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DEVELOPMENT OF INTERNAL KEY WAY ATTACHMENT FOR LATHE MACHINE

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Abstract
Internal key way to any hollow shaft is cut by using different manufacturing methods like milling, broaching etc. This machining process required separate machine to carry out machining of product. It means it consumesmore space, the overall time increases and also expenses will increase. By developing the special attachment for machine will reduces consumption of time and space. Various operations like Turning, Drilling, Facing, slotting will be done on single machine. Instead of milling machine we are using the special attachment for lathe machine to machining of internal key way slot. In thispaperdiscussed abouttheinternal key way attachment for lathe machine through whichwe eliminated cost of broaching or milling. Machine operates through lathe machine. It consists of lathe machine, a cam follower attachment, power chuck, cutting tool etc.

Keywords:lathe machine, internal key way, cam follower mechanism.

Introduction

In present various conventional machines are used for producing internal key way operations. These machines are having some advantages and limitations over project mechanism. Milling is a machining operation in which a work part is fed past a rotating cylindrical tool with multiple cutting edges. The axis of rotation of the cutting tool is perpendicular to the direction of feed. Owing to the variety of shapes possible and its high production rates, milling is one of the most versatile and widely used machining operations. Broaching is a machining process for removal of a layer of material of desired width and depth usually in one stroke by a slender rod or bar type cutter having a series of cutting edges with gradually increased protrusion. Broaching enables remove the whole material in one stroke only by the gradually rising teeth of the cutter called broach. Machining by broaching is preferably used for making straight through holes of various forms and sizes of section, internal and external through straight or helical slots or grooves, external surfaces of different shapes, teeth of external and internal splines and small spur gears etc.

The advantages of conventional machines are very high production rate, high dimensional and form accuracy and surface finish of the product and it is extremely suitable and economic for mass production.

The disadvantages of those machines are only through holes and surfaces can be machined, usable only for light cuts, cutting speed cannot be high. Defects or damages in the broach severely affect product quality. Also it requires a specialized machine which increases cost.

In this paper an attachment is developed tocreate internal & external keyway.This attachment can be used for maintenance purpose in small workshops, medium scale industries as well as job shop production and work having less number of volume production and non-standard jobs. This key way attachment is flexible. By using this arrangement we can produce different types of key ways by changing the cutting tool. This internal key way attachment is very simple for fitting and removing from lathe spindle. The assembling and disassembling is very simple and time required for it is less. The shaping and broaching machines are not compact, portable and affordable. These all problems are overcome by an internal key way attachment. The center lathe is used as interchangeable unit. There is no requirement to purchase an expensive shaping and broaching machines. So an internal key way mechanism is affordable in small workshops.

Literature Survey

Darshanattarde et al. [1] developed attachment for lathe machine with grinding wheel for grinding process. Grinding operation is the surface finish operation which is performed after all process. After machining of component it required tofinish the burr and sharp corners of components on different machine. To avoid this type of situation it is easy to make a attachment for lathe machine which performed grinding without removing the component.

Some of paper related to attachment for lathe for gear manufacturing which is represented by Gadakh Ramesh et al. [2] studied that different type of gear manufacturing process and methods. There are some process like casting, milling, hobbing and shaping. Every process is best at their material properties, type of gear, finishing of gear. Milling is used

forgear manufacturing but it costly. For overcome the cost it is better to develop one attachment on lathe.
Now a day's so many products are produce by new technologies. Some of these modern technologies consist of computer, hydraulics, hard ware to accurate machining. By using conventional lathe machines it is possible to milling operation with accuracy that was discovered by Prakash N. Parmar et al. [3]. Instead of lead screw it is better to replaced by ball screw, because of this change accuracy is increases.
Design of machine elements [4] book played important role for the selection of bolt, nut and pins.

Mechanism

This project has internal cam and follower mechanism for producing an internal key way. The project mechanism is shown in the figure1

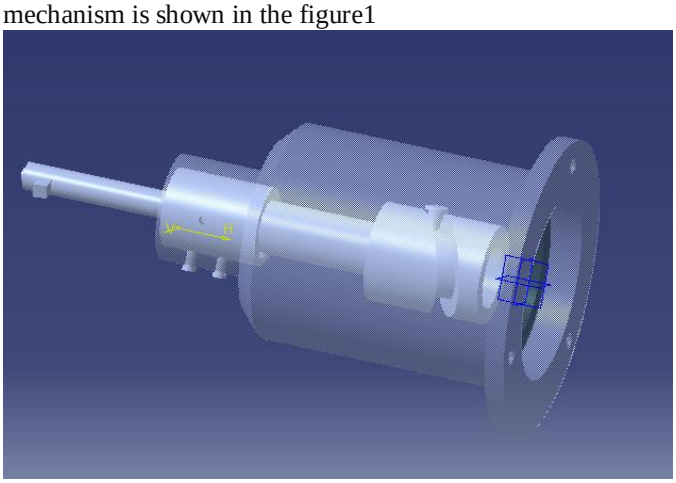

Figure 1: CAD Model of Attachment

Figure1 shows the working model of an internal key way mechanism. The rotary motion of lathe spindle is converted into the reciprocating motion of the cutting tool. Using cam and follower mechanism the conversion of motion takes place.

