Multi-Purpose Indexing Device-Lathe, Milling, Drilling Attachment

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Abstract— This project entitles "Multipurpose Indexing Device -Lathe, Milling, Drilling." to develop the lathe, milling and drilling machine by adding the features of as fixing four tools in the chuck for frequent machining. In this project we design multi chuck drilling machine with indexing to reduce time conception for lathe, milling and drilling various size holes in work piece. In a single machine multiple drilling operations can be carried out. By this we tried to fulfill the industrial requirements.

Key words: Attachment, Drilling, Indexing, Tool

I. LITERATURE REVIEW

A drill chuck is the part of a drill that holds the rotating bit. Drill chucks are designed to hold the bit tightly and not loosen even when there is a high amount of torque. They can also be used to hold other types of rotating tools, such as screwdrivers or rotating spades for making large holes. Drill chucks can be keyed or keyless, depending on the preference of the user and the requirements of the tool. A keyed drill chuck requires a removable key to open and close it. The key is a T-shaped tool that is inserted next to the chuck. When the chuck key is turned, it moves a gear that makes the collar rotate around the jaws to open or close them. A keyless drill chuck works on a similar principle, but instead of a key, the user turns the chuck with a sleeve at the end of the drill to open and close the Some people prefer keyless chucks, especially for home power drills, because the chuck key can easily be misplaced. However, a keyed chuck can hold the bit more tightly since it gives more torque and can be tightened by hand more efficiently using less force. The price and availability of particular size bits does not change uniformly across the size range. Bits at size increments of 1 mm are most commonly available and lowest price. Sets of bits in 1 mm increments might be found on a market stall. In 0.5 mm increments, any hardware store. In 0.1 mm increments, any engineers' store. Sets are not commonly available in smaller size increments, except for drill bits below 1 mm diameter. Drill bits of the less routinely used sizes, such as 2.55 mm, would have to be ordered from a specialist drill bit supplier. This sub setting of standard sizes is in contrast to general practice with number gauge drill bits, where it is rare to find a set on the market which does not contain every gauge. Metric dimensioning is routinely used for drill bits of all types, although the details of BS328 apply only to twist drill bits. For example, a set of forester bits may contain 10, 15, 20, 25 and 30 mm diameter cutters. The shank is the part of a drill bit grasped by the chuck of a drill. The cutting edges of the drill bit are at one end, and the shank is at the other. Different styles of shank/chuck combination deliver different performance, such as allowing higher torque or greater centering accuracy. The straight shank is the most usual style on modern drill bits, by number manufactured. It is most often made the same diameter as the drill bit, for economy. It's then held in a 3-jaw drill chuck. Very small bits can have straight shanks larger than the drill diameter, often for holding in a standard size

collet. Large drill bits can have straight shanks smaller than their drill diameter, so that medium-size chucks can be used to drill large holes. Such a drill bit is called reduced-shank or a blacksmith's drill. One particular type of reduced-shank drill bits are Silver & Deming (S&D) bits, which have a 1/2" reduced shank, and are 6" long with a 3" flute length.

Easy to make on a lathe

- Minimum of turning or grinding needed if the drill
- bit is made from appropriately sized round bar stock Can be held in a collet chuck
- Can be held in a drill chuck, the commonest sort
- very accurate centering
- low torque transmission

II. INTRODUCTION

There are many of lathe accessories including various centres, extensions and tool rests also various type of tool holder, chuck, headstock. Similarly to this principal we design Multipurpose indexing device. This device is generally used for lathe tool post. Our project is depending upon the worm and worm gear for the indexing purpose to index the tool post.

Our aim through this project is to index the tool which is on tool post of the lathe machine. The rotary motion of the worm is used to index the tool. In this the worm and worm gear assembly is fitted between two supporting plates which are fixed by the clamping.

The main purpose of conducting this project is by using indexing method we easily calculate any angle rotation of job and tool. It mainly depends upon the principle of rotary table i.e. this allows to rotate the jobs or tool at any desired angle. In earlier day, the more convention method of tooling used was the four sided, square index turret. It allows machinist to index every 90 degree in 1 direction; it does not offer a quick change system to the cutting tool is necessary to achieve centre heights.

