INTERNATIONAL JOURNAL OF RESEARCH IN AERONAUTICAL AND MECHANICAL ENGINEERING

ISSN (ONLINE): 2321-3051

Vol.4 Issue 2,

February 2016

Pgs: 108-113

Review on Design of Jig and Fixture for Turning on Lathe

Gulam Shaikh[1], Siddiki Arshadali[2], Shaikh Masood[3], Thakur Aditya[4], Juberbhai Mansuri[5]

[1]Theem College of engineering, shaikhgulam45@gmail.com
[2] Theem College of engineering,arshedali.ali233@gmail.com
[3] Theem College of engineering,shaikhmasoodahmed48@gmail.com
[4] Theem College of engineering,adityathakur93@hotmail.com
[5] Theem College of engineering,jubermansuri7@gmail.com
Author's Correspondence: Munshi Chawl, Patel Pada, Dahanu(E)-401602, 9762026646

Abstract

In the past a wide variety of devices designed to out such shapes has been developed but they have been so massive in construction and high in cost that the average lathe owner has not felt the purchase of such attachments would be feasible.There is always a difficulty in spherical turning on lathe. The method now used is complex and very much time consuming. There cannot occur any variation of speed and depth of cut i.e. cannot take large depth of cut. In the construction of machines or tools it is often necessary to form a small portion of a spherical surface of which the radius of curvature is very long. This is particularly the case when making lens-grinding tools. The tool employed for grinding or polishing the surface of a lens may be described as a circular disk, usually of brass or cast iron, with a hub at the center of one face by which it can be mounted on a spindle and with the other face, in special cases plane, but generally convex or concave, the radius of curvature being the same in magnitude but opposite in sense to that of the surface desired on the finished lens. This invention relates to improvements in machine lathe attachments and more particularly to a simple attachment designed to facilitate the cutting of spherical, concave and convex shapes.

Keywords: Spherical, Turning, Lathe, attachments, jigs, fixtures.

1. Introduction

As we are familiar that lathe was the first machine which came in to existence for machining the metal. The basic idea emerges from the wooden lathe. The different operation such as drilling, milling, boring, straight turning, etc. is performed on the lathe for simple job. When the complex shape such as radius cutting has to contour within the job, then ideas emerges about designing a special purpose machine (SPM).

Design of portable Attachments reduces machining time, loading and unloading time, cost of production. Turning is one of the most common of metal cutting operations. In turning, a workpiece is rotated about its axis as single-point cutting tools are fed into it, shearing away unwanted material and creating the desired part. Turning can occur on both external and internal surfaces to produce an axially-symmetrical contoured part.

Parts ranging from pocket watch components to large diameter marine propeller shafts can be turned on a lathe. The capacity of a lathe is expressed in two dimensions. The maximum part diameter, or "swing," and the maximum part length, or "distance between centers." The general-purpose engine lathe is the most

basic turning machine tool. As with all lathes, the two basic requirements for turning are a means of holding the work while it rotates and a means of holding cutting tools and moving them to the work. The work may be held on one or by both its ends. Holding the work by one end involves gripping the work in one of several types of chucks or collets.

Chucks are mounted on the spindle nose of the lathe, while collets usually seat in the spindle. The spindle is mounted in the lathe's "headstock," which contains the motor and gear train that makes rotation possible. Directly across from the headstock on the lathe is the "tailstock." The tailstock can hold the work by either a live or dead center. Work that is held at both ends is said to be "between centers." Additionally, longer workpieces may have a "steady rest" mounted between the headstock and tailstock to support the work. Typically workpieces are cylindrical, but square and odd shaped stock can also be turned using special chucks or fixtures. Lathe cutting tools brought to the work may move in one or more directions. Tool movement on the engine lathe is accomplished using a combination of the lathe's "carriage", "cross slide", and "compound rest". The carriage travels along the machine’s bedways, parallel to the workpiece axis. This axis is known as the "Z" axis.

