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Design and Fabrication of Radius Turning Attachment using Worm Wheel Mechanism

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Abstract:

Radius turning has always been a challenging task in lathe. Though in recent times numerous attachments and arrangements have been developed, their accuracy and finish have always been in doubt. Our radius turning attachment aims at providing an easier and a more accurate operation using a worm and wheel mechanism. The wheel provides the necessary turn for the tool while the turn itself Is given by means of a worm meshed to the wheel. This ensures a smoother and a much faster operation compared to existing mechanisms.

Keywords — **lathe, radius turning attachment, wheel, worm.**

I. INTRODUCTION

Lathe is the heart of every mechanical engineer. Over the years, the lathe has undergone countless developments to improve the performance of the tool and quality of work. Various operations like facing, turning, boring, threading etc can be done in lathe.New fabrication techniques are developed to satisfy the technological demands. Each general typical machine is meant and are used for a group of specific machining work on jobs of restricted vary of form and size. But often some unusual work also needs to be done in specific machine tools, e.g.milling during a shaper, tapping in a drilling machine, gear teeth cutting in shaping machine and so on. Under such conditions, some special devices or systems are additionally used being mounted in the ordinary machine tools. Such additional special devices, which augment the processing capability of any ordinary machine tool, serves an equivalent purpose. For example, a lathe occupies a

place opposite to that of a gear cutting machine, the machines mainly used to produce cylindrical and plain surfaces respectively. By implementingassociate attachment to a unit, the capacity of the unit can be increased which is very economical. Attachments aren't that inevitable and procured singly as and once needed.

Radius turning is giving radius to the work. It primarily involves a curve like movement of the tool. Our focus on this attachment is to ease up the tool movement by mounting it on a wheel, which is meshed to a worm. The attachment has a worm and a worm wheel meshed together. The worm and wheel are held in position by means of bearings and Plummer blocks. The tool is set on the upper surface of the wheel. As the worm rotates, the wheel rotates and with it the tool along a curved path. This is the worm wheel mechanism. This attachment can be fitted to any lathe just by altering the base dimensions. The range of the attachment can be altered by altering the wheel and worm dimensions proportionally.

II. DESIGN PROCEDURE

The design stresses and gear parameters are calculated by using the AGMA method of gear design. First, the design power is calculated by using the following formula.

$P_c = (a_p * f * V_c * K_c)/(60*10^3*\eta)$

Where,

- Pc- Cutting power in kW
- a_p- Depth of cut in mm
- f- Feed per revolution in mm/rev
- V_c- Cutting speed in m/mm
- K_c- Specific cutting force

From the above formula, the cutting power is found to be

PC = 0.44 kW ~ 0.5kW

Using the above cutting power, the worm gear is designed as follows.

The number of teeth on the wheel is assumed to be 40 and threads on the worm are assumed to be 10. This gives a gear ratio of 4.

Worm wheel torque and design stresses are determined using appropriate formulae and values of wheel torque, bending stress and crushing stress are found to be **732.48 Nm**, **2.94*107 N/m^2** and **6.86*107 N/m^2**respectively.

The center distance found using a computer-controlled co-ordinate measuring machine is found to be **50.8*10^{-3}m**.

The axial module is **1**and pitch diameters of worm and wheel were found to be **21*10^{-3}m** and **40*10^{-3}m** respectively.

The material of the worm and wheel are determined based on the design stresses and are verified against the known ultimate stresses of the material.

III. EXPERIMENTAL SETUP

The setup consists of a base, worm, wheel, bearings, pillow block and a tool post that are designed using PTC Creo Parametric 3.0 software as shown in Fig 5. The wheel (e.g. Fig 1) rests on a radial bearing that is fixed in a slot on the base (e.g. Fig.2). A tool post (e.g. Fig 3) is mounted on top of the wheel using screws to support the tool. The worm (e.g. Fig 4) is fixed such that its axis is perpendicular to the axis of the worm using roller bearings mounted on pillow blocks. A handle is attached on the worm shaft.