III. CONSTRUCTION

A. Worm and Worm Gear –

In our project the area of interest is about the main part i.e. worm and worm gear. The worm gear is widely use for transmitting power at high velocity ratio between none intersecting shafts that are generally, but not necessarily at right angles. The worm gear is mostly used for the speed reducer. The worm is generally made of steel while the worm gear is made of bronze or cast iron for light services. The worm gearing is classified as non-interchangeable, because a worm wheel cut with a hob of one diameter will not operate satisfactory with a worm of different diameter, even if thread pitch is same.

1) Cylindrical or straight worm

Fig. 1: Worm Shaft

2) Hobbled straight face worm gear

Fig. 2: Worm Gear

3) Bearing mounter plate:

This bearing mounter plate is used to mount the bearing and to support the worm shaft at both ends. It's having mild steel material. Four holes are drilled at each corner of plate for screwing purpose.

Fig. 3: Bearing Mounter Plate

4) Trust Bearing and ball Bearing:

Thrust ball bearings consist of two precision chrome steel washers (ring) and a ball complement spaced by bronze retainer. They can be supplied with or without radius ball grooves in the rings. Thrust bearings are used under purely axial loads. The thrust ball bearing are used to carry thrust load or load applied (W = 2000 kg) and at low speed. The Thrust ball bearing supports the nut which is subjected to all loads along the axis of nut. The thrust ball bearing is selected for diameter of shaft = 20mm.

Fig. 4: Trust Bearing to take axial load

5) Standard parts:

We know that, in design any machine 'use of standard parts' is very important activity. Standard parts such as nut, bolt, washer, bearings are available in standard size and shape with tolerance. Due to these parts interchange ability is possible. This parts are easily available in low prices.

6) Clamping methods

This device works against various forces like cutting force and other forces. So most important thing is that the device must be fixed rigidly. Due to cutting forces it should not get vibrated. After desired angle is achieved clamping of tool post is necessary for avoiding vibration problem.
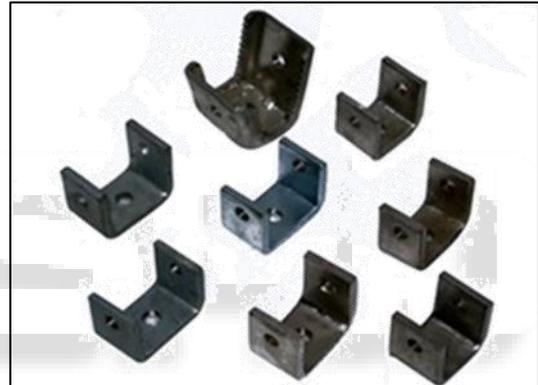

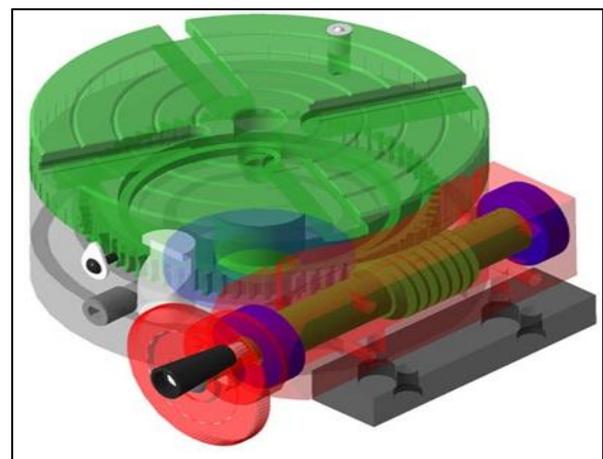Fig. 5: U Clamp

IV. WORKING PRINCIPLE

Fig. 6: Working Principle of Indexing Device

This device mainly works on worm and worm gear speed reduction principle. We know that worm gear gives high velocity ratio i.e. 40:1,

This may be helpful for indexing purpose, that's why worm gearing used for mainly indexing. The ratio of

worm gear is easily divided into 360°.because of high gear reduction ratio, it is possible to maintain accuracy.