2.0 Types of spherical Turning attachments

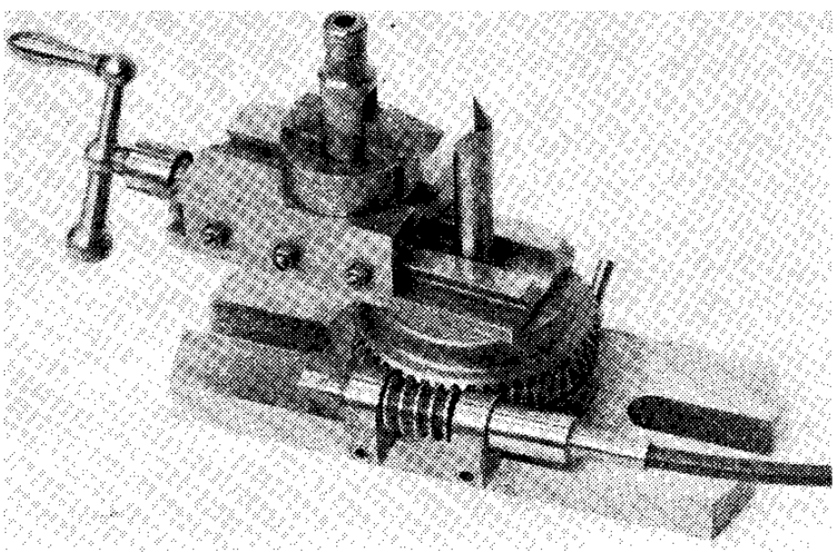

Fig 2.1: A worm-geared spherical turning appliance.

The worm gear provides an adequate turntable for the radial slide, with a broad under-surface to form a thrust bearing, with adjustment for end play from below, in the recessed bolster plate. A removable gauge pin, cut away to the centre to facilitate radial measurement, is fitted to the centre of the worm wheel. The radial sliding member is fitted with a gib for adjustment, and is moved by a feed screw with a balanced handle, hating an indexed sleeve, though the markings on it are not visible in the photograph. A lantern type of tool post, with rocker adjustment for the tool height, is anchored in a T-slot which enables

the latitude of radial movement to b e extended. Smooth and steady motion of the rotary traverse is facilitated by the worm gearing, and the worm shaft is fitted with a flexible drive, so that it can be operated from any convenient position, or even coupled to a self-acting drive if required. A worm-geared spherical turning appliance. ofttn found that this does not give sufficient clearance.

