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STUDY OF CAPACITOR LEAD CUTTING MACHINE

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ABSTRACT

To understand the application and involvement of automation in conventional capacitor cutting machine in manufacturing. A cutting machine is available in various shapes and sizes with small hand-held power cutting system and to bench mounted and finally floor mounted models. This paper includes the type of cutters and shop formulas for setting up each operation. Safety plays a critical part in any operation involving power equipment. This paper also includes procedure for maintaining and proper setting of the work and methods of selecting various tools and object holding devices to get a job done safely without causing damage to the equipment, workers or somebody nearby

I. INTRODUCTION

This chapter describes the company information, background, problem description and goal for this. It also describes the disposition of the report.

II. LITERATURE REVIEW

- In 'Kalash Electronics' the method now used is manually and semi-automatic which is inaccurate ,time consuming and rejection rate of capacitor is high .
- In 2014 the rejection rate of capacitor was 22% of the total production .it was due to the inaccuracy of the cutting mechanism.
- The machine now used works on the principal of shear stress. A horizontal slit is provided over a rotor which acts as a cutter. The wire to be cut is drawn through the slit and is fed to the rotor. The rotor cuts the wire and it is collected in the collector.

  Disadvantages:

- The wires cuts are inaccurate and dislocation of lead in the slit is frequent.
- Production rate is low.
- Rejection rate is high.
- Time consumption is more

Semi automatic machine

III. OBJECTIVE

- Automation is essential in every industry in order to increase the productivity and quality.
- In 2014 the rejection rate of capacitor was 22% of the total production .it was due to the inaccuracy of the cutting mechanism.
- So, it is very essential for ‘Kalash Electronics’ to automate the system to increase the productivity and reduce the rejection rate.
- Also the production cost will be reduce

IV. FLOW CHART OF WORK PROJECT

Steps followed for the whole processing of Capacitor Lead Cutting Machine is given below. These steps gives way about how work is to be carried out in systematic way. It is standard process of describing how it is done in the simplest manner.

Design of capacitor lead cutting mechanism

Select Standard part

Manufacturing each component and construct the setup

Conduct the experiments

Conclusion

Flowchart of project work

IV. METHODOLOGY

4.1 Design

Design consists of application of scientific principle, technical information, and imagination for development of new mechanism to perform specific function with maximum economy and efficiency. Hence careful design approach has to be adopted. The total design work has been split into two parts.

System design

Mechanical design

System Design

System design is mainly concerns the various physical constraints and ergonomics, space requirements, arrangement of various components on frame at system, man-machine interaction, no. of controls, position of controls, working environments, of maintenance, scope of improvement, weight if machine from ground level, total weight of machine and a lot more. In system design we mainly concentrated on the following parameter:-

System selection based on constraints

Our machine is used in small-scale so space is major constrain. The system is to be very compact so that it can be adjusted in small space.

Arrangement of various ingredients

Keeping into view the space restrictions all components should be laid such that their easy removal or servicing is possible. Every possible space is utilized in component arrangements.

Man machine interaction

Friendliness of machine with the operated that is operating is an important criterion of design.

Chances of failure

Losses incurred by owner in case of any failure are important criterion of design. Factor of safety while doing design should be kept high so that there are less chances of failure. Moreover periodic maintenance is required to keep unit healthy.

- Servicing facility

Layout of components should be such that easy servicing is possible. Those which require frequent servicing can be easily disassembled.

- Scope of further improvement

Arrangement should be provided in such way that if any changes have to be done for future scope for improving efficiency of machine.

- Height of machine elements from ground

All the elements of the machine should be arranged to the height from where it is simple to operate by operator. Machine should be little higher than the waist level, also enough clearance should be provided from the ground for cleaning purpose.

- Weight of machine
- Total weight depends on the selection of material of all components as well as their dimensions. Higher weight will result in difficulty in transportation; it is difficult to take it to workshop because of more weight
- Mechanical Design:

In mechanical system the components are listed down and stored on the basis of their procurement, design in two class namely.

- Designed parts
- Parts to be purchased

Mechanical design phase is very important from the view of designer as whole success of project depends on the correct design analysis of the problem.

Many preliminary alternatives are eliminated during this stage. Designer should have adequate knowledge about physical properties of material, load stresses and failure. He should identify all internal and external forces acting on machine parts.These forces may be categories as,

- Dead weight forces
- Friction forces
- Inertia forces
- Centrifugal forces
- Forces generated during power transmission etc.

Designer should forecast these forces very accurately by using design equations. If he does not have sufficient information to estimate them he should make certain practical consideration based on similar conditions which will almost satisfy the functional needs. Considerations must always be on the safer side. Selection of factors of safety to find working or design stress is another puissant step in design of working dimensions of machine elements. The correction in the theoretical stress values are to be made according in the form of loads, shape of parts & service requirements Selection of material should be made according to the condition of loading shapes of products environment conditions & desirable properties of material supply should be made to minimize nearly adopting proper lubrication method.

