVC conduit wiring that mostly use by the wiring contractor. Surface conduit wiring is a method where the conduits installed on roof or wall using rawal plugs which make a house and office contemplation of disorder. Concealed conduit wiring is where the electrical conduit wiring system is hidden inside the wall and plastered after the concealed wiring is done hence no conduit or electrical wire visible in the house for sleek and elegant looks. Although aesthetics is the main reason that determined the choice of concealed wiring, its effectiveness as a method of wiring appropriate and safe affected (Surendran & Mani, 2010).

The conventional method of doing a concealed wiring can be depicted in block diagram as shown in Figure 1. The lines need to be marked on the wall using a pencil then the grinder use to cut the chased lines, finally the stone breaker used to chop out the concrete slot or chases, which the traditional approached used a chisel and hammer before inserted the PVC conduit and buried inside the wall. The chases then plastered with cement to let the PVC conduit embedded inside the wall where only finishing accessories appeared on the wall (Manan, 2007).

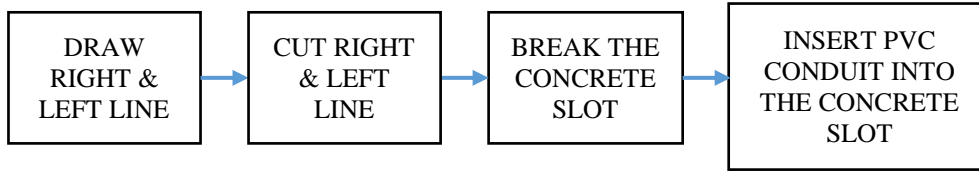


Figure 1
Block Diagram of Conventional Concealed Wiring

Magar and Trikal have proposed a machine for cutting chase in wall for concealed electrical fitting. They designed the machined based on engraving technique to make the process simple and accurate in a single machine. However the designed did not use the laser beam and light emitting diode (LED) to ensure the cutting process is straight and the cutting process can be done in the dark area (Magar & Trikal, 2015). In this paper the proposed machine will overcome all the problems with the additional laser beam and LED by modified the existing grinder machine.

2. Methodology

The proposed method on this paper can be simplified into block diagram as depicted in Figure 2.0. The power supply will be built as a direct current (dc) source to energize the LED and laser beam. The main part of innovation done in this paper is to do a modification from an existed grinder machine used to cut and break the concrete simultaneously.

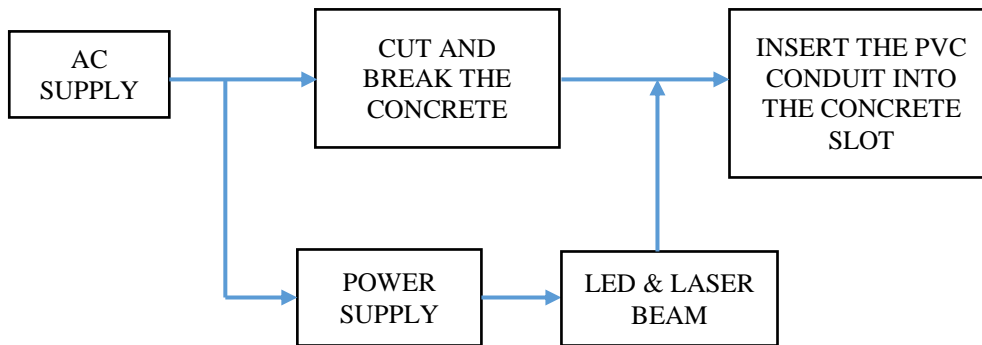


Figure 2
Block Diagram of Proposed Design

The proposed design of the concrete cutter is shown in Figure 3. Several concrete cutter discs will be added into the existed grinder machine. To do such a thing some modifications need to be made. To add more concrete cutter discs the mounting flange need to be expand.

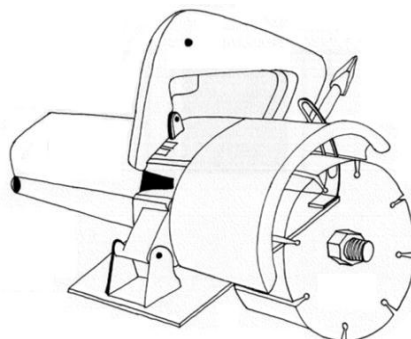


Figure 3
Proposed Design of Concealed Wiring Concrete Cutter Diagram

A new shape of mounting flange which is longer than the existing one will be designed. The mounting flange design with a pocket on it to insert the key used to avoid the concrete cutter discs moving during the wiring work. An original mounting flange and a new designed of mounting flange is shown in Figure 4a and Figure 4b respectively.