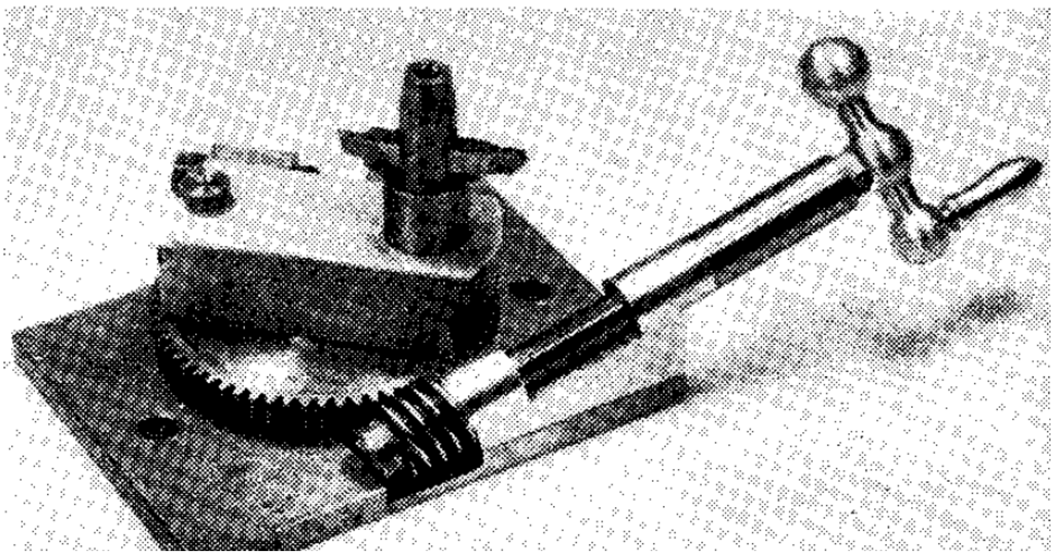

Fig 2.2: Spherical Turning Appliance With Oblique Wormshaft

The only thing to be done then is to slew the tool round to the left in the tool post, but though this enables the arc of surface to be increased, it reduces the advantages of fitting a slide which gives direct radial tool adjustment. It will be clear that the movement of the tool slide is no longer truly proportional to the radial adjustment at the actual tool point. As I have often had to carry out spherical turning,in the course of solving those awkward little machining problems which are passed on to me from time to time, I have devoted a good deal of time to the design of appliances which give maximum facility without serious limitations for work of this nature. The photographs, show one of the most useful of these which I have so far been able to (produce. In the drawing, a few minor modifications have been introduced in order to simplify construction with materials most likely to be readily available.

3.0 Work Design

Fig 3.1: Photo of our design work

We have designed a spherical turning attachment using worm and worm wheel which can be used as a tool for turning concave or convex surfaces on cylindrical jobs.

4.0 ELEMENTS OF SPHERICAL TURNING

Whether the device employed for producing spherical contours is simple or elaborate, the very first principle to be observed in its operation is the Location of the centre around which the generating tool is rotated, b y means of a hand lever or other means. This was referred to in the previous issue, But in view of its importance, further explanation which shows the effect of Displacing the pivotal point i n either direction. If carried to the extent indicated, the error is readily visible to the eye, but for work in which high spherical precision is necessary, even the smallest discrepancy may spoil the finished results. For this reason, some positive means of locating the pivot centre on the cross-slide or bed of the lathe.

In general work, some method of radial adjustment For the tool point, to deal with varying sizes Of work, is equally important; it is also an advantage To provide the smoothest possible feed movement Of the rotating tool fixture. But it may be Mentioned that in commercial production, spherical Curves of fixed dimensions, over a limited Angle of arc, are accurately produced by methods And appliances which do not provide either of These facilities. Components such as ball-and socket Joints for motor car steering and suspension Systems, in which smooth articulation is absolutely Necessary are often finished to close limits Of precision by means of a hollow grinding wheel, Running at high speed on an axis at 45 deg. To that Of the work. The spherical arc generated in this way is usually Limited to about 90 deg., which is sufficient For the particular purpose, provided that the rest Of the surface is undercut or relieved, as indicated In the example of work dealt with.

In order to Maintain the uniformity of the spherical diameter Despite the inevitable wear of the grinding wheel, It is dressed, when necessary, on the front flat face Only. The same generating principle could be Applied to the use of a cutting tool such as a Hollow milling cutter. Increasing the angle of the Tool axis in relation to the work would enable the Spherical arc to be extended within certain limits, But it would always leave either a cone or a flat On t h e front end of the work. It is just as important, However, to observe the first principle, in Locating the axis of the grinding or cutting tool so That it exactly intersects that of the work. It has already been mentioned that many ingenious Spherical turning appliances have been Produced for use on the lathe, either by manufacturers Or lathe users.

5.0 CONCLUSION

Jigs and fixtures are manufacturing tools that are employed to produce interchangeable and identical components. They eliminate the need for a special set-up for every work-piece thereby facilitating production and also ensuring that every work piece is manufactured within a predetermined tolerance. The design of jigs and fixtures is dependent on the operation type as well as the machine tool to be used for the operation. There are numerous advantages that are associated with the use of jigs and fixtures, they include: production increase, low variability in dimension thereby leading to consistent quality of manufactured products, manufacturing cost reduction, interchangeability and high accuracy of parts, reduces the need for inspection and quality control expenses, reduces accident as safety is improved, semi-skilled machine operators can easily use them thereby saving the cost of manpower.

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