

## Fabrication of Portable Pantograph

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**Abstract** - The study of theory of machines deals with various mechanisms, of which four bar mechanism, is one important system. Pantograph is an example of this four bar device, using parallelogram copying technique for copying a range of profiles. A pantograph is a simple yet powerful tool which can broaden the scope of artwork and crafting. Using this tool and technique one can copy images to a reduced or enlarged scales depending on how the parts are measured and assembled.

Based on above said application, this project work is an effort made to "design, develop and analyze a portable pantograph for engraving letters on wood". The work mainly focused on incorporating light in weight and portability aspects to the pantograph, also copy with different scaling factors. This is a low cost machine compared to conventional pantograph, finds many benefits and has a vast scope in present day engineering applications.

**Key Words:** Engraving Letters on Wood, Portable Pantograph

### 1. INTRODUCTION

Pantograph is a geometrical instrument used in drawing offices for reproducing given geometrical figures or plane areas of any shape, on an enlarged or reduced scale. It is also used for guiding cutting tools. Its mechanism is utilized as an indicator rig for reproducing the displacement of cross-head of a reciprocating engine which, in effect, gives the position of displacement. A pantograph is a simple yet powerful tool which can broaden the scope of artwork and crafting. We can copy images to a reduced or enlarged scale with a pantograph depending on how the parts are measured and assembled. The pantograph does the image resize calculating for us by using the distances between its pivot points as the "algorithm" for creating your finished copy.

Engraving is the machining process of using rotary cutters to remove material from a work piece advancing (or feeding) in a direction at an angle with the axis of the tool. It covers a wide variety of different operations and machines, on scales from small individual parts to large, heavy-duty engraving operations. It is one of the most commonly used processes in industry and machine shops today for machining parts to precise sizes and shapes.

The pantograph is one of the most fascinating pieces of engineering equipment ever invented and in some form or other it should be part of every engineering shop's

equipment. Engraving lettering in two dimensions is just one of its functions, more sophisticated versions work in three dimensions and will copy complicated three dimensional designs and engineered components, enlarging or reducing them in size as required.

A pantograph is a simple yet powerful tool which can broaden the scope of artwork and crafting. We can enlarge or reduce images with a pantograph depending on how the parts are measured and assembled. The pantograph does the image resize calculating for us by using the distances between its pivot points as the "algorithm" for creating your finished copy. The pantograph in the illustration would produce a copy smaller than the original. By changing the distances between the pivot points you can change the percentage of enlargement your pantograph provides.

### 2. PROBLEM STATEMENT

Traditional engraving machine are bulky and are difficult to transfer from one place to another. This kind of machine has large workspace, high weight and good maneuverability; it is most important in field of wood or metal engraving. Here, we designed a pantograph for engraving letters on wood.

Which having easy handling, portable, low cost and low weight as compare with traditional engraving machine.

### 3. OBJECTIVE

Our paper topic is titled as "Design, development and analysis the portable pantograph for engraving letters on wood." For design and fabricate an engraving machine we use pantograph mechanism. The engraving tool mounted on the pantograph should travel the same path given by stylus as an input. Stylus will trace the shape of already existing object. Using such kind of manipulator we can generate the de-scaled replica of the object or we can say it to be a copying machine which can be employed in mass production with economical production. So we can enlist the objectives of our project such as-

- 1) Design an engraving machine by using pantograph mechanism.
- 2) For engraving machine using various scaling factor for decaling purpose.
- 3) Machine should be compact in size and light weight.
- 4) Total cost for production of an engraving machine

remains low.

- 5) Machine should be easy for handling for unskilled workers.
- 6) Engraving machine should be portable.

The three degree of freedom in this manipulator adds a feature to increase or decrease the depth of engrave and th.us can be used in metal engraving industries or wood carving industries to copy the engraved design.

#### 4. METHODOLOGY

Pantograph is a geometrical instrument used in drawing offices for reproducing given geometrical figures or plane areas of any shape, on an enlarged or reduced scale. It is also used for guiding cutting tools. It is proposed to use the same pantograph mechanism for designing our engrave machine. The team has designed a pantograph for reproducing geometrical figures or plane areas of any shape on the basis of parallelogram mechanism. A parallelogram is a quadrilateral with opposite sides parallel and equal to each other. The following flow chart illustrates the making of the model.

The pantograph in the illustration would produce a copy of the original. By reversing the positions of the pencil and stylus, we would get a copy smaller than the original.

This could be a handy tool if we want to get into painting small wall murals.

#### 5. WHAT IS ENGRAVING

The practice of incising a design onto a hard, usually flat surface, by cutting grooves into it. Engraving is the machining process of using rotary cutters to remove material from a work piece advancing (or feeding) in a direction at an angle with the axis of the tool.



Fig 1: Method of Engraving

It covers a wide variety of different operations and machines, on scales from small individual parts to large, heavy-duty engraving operations. It is one of the most commonly used processes in industry and machine shops today for machining parts to precise sizes and shapes.

There are three basic types of mechanical engraving:

- 1) Diamond Drag (Scratch) engraving
- 2) Burnishing,
- 3) Rotary engraving

#### 6. WORKING MECHANISM

Pantograph is a linkage constituting of five link connected with pin joints to form revolute pairs. It is connected in a manner based on parallelograms so that the movement of one point, in tracing an image, produces identical movements by second point. A pantograph is used to reproduce to an enlarged or a reduced scale and as exactly as possible the path described by a given point. If a line drawing is traced by the first point, an identical, enlarged, or miniaturized copy will be drawn by a pen fixed to the other. One of the revolute pair is fixed into the base, so that we can move this mechanism with respect to fixed point. Because of their effectiveness at translating motion in a controlled fashion, pantographs have come to be used as a type of motion guide for objects large and small. The point which traces the profile can be in any form e.g. Simple pin having conical point, rod having a bearing mounted at its end. And the point which gives the output can be in forms like router, pen, drilling machine etc.

The pantograph is made up of five links. One end is hinged and at the other end is the stylus which we will be moving manually. The link will work in only X & Y direction and Z axis will be restricted. As the stylus will be moved the tool will also follow the same path. The scaling factor will be responsible for the change in size of the engraved profile. The schematic diagram of our portable pantograph is shown in fig.



Fig 2: Model of Portable Pantograph

#### 7. Applications

- This machine can be used almost in all types of industries. (Large, small, medium scale industries).
- This machine is mainly used in fabrication oriented industries.

- The material can be removed at any shape like oval, rectangular, ellipse, square, circular, pentagon, hexagon shapes etc.
- This machine is used to guide the cutting tools.
- This machine is used for reproduction of maps and plans on enlarged or reduced scale.
- A modified pantograph is used to collect the electric power at the top of an electric locomotive (e.g. electric train)

### 8. Advantage of Pantograph

- Setting of machine is easy.
- It reduces the fatigue of the worker.
- Skilled labor is not required.
- Labor cost is less.
- Production cost decreases.
- Machine looks compact in size, so it can be carried from one place to another place.
- The process is most economical.

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### 9. CONCLUSION

Pantograph may be old mechanism, but still in present days it has many beneficial uses and many other advantages. Pantograph is parallelogram linkage which is used in our paper engraving purpose on material like wood, steel, plastic etc. Our model of pantograph engraving machine is having low weight, portable and easy to handle for unskilled persons also than other complicated engraving machines. We designed such mechanism for engraving machine which is safe; hence there are no problems in manufacturing too. It works with accuracy. It has a highly effective working mechanism. Hence the letters are traced successfully without any difficulty.

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