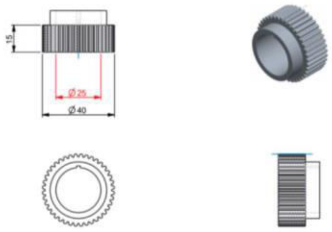

Fig. 1 Wheel

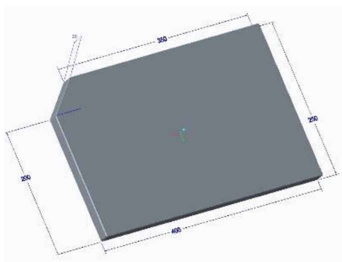

Fig.2 Base Plate

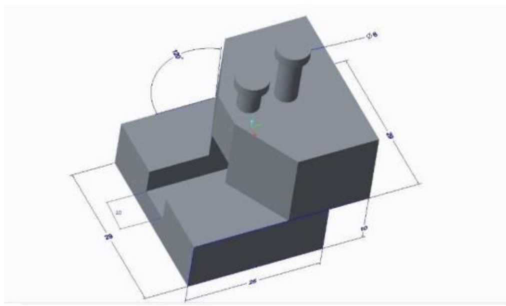

Fig.3 Tool post

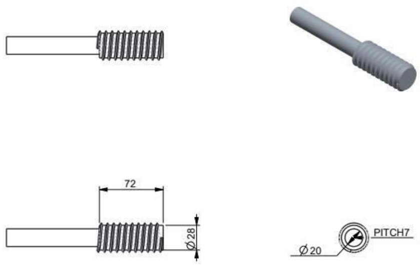

Fig.4 Worm

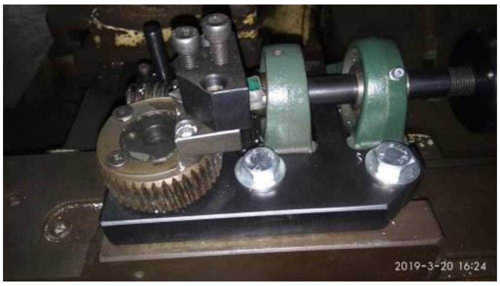

Fig.5 Assembly

IV. WORKING

The tool is mounted on the tool post and is aligned using a cylindrical gauge of the required diameter. As the handle is turned, the worm rotates which in turn rotates the wheel. The wheel rotates the tool post which holds the tool which when in contact with the workpiece, provides a cut as shown in Fig. 6. As the feed rate is increased, the cut is made more and more prominent until an almost complete sphere is turned.

Fig. 6 Radius turning

V. CONCLUSION

Due to this research, it is possible to make the product of different shape like a spherical, convex, elliptical etc. Even though manufacture with the low cost and in the less time rather than manufacture by the CNC machine. Cylindrical shape objects can manufacture easily. Concave and convex type design can be given to the component. This attachment can be implemented on every lathe machine in college and small-scale industries at a cheap cost. A complete analysis of total force acting on a tool as well as workpiece can be done. The attachment which is available in the market is costlier than our attachment. We gained unique experience of integrating and evaluating theory and practical aspects of a design and manufacturing. This helped us to extract valuable knowledgeanddata.

ACKNOWLEDGMENT

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REFERENCES

1. *Milan Patel, DivyeshPateliya, Ankur Parmar, Bharat Kapadiya, "Design ofFixture for Radius Turning on Lathe Machine"..*

2. *Mr. Ashish D Saste, Mr. Shriram K Shinde, "Spherical TurningAttachment"..*

3. *Mr. Sushant Sanake, Mr. Nagesh Shankarshetty, "Design of SphericalTurning Attachment For Lathe Machine"..*

4. *I C Gardner, "An Attachment for Turning Approximately Spherical Surfacesof Small Curvature on a Lathe"..*