

A REVIEW ON PANTOGRAPH MILLING MACHINE MECHANISM

Yogendra U. Fegade¹, Siddhant V. Patil², Pranjal G. Metkar³, Pooja S. Sonawane⁴,
Prof.V.B.Sarode⁵

^{1,2,3,4} Student Mechanical Engineering Department, GCOERC, Nashik

⁵Professor, Mechanical Engineering Department, GCOERC, Nashik

Abstract - The paper intends to give proposal and reasoning for various applications where a pantograph milling machine mechanism can be utilized to obtain a machine with high accuracy. Today in this phase of the 21st century every task has been made quicker due to advancement in technology, but in some of the small-scale industries we have seen that they are still using old fashions for milling or engraving. Pantograph mechanism function is to follow an enhanced image of the geometry it traces.

Afterwards, it can be installed with some modifications in different machines to ease the complexity of these machines and its costs. Individual modelling and motion analysis in solid works of these mechanism is also in the scope of this paper. Our extension behind this work is to make Pantograph milling machine for wood working in small industries easier and effective.

Key Words: Pantograph, Milling Machine, Four Bar Mechanism

1.INTRODUCTION

Pantograph is a linkage which having four links connected in a manner to form revolute pairs in which motion of two bodies to pure rotation along a common axis. It is connected like parallelograms so that after the movement on an tracing image movement transfer from one point to another. By using pantograph mechanism, we are able to get complex shape on wood. Through this it can be used for making 2-D figures with proper scale. Pantograph is an example of this four-bar device, same as of parallelogram with this range of profiles can be obtained by copying image. It has a ability to scale and copy simultaneously the image it traces. In this the drawing can made to a large scale, perhaps ten times full size, and then reduced to actual size by a pantographic method. A Pantograph is a tool, which can make scope to artwork and crafting. We can adjust the location of tool. The pantograph calculates the distances between its pivot points and resizes the image. The enlargement of the pantograph was provided by changing the distance between the pivot points. A design, develop and analyze the portable pantograph for engraving letters on wood.

The pantograph is light weight and portable. Main work of this pantograph is to copy different scaling letters and the scale can be adjusted by changing tool location.

2. Literature Review

1.More et al (2016)

The properties of material changes with the processes so in engineering many processes requires and different parts also required for different processes. Project is a mission of creating something new i.e., manufacturing of new product. The machine uses a high-speed cutter that can be fed as per up and down to give depth of cut whereas the x-y axes table is given motion using a pantograph mechanism that copy or scale the template or shape that is to be produces on the job, this is an accurate method so also the first job will be same as the last job.

2.Christopher Scheiner, (1603)

He has invented One arm of the pantograph contains a small pointer, while the other holds a drawing which implement, and by moving the pointer over a diagram, a copy of the that diagram is we get on another piece of paper. By changing the positions of the arms in the linkage between the pointer arms and drawing arm, the scale of the image produces can be change.

3.Zwicket al (1932) His invention relates to engraving and copying machine in which a pantograph system is used, a cutting tool and tracing point or stylus being mounted on the pantograph system. An object of the invention is to provide a generally improves and more satisfactory machine of this character, and particularly one in which heavy cutting may be accomplishes with no exertion on the part of the operator, irrespective of the direction of the cut.

4.Barpatet al (2016)

During this case study it's shown that how the design, development and analysis the portable pantograph for engraving letters on wood has been done. He uses pantograph mechanism for design and fabricate an engraving machine. The engraving tool mounts on the pantograph should travel the same path given by stylus as an input. Stylus will trace the shape of the object which already exists.

5. Vijay Patil, P.R. Anerao, and S.S. Chinchankar (2016)

Done the work on Finite Element Analysis, according to his work, Micro positioning mechanism is a key and essential technology in many fields, such as scanning electron microscopy, X-ray lithography and micro-electro mechanical system (MEMS). There has been quite a number of studies on the analysis and design of micro positioning mechanisms. Pantograph mechanism are very well suits for positioning resolution by scale down the motion of linear stage and design, analyze and test a pantograph compliant mechanism.