4.2. Design of Shaft

A shaft is a rotating element which is used to transmit power from one place to another. The power is delivered to the shaft by some tangential force and the resultant torque set up within the shaft permits the power to be transferred to various machines linked up to the shaft. In order to transfer the power from one shaft to other, the various members such as pulleys, gears, etc are mounted on it. These members along with the forces exerted upon them causes the shaft bending.

The shaft usually cylindrical, but may be square or cross shaped in section. They are solid in cross section but sometimes hollow shafts are also used.

Material used for shaft

- It should have high strength.
- It should have good machine ability.
- It should have good heat treatment properties.
- It should have high wear resistance properties.

The material used for ordinary shafts is carbon steel of grades 40C8, 45C8, 50C4 & 50C12. Also M.S. & En8 can be used.

Stresses in shafts

- Shear stress due to transmission of torque. (i.e. due to tort tonal load.)
- Bending stresses (tensile or compressive) due to the forces acting on the machine elements like gears, pulleys etc. as well as due to the self weight of the shaft.

The shafts are designed on the following basis.

Strength & Rigidity:

The following cases may be considered.

- Shaft subjected to twisting moment or torque only.
- Shaft subjected to bending moment only.
- Shaft subjected to combined bending twisting moment.
- Shaft subjected to axial loads in addition to combined torsional & bending.

Components used:

- 3/2 pneumatic valves- 3Nos
- Pneumatic cylinders- 3 Nos
- Pressure regulator – 3 Nos
- 3/1 tab- 1 No
- Timer -1 No

V. STEPS FOLLOWED

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a) Design of Capacitor Lead Cutting Machine.

b) Design of base plate and supporting plate, guide ways and moving plate

c) Selection of various pneumatic components and accessories from different catalogues. d) Schematic 2D drawing of Capacitor Lead Cutting Machine.

VI. CALCULATIONS Design of Capacitor Lead Cutting machine by using Pneumatic Actuator.

Useful input data:-

Force on base frame (F) = 78.48 N

Length of base plate= 560 mm

Length of supporting plate=146 mm

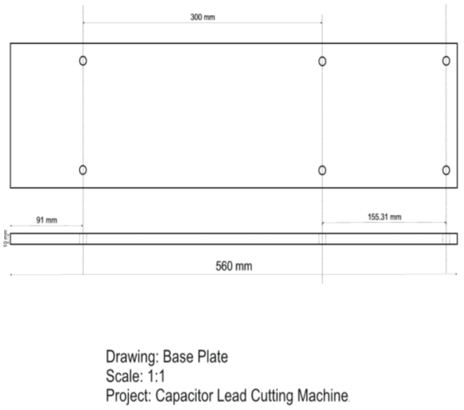
Width of base plate (b) =146 mm

Thickness of base plate= 10 mm

Thickness of supporting plate= 16 mm

There are various Pneumatic Actuators used for various purposes but this is special purpose machine which is only used for base frame having 78.48 N force

Design:



Base plate

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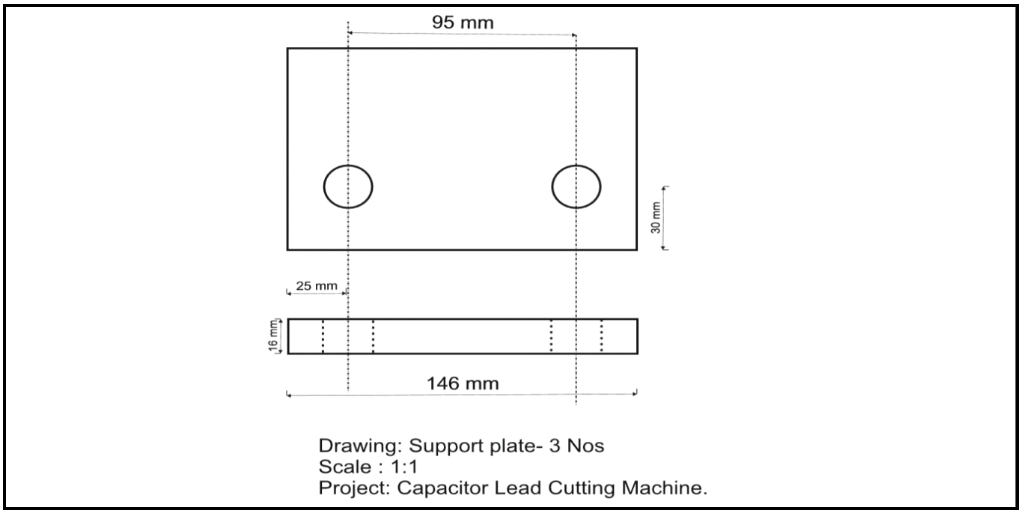

Support plate

Selection of material for frame:

150

Assumptions 600

(Area of frame = 600 × 150 mm^2)

Total load on frame is about 8kg

F = 8 × 9.81 = 78.48 N

This load is applied at the centre as shown in fig. R1300 300 R2

From fig.