Figure 4a
Original Mounting Flange Diagram



Figure 4b
Modified Mounting Flange Diagram

A modification of concrete cutter disc need to be made to ensure the modified mounting flange can hold all the concrete cutter discs perfectly. The original concrete cutter disc and the modified concrete cutter disc is shown in Figure 5a and Figure 5b respectively. The arrangement of the concrete cutter discs with a disc washers inserted to mounting flange is shown in Figure 6.



Figure 5a
Original Concrete Cutter Disc Diagram



Figure 5b
Modified Concrete Cutter Disc Diagram

The modification of a steel flat washer is shown in Figure 6 and the final arrangement of the concrete cutter discs with a steel flat washers inserted to mounting flange is shown in Figure 7. Based on the observation by the author the suitable distance between each concrete cutter disc is 0.2cm which separated by a steel flat washer, to ensure the cutting and drilling process of the wall run smoothly without damaging the wall itself.



Figure 6
Modified Steel Flat Washer Diagram



Figure 7
Concrete Cutter Discs and Steel Flat Washers Arrangement Diagram

To avoid the dust flying around during the wiring work run, a dust protection with a funnel to allowed the dust fall into the funnel need to be designed. Instead used as a dust cover it is also used as a base to mounted the laser beam and LED hence main purpose as a chase guide line and LED used to light up the work area on the dark. The proposed diagram for dust protection is depicted in Figure 8.



Figure 8
Diagram of Proposed Dust Protection Designed

3. Result

Cutting a chase is a simple task for most electricians. There are simple rules for that particular task in order to make the installation cables as safe as possible. Referring to Figure 9, the vertical chases must not be any deeper than one third of total wall thickness. Meanwhile, the depth of the horizontal chases should not be more than one sixth of the wall thickness. Then, size of the using conduit will setting the width and length of the vertical or horizontal cutting chases. All chases in wall must be in a straight line.

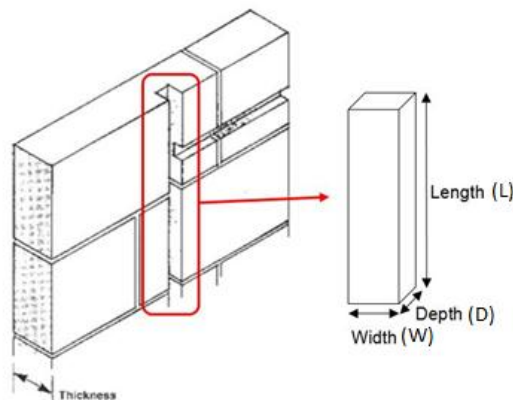


Figure 9
An Illustration of The Vertical Cutting Chases in Wall

As can be seen in Table 1, the time taken to make chases in wall in single operation by using the proposed design of concealed wiring concrete cutter being shorter than the time it takes to create chases in walls with the help of several hand tools like hammer, chisel, grinders, and demolition hammer. The findings indicated that an electrician who used the proposed design of concealed wiring concrete cutter can save the time taken to make a chase in walls by about 50% to 70% depend on the length of the chases. This findings also shows how efficiently this cutter as it can enhance the conduit installation works in a short time by the electrician without making any dust flying around.

Table 1
Comparison of Time Taken for Proposed Design and Conventional

Size of chases (WxLxD) (inch)	Time taken by the proposed design of concealed wiring concrete cutter to cutting chases (min)	Time taken by several hand tools to cutting chases (min)	Percentage of time saving (%)
1 x 1 x 5	0.5	1	50
1 x 1 x 10	1	3	67
1 x 1 x 60	3	10	70
1 x 1 x 120	6	20	70

Calculations:

$$\text{Percentage of time saving} = \frac{A - B (\text{min})}{B (\text{min})} \times 100$$

Where;

B = Time taken by the proposed design of concealed wiring concrete cutter to cutting chases (min)

A = Time taken by using several hand tools to cutting chases (min)

4. Conclusion

Proposed concealed wiring designed successfully in order to make the wiring task easier and efficient. The result showed that time can be reduced by 50%-70% depends on the width and depth that need to be cut. This special tool comes with dust protection to avoid the dust flying around and the LED to help the wiring contractor doing work in the dark. Thus this proposed concealed wiring is suitable for concealed wiring job in domestic and industrial.

5. Acknowledgement

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