A. *Detailed working of project as follows:*

1) We know that, this multipurpose indexing device works on 'worm and worm gear principle.
2) For supporting the worm and worm gear we used two rectangular mild steel plates which one is placed at bottom i.e. base (bottom side) plate and another placed on top of worm gear.
3) Stud or worm gear shaft is welded with worm gear inner diameter, and this shaft further transferred from both the plates with the help of two ball bearing which is fitted on plates, both plates having bore diameter equal to the ball bearing outer diameter and one thrust ball bearing (for supporting the axial load)
4) This stud has some threads at top portion for engaging the hex bolt. the diameter of stud is equal to the inner diameter of ball bearing.
5) Worm shaft is also welded with 'worm', and this shaft also passed from two bearing plates, bearing mount with the help of bearing mounter plate. Hand wheel is provided at the one end of worm gear shaft.
6) Bearing mounter plates helps to mount the bearing as well as it helps for rigidly supporting the two plates (i.e. top plate and bottom plate).with the help of screwing.
7) Two holes drilled on both the plates for passing bolt and bush for more firmly join.
8) Circular disk is fixed (either by welding or pressing) above the shaft (stud) from 4-5 mm above the top plate.
9) Above this disk tool post is mounted with the help of nut, bush, and washer. Disk reduces friction between the tool post which rotating and the top pate which fixed.
10) Circular scale is provided above the top plate, which helps to indexing the tool post or notifying the position of tool post.
11) Clamping is provided to fix the circular disk with the top plate.
12) When hand wheel rotates then worm shaft rotates with the worm. Due to rotation of worm, worm gear also rotated which is in engaged position with worm. Due to this stud rotates with the tool post. By observing the scale, we can easily bring the tool post at desired angle with the help of this device.
13) When desired angle is achieved then by clamping the circular disk with top plate, tool post comes again in steady position.

V. ADVANTAGES

– Tool can be rotated at any desirable angle.

– We can easily perform operation without removing tool holder, face, chamfer, thread & groove.
– Accuracy is high-Accuracy of device can be increased by dividing the circular movement of worm shaft. It is possible to achieve the minimum 15″ accuracy, if scale is designed for worm shaft and put scale on bearing plate.
– Simple in construction -Since the plates are assembled with nut and bolts, so the manufacturing of this device is quite simple.
– Less time require.
– We make any complex job which having multiple arc & circles very easily.
– Used for drilling machine for drilling multiple holes on same plate.
– We easily calculate the degree of angle rotation without any calculation.
– By using some other accessories like chuck, indexing plate and other devices we can elaborate the area of application.
– It is easy to assemble and disassemble.
– Reduces non productive time.

VI. DISADVANTAGES

1) This device work against various forces like cutting forces, so chances of vibration is more. This may be damage gears or function of device.
2) Backlash in gear may cause reduce the accuracy.
3) Due to Weight of fixture is more, handling problem arise.

VII. APPLICATION

– Milling curved slots.
– Drilling a bolt holes circle around the circumference of a parts
– Chamfering the job of any angle by using straight tool.
– Indexing the job as well as tool.
– Drilling complex shape parts.
– For cutting the arcs

VIII. CONCLUSION

This project is made with pre planning, that it provides flexibility in operation. This innovation has made the more desirable and economical. This project "Multipurpose Indexing Device -Lathe, Milling, and Drilling." is designed with the hope that it is very much economical and help full to large scale industries, workshops, etc... This project helped us to know the periodic steps in completing a project work. Thus we have completed the project successfully.

REFERENCES

[1] Olga Guschinskaya, Alexandre Dolgui, Nikolai Guschinsky, and Genrikh Levin – Scheduling for multi-spindle head machines with a mobile table. January 2007 (Research report 2007 – 500 – 002)
[2] Ali Riza Motorcu, Abdulkadir Gullu - Statistical process control in machining, a case study for machine tool

capability and process capability. Materials and Design 27 (2006) 364–372

[3] Dolgui, N. Guschinsky & G. Levin – A design of decision support tool (DSS) or mass production machining systems vol. 57, No. 3, 2009.

[4] R. S. Khurmi and J. K. Gupta, A Textbook of Machine Design, Eurasia Publishing House, New Delhi, India, 2002. JOURNAL PAPERS:

[5] C. Brecher, M. Esser, S. Witt - Interaction of manufacturing process and machine tool. CIRP Annals - Manufacturing Technology 58