6. C. S. Sharma, K. Purohit (2006)

Every part of a machine, which moves relative to other part, is known as a kinematic link. A link may consist of different parts, which are rigidly fasten together they do not move relative to one another because of these things. A body is to be a resistant body if it is capable of transmitting the require forces with negligible deformation. Pantograph links must have these two qualities, the input and output link will not able to attain their correct positions and the mechanisms will not be able to provide exact scaled shape and the links will deform in case of pantograph not having those qualities. When the kinematic pairs are couple in such a way that the last link is join to the first link to transmit the motion, it is called a kinematic chain. First link is a stationary base or the ground, with which second link is connected with the help of revolute pair. First link is also connected with the last link with the help of either a higher pair or a lower pair according to the requirement of degree of freedom. In the design or analysis of a mechanism, one of the most important concerns is the number of degrees of freedom of the mechanism. It is defined as the number of input parameters which must be independently controls in order to bring the mechanism into a useful engineering purpose. It is possible to determine the number of degrees of freedom of a mechanism directly from the number of links and types of joints which it includes.

Literature Gap:

Before cameras and digital editing helps us share and enlarge our photos, tools such as the pantograph helps people to duplicate and adjust a drawing or map, they wanted to share and document. Pantographs are uses for reducing or enlarging engineering drawings and maps and for guides cutting tools over complex paths.

The original use of the pantograph is for copying and scaling line drawings. Modern versions are sold as engraver and router machines for crafting and name printing applications.

METHODOLOGY & SOLUTION

Pantograph is a instrument with linkages uses for reproducing given geometrical figures or plane areas of any shape, also uses in drawing offices. It is also used for guiding tools as we can change location of tool. It is proposed to use the same engrave machine for designing our pantograph mechanism. The team has design a pantograph for reproducing geometrical figures or plane areas of any shape on the basis of parallelogram mechanism. A parallelogram has opposite sides parallel and equal to each other. A copy of the original can be produce by pantograph in the illustration.

we noted that every mechanism has a fixed link called the frame. When different links are chosen as the frame, the relative motions between the various links are not altered, but their absolute motions (those measured with respect to the frame) may be changed significantly. The process of choosing different links for the frame is known as kinematic inversion.

Concept of Pantograph:

Pantograph is a linkage of Four link connects with pin joints to form revolute pairs. It is connected in a manner base on parallelograms so that the movement of one-point traces an image, produces same movements by the second point. A pantograph is uses to reproduce to an enlarge or a reduces scale and as exactly as possible the path describes by a given point. If a line drawing is trace by the first point, an same enlarged, or small copy will be drawn by a pen fixed to the other. One of the revolute pair is fix into the base, so that we can move this mechanism with respect to fix point. Pantographs have come to be uses as a type of motion guide for objects large and small. It can enlarge or reduce the drawing two, three, four or even the five times of the original size.

The point which traces the profile can be in any form of milling e.g., Simple engraver 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, milling machine etc. The pantograph is made up of four links. One end is hinged and at the other end is the stylus. The link works in only X & Y direction and Z axis will be restricted. As the tool will be moved the tool will also follow the same path. The scaling factor will be responsible for the change in size of the engrave profile also depends upon location of tool.

The Pantograph machine is consider as a significant one which has its own missions including figures copying, sculptural and minting works. We get a new type of pantograph machine which can make many copies for some figures desire to copies with different magnification factors. Pantograph milling machine is the machine which operates and uses for cutting mild steel plate in a short duration with variety of geometries and shapes. It leads to more economical as the cost of operation is less.

Advantages:

1. If there is no wear and tear of the arms of pantograph its accuracy will always be maintain.
2. Pantograph is a portable and it can move in 180 degrees of rotation.
3. The scaling factor can be adjust according to the need with slight changes in the design depends on if the scale has to be reduce or enlarge.
4. The cost is reduced to greater extent.
5. Unskilled workers can do operations easily.
6. It reduces the fatigue of the worker.
7. Vibration control can be done and it will create less noise.