R1 +R2 = F

And Taking moment at R1

$\Sigma M_{R1} = 0$, .: F × 300 - R2 × 600 = 0, .: 78.48 × 300 – R2 × 600 = 0

Therefore, Reaction Force at R2

R2= 39.24 N, .: R1 + 39.24 = 78.48

Reaction Force at R1 = 39.24 N

Moment about point B, M_b = 39.24 × 300= 11772 N-mm

Y= b/2 =16/2 = 8mm (as b=width)

I = bd^3 / 12= 16*(20.1) ^3/ 12 = 10827.468 mm^4

Stress on frame,

$\sigma = M_b\, y / I$ = (11772 × 8) / 10827.468 = 8.697 N / mm^2

$\sigma = S_{yt}$/ fos

Therefore,

S_{yt}=σ × fos = 8.697 × 10 …………… (assuming fos = 10)

= 86.97N / mm^2

Selecting material GCI 15 having Tensile strength (min) = 150 N / mm^2. Therefore all assumptions are in safer state.

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Material Selection

Designation	UTS (N/mm^2)	YEILD STRENGTH (N/mm^2)
15C8	440	240

Table.1. Material specifications

ASME code for design of shaft:

Since the loads on most shafts in connected machinery are not constant, it is necessary to make proper allowance for harmful effects of load fluctuation.

According to ASME code permissible values of shear stress may be calculated from various relations.

$F_{s(allowable)} = 0.18$

$F_{(ut)} = 0.18 \times 440 = 79.2$ N/mm^2

OR

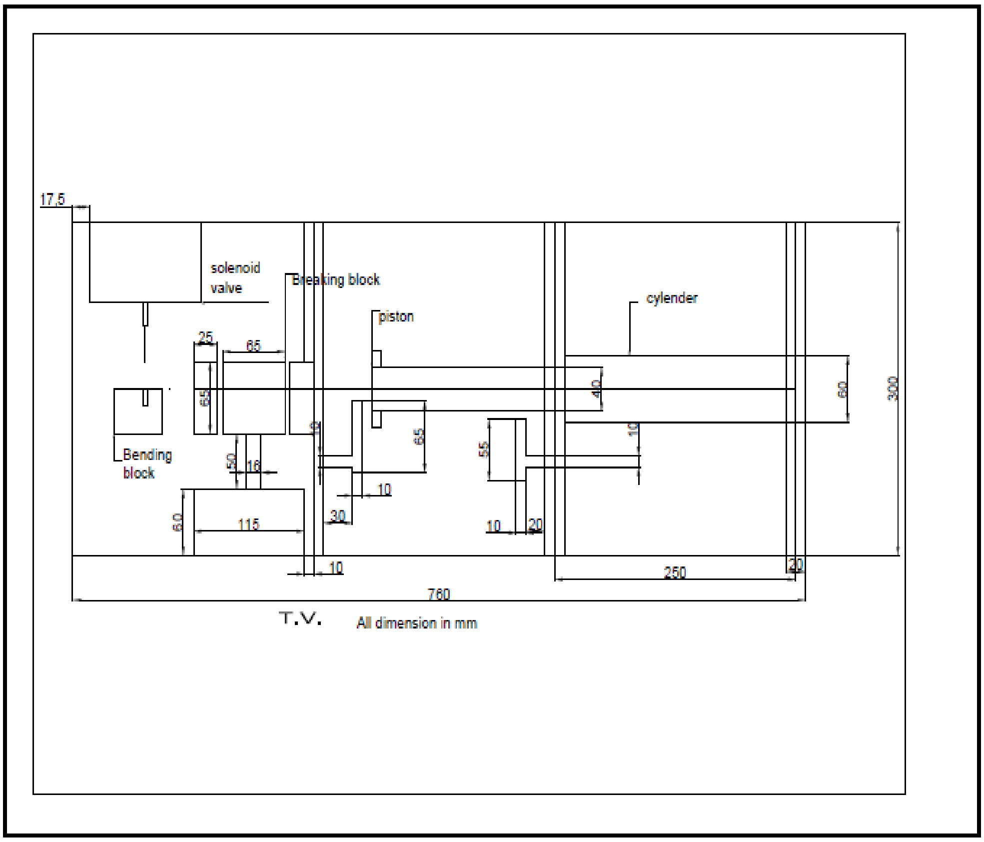
$Fs_{(actual)} = 0.3$

$F_{(yt)} = 0.3 \times 78.48 = 32.544$ N/mm^2

Considering minimum of the above values

Fs (allowable) = 32.544N/mm^2

This is allowable value of shear stress that can be induced in shaft material for safe operation.



VII. WORKDONE

Assembly of base frame

VIII. CONCLUSION

In this study the application of machine improves the cutting quality of the work pieces. The major benefit is high accuracy. The accuracy increases because the job loading and unloading is done automatically. The feed rate is controlled by application of pneumatic sensors. The controlling of whole process is done with application of electrical as well as pneumatic energy. We also conclude that the use of automation resulting into less human interaction with high production rate.

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