

Development and Designing an Adjustable Metal Cut off Machine

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ABSTRACT

Nowadays metal-cutting equipment is in demand in the market because of the different construction process not only on this infrastructure but also on the training process of different schools that offer qualification under the metals and engineering sector. Cutting these metals may also affect the budgetary cost of the output. Cut off machines are commonly used for this purpose. Cut off machines that are produced in the industry seem to be more expensive not just because of the parts but also because of the use of the consumption of the disc. Cut off machines uses #14 cut off disc. After using it there is always a residual disc that is having a diameter of 12 cm. This residual disc is almost the size of the disc of an angle grinder which is having a #7 cutting discs that almost cost 80 pesos. Also, this cut off machine cannot cut at your desired angle. Upon this issue, the researcher came up with developing and designing an adjustable metal cutter that can maximize the use of the disc and can cut at a different angle, As the result of the project almost 6 cm diameter was the maximum size of the waste disc. This machine can be used in the metals and engineering sector, specifically in SMAW, welding shops, construction companies, and others related to metal workings. This has also become economical because some parts of the machine are recyclable materials. A full factorial design of the experiment is selected for experimental planning and the analysis of variance (ANOVA) has been employed. Upon the evaluation, the adjustable metal cut off machine passed the level of (1) acceptability (2) functionality and (3) safety of the product.

Keywords: Adjustable, cutting, cut off machine, disc

INTRODUCTION

In this modern generation lots of factories and buildings were put up. The process of putting it up creates a big demand or need for the metal cutting machines. All buildings, houses and other furniture are almost made out of different kinds of metal. The fabrication process of the materials should always be on the right and accurate measurements to follow according to the plan and achieve the right output.

Many cutting metal machines are invented nowadays and they are proven effective, like plasma cutters, oxy-acetylene that use different types of gases that are hazardous not just in our health but also in our environment. There are also metal cutting machines like cut off and others which are expensive and they are all set for similar purposes.

There are also a small cutting machine, an angle grinder or a side disc grinder is a versatile tool that is typically used in repair workshops and construction site and comes in a wide variety of different sizes and motor powers, operating an angle grinder, safety becomes a number one issue and there are a number of risks involve that need

to be taken seriously, especially for first time users. Wheels can catch onto an edge and cost the object to throw or the grinder to kick back. Hence this machine is cheaper than other cut off machines but it highly consumes cutting discs because of the thickness of the disc.

The paper presents the experimental study; to investigate the performance of the adjustable metal cut off machine. Full factorial experimental design and analysis of variance (ANOVA) has been employed to determine the best combination of cutting parameters. The machine will be evaluated by the three groups of respondents, namely the metals and engineering trainers of TESDA, industry experts and mechanical engineering instructors.

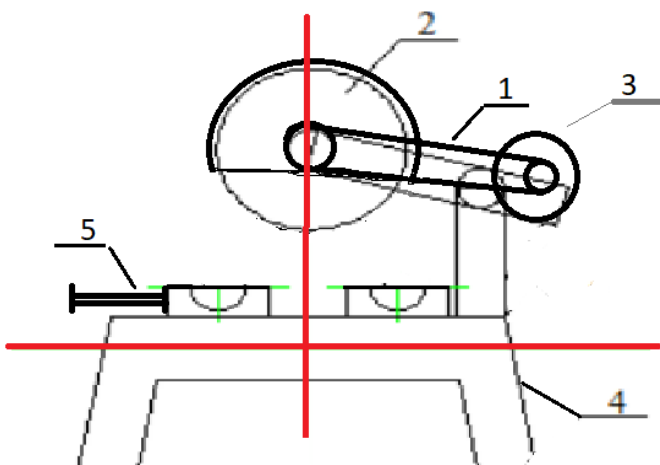
The study's objectives are to develop and determine the acceptability of the adjustable metal cut-off machine, to produce a machine that will maximize the use of the cut-off disc, and to determine the acceptability of the adjustable metal cut-off machine in terms of functionality, durability, and safety.

METHODOLOGY

There are numerous operating principles for cutting metals, steel bars, and other metal construction materials available today. A cutting machine powered by an electric motor is proposed in this study. A technology of cut off machine is suggested in accordance with the general requirements of the industry and the actual conditions of equipment, as shown in Fig. 1. It consists of five parts: (1) the fan belt, (2) the disc cutter, (3) the electric motor, (4) the base, and (5) the adjustable vise. A cutter is connected to an electric motor in this principle. The advantage of this technology is that it can run continuously because it is powered by an induction motor (1ph or 2ph) and it is also simple to inspect and maintain because there is no need for a carbon brush, which is almost always the cause of a grinder or cut off machine's armature breaking.