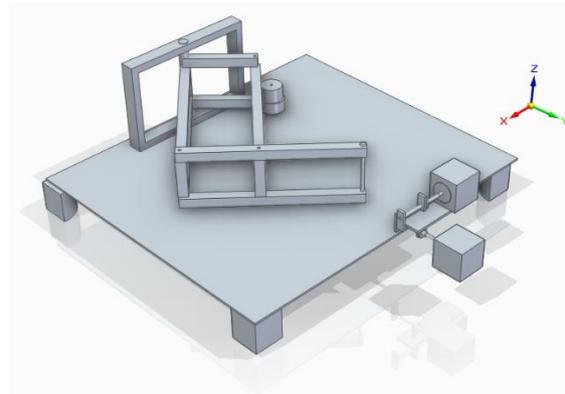


Fig -1: Figure

List of materials

Sr. No.	Name Of the material	Specification	Cost
1	MS Square channel	20*20*2 mm	700/-
2	Coupling Rod	6mm, Mild steel rod	430/-
3	Macknum Wheel	12mm Ball type macknum wheel	120/-
4	Motor	DC 12V, 2 Amp, 4000 RPM High torque	340/-
5	Spindle Head	Steel Machined Engraver spindle	200/-
6	Drill/Engraver	1.8mm Drill	110/-
7	Foundation	650mm*650mm*3mm thickens MS Square plate	900/-
8	Foundation base	25*25 Square channel base	200/-
9	Rubber shock absorbers	5mm thickens, PVC Rubber	50/-
10	Paint	Acrylic Black matt	240/-
11	Power supply	12v, 2 Amp SMPS	340/-
12	Mains cord	2 Pin 2 mtr	60
13	Wire	0.5Sq.mm red black	20/-
14	Miscellaneous	---	200/-

RESULT AND DISCUSSION:

The machine can be used in small and medium scale industries. This machine is mainly used in wood or foam board fabrication-oriented industries. Also it can be used for creating stamps. The material can be removed at any shapes as per requirement. Through this machine we can the guide the cutting tools also we can change locations of cutting tool. The machine can be used for reproduction of maps and plans on enlarged or reduced scale.

FUTURE SCOPE OF RESEARCH

Physical feasibility of some of these applications needs to be tested. It can also be installed with a CNC machine (In which all the movements are controlled by computer), which has tool on one point and a probe on other side. Finite Element Analysis (FEA) of pantograph in solid works still needs to be performed of different designs to check which one has better viability in practical conditions.

Summary:

The growth of Indian industries is looking on productivity. during this paper for improving productivity study some paper associated with automation. Our work and the results obtained so far are very encouraging and reinforce the conviction that pantograph milling machine are practical and potentially very contributive to the production and manufacturing industries.

3. CONCLUSIONS

Still in the present days the pantograph milling machine mechanism has beneficial uses. As it may be very old mechanisms, but it has not been obsoleted yet. Pantograph is a linkage same as of parallelogram which can be used for various applications like engraving on wood. By this mechanism it becomes easy to engrave large number of plates in very less time. Hence the wooden plates traces letters without any difficulty. It is an accurate system which works with precision. It is highly efficient to work with and it also eases many painstaking operations. Its scope is very vast. Automatic pantograph Milling machine will be a next level precision and accurate routing and engraving tool and will be used by all kind of applications such as industrial works and crafting and molding works, metal name printing will also be possible through our machine.

ACKNOWLEDGEMENT

A special thanks to Guru Gobind Singh College of Engineering and Research Center, Prof. V. B. Sarode for guiding and supporting me throughout the review process.

REFERENCES

1. C. S. Sharma, K. Purohit, "Theory Of Mechanisms And Machines," Technology & Engineering, pp. 119-120, 2006.
2. Paritosh Rustogi Northern India engineering college, G.G.S.I.P.U., New Delhi India, 2014
3. Wendland J., (1901) "Deep engraving of metals for the automotive sector using high average power diode pumped solid state lasers." Application of Laser and Electro Optics. Vol. 3, Issue 4, p.2277-9655.
4. Mayank Dev Singh, March 2016 "Pantograph Engraving Machine – A review"
5. <https://en.wikipedia.org/wiki/Pantograph>.
6. Abrar , A. , Haque , N. , Mallick , S. , Mehta, Land Tyagi, R. K.,The Mechanism and Kinematics of a Pantograph Milling Machine, European Journal of Applied Engineering and Scientific Research , Amity School of Engineering & Technology, Amity University, Noida, India , 2 (3):1-5, 2013.
7. J. Thamilarasan, A. Prabhu , R. Pushapkumar & K. Karthik, Design And Fabrication Of Pantograph Mechanism, International Journal of Mechanical and Production Engineering Research and Development (IJMPERD), Vol. 8, Issue 2, Apr 2018, pp. 955-964.
8. Applications of pantograph International journal of advancements in Mechanical.