Figure 1

Calculation of the power on the tool carrier



1) Calculation of the power on the tool carrier

The power of the tool carrier is computed as below

$$Mx = 9.55 \times 10^6 \times \frac{N}{n} \text{ N.mm}$$

$$N = \frac{Mx \times n}{9.55 \times 10^6} = 1.365 \text{ KW}$$

$$n = \frac{60 \times 1000 \times Vd}{\pi \times Dd} = 1400 \text{ rpm}$$

with $Vd = 37 \text{ m/s}$,

$Dd = 80 \text{ mm}$ in which:

Mx is the tool bearing shaft moment;

N is the power of the tool carrier;

n is velocity of disc cutting by rpm;

Vd is velocity of disc cutting by m/s;

and Dd is the diameter of disc cutting.

2) Cutting Motor Power Calculation

the cutting motor power is calculated by:

$$N_{ct} = \frac{N}{n} = 1.5$$

in which:

Machine powered by motor and V-belt,

Belt driver efficiency, = 0.96

Ball bearing efficiency, = 0.995

So, $n = 0.962 \times 0.9952 = 0.91$

$N = 1.365 \text{ KW}$, $n = 0.91$,

N is the power of the tool carrier, and n is mechanical efficiency.

Based on the above data, the electric motor for the cut off is selected as

$N = 1.5 \text{ KW}$ and $n = 1450 \text{ rounds/min}$.

The development stage of the metal cutter used the design specification of the product provided parts, testing and modification of design is an important thing to achieve the desired product.

The respondents of the study, the data gathering procedures and statistical tools employed by the researchers.

The evaluators are the trainers in metals and engineering sector, mechanical engineering trainers and experts in the metal industry. They are knowledgeable about this study. A total of 15 respondents were needed in this study.

The research instrument that was used in this study is an outcome based experimental research. After granting the permission, administration of the questionnaires followed. Directions in relation to the accomplishment of the questionnaires were done individually. Copies of the questionnaire-checklist were retrieved after being accomplished by the respondents.

The method used in this study was the experimental method with the used of outcome-based form, which will provide sample information to have our in-depth analysis and interpretation of the outcomes of “adjustable metal cut off machine”

The project was subjected to dry run testing evaluation. The respondents were properly oriented on what and how to evaluate using a score.

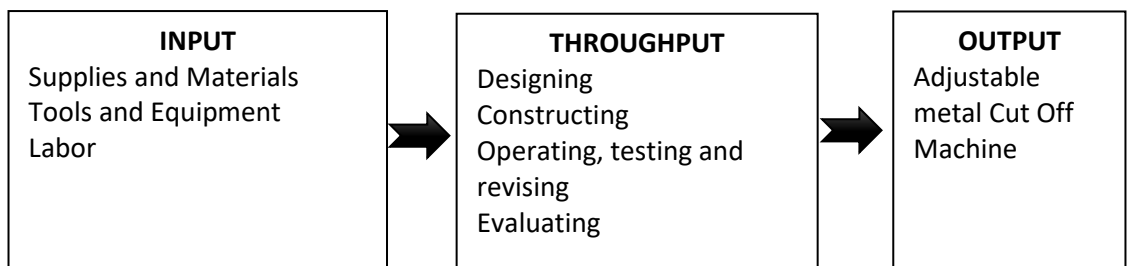
ANOVA (Analysis of Variance). This was used to determine if there are significant differences in the responses and evaluation of the respondents in terms of the identified variables.

With regards to the acceptability and effectiveness of “adjustable metal cut off machine” the range with its qualitative description are as follows:

CONCEPTUAL FRAMEWORK

The conceptual model which guided this study depicted a form of a paradigm in This study followed the input, throughput and output approach.

Figure 2
Conceptual model of the study



The inputs are the supplies and materials, tools and equipment and labor. The throughput consists of the processes involved in the development of the machine such as, designing, constructing, testing and revising. The output is the complete Adjustable Metal Cut-off Machine.

RESULTS AND DISCUSSION

After the testing operation cutting modes, the results show that the machine structure works stably and the chassis is strong enough. Besides, the system is a precise

control, the control is easy and reasonable. Compared with the same machine in the market, it is more economical.

CONCLUSIONS

Based on the theoretical basis and the actual fabrication, testing the adjustable metal cut off machine has been manufactured to meet the initial design requirements. The results are drawn as follows:

- The results indicated that the machine structure works stably and the chassis is strong enough.
- The results indicated that the range of cutting tool speeds from 1500 rpm to 2000 rpm has been achieved.

RECOMMENDATIONS

The following recommendations were made based on the study's findings and conclusion. The components can be lubricated automatically. As with other small metal cutting machines, the size can be reduced. The machine can be tested with other machines and take its advantages and efficiency.

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