. The motor power is in the form of rotary motion. This is supplied to the gear box via belt. That motion further transfer to the spindle. On that spindle our attachment is fixed. Housing is fixed to the headstock. In that guide base cam and follower arrangement is fixed. Arbor is connected to that arrangement and this arbor is reciprocates in the guided and supported bush. Further the tool holder is fixed in the arbor by alien screw. Tool bit is fixed at the end of tool holder by alien screw. Due to the reciprocating motion of flat point cutting tool machining takes place.
Following components are used in the mechanism:
1) Cam 2) Follower 3) Housing 4) Cam Guide 5) Arbor 6) Boring bar 7) Follower pin 8) Key

Design & Analysis:

In designing this attachment, three major components are selected which actually take part in force transmission viz. cutting tool holder, square key, arbor.

Table1: Design Specifications

Sr no.	Component	Material	Dimensions	Actual stress (N/mm^2)	Permissible Stress (N/mm^2)	Safe/unsafe
1	Cutting tool holder	C40	D=14mm L=110mm	72.05	410	Safe
2	Square Keys	40Cr1Mo28	L=48 mm b=8mm	81.64	230	Safe
3	Arbor	C40	D=27 mm L=135mm	16.89	410	Safe

The whole assembly is structurally analyzed in ANSYS15.0.A SOLID45 element is used for analysis with 5mm element size. All material properties are assigned to each component. Face plate of housing and entire housing part kept fixed and forces are applied at the end of the cutting tool. Following results are found out in ANSYS

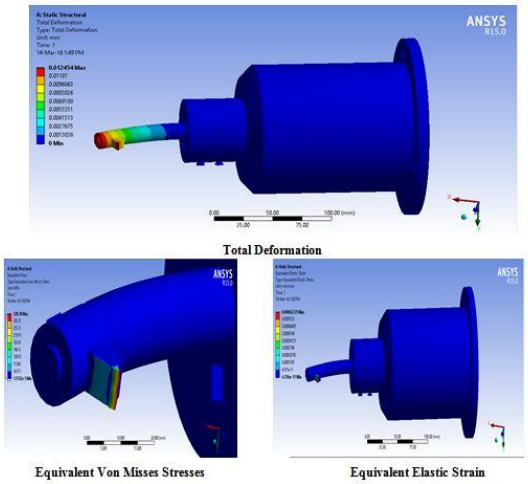

Figure 2:ANSYS Results

In ANSYS analysis total deformation, equivalent von misses stresses & equivalent elastic strains are checked and all parameters are found in within safe limit.

Fabrication

In fabrication process following components are fabricated:
1)Housing: Housing is fabricated by using a circular flange & pipe mild steel. The dimensions of housing are selected by considering lathe machine chuck dimensions. Machining is done on both flange & pipe to get required dimensions and both components are welded as shown in figure3.

Figure3: Housing

2) Cam: It is an important part in assembly which helps in converting rotating motion into sliding motion. Cam is fabricated from mild steel pipe which is cut by using hacksaw to a required length subsequently facing of both end is carried out. Groove inside pipe is machined by using milling machine as shown in figure 4.

Figure 4: Cam

3) Cam guide: It is made of mild steel pipe. It is machined in its shape by turning operation on lathe and a hole is drilled on drilling machine as shown in figure5.

Figure 5: Cam guide

4) Arbor: Arbor is manufactured from a shaft of EN8. Facing, turning, taper turning & drilling are the operations carried out for arbor. The final product as shown in figure6

Figure 6: Arbor

5)Job holding device: A job holding device is shown in figure7. It is made of mild steel. It used for holding the job for keyway

Figure 7: Job Holding Device

Testing & Results:

Testing for this attachment is carried out to find out time required to machine a keyway as shown in table2. For testing a hollow shaft of gun metal is taken with 25mm internal diameter, 45 mm outer diameter & 30 mm length.

Table2: Testing & result

Sr no	Depth of cut (mm)	Time required to keyway of total depth = 5 mm(minutes)
1	0.2	6.25
2	0.4	3.44
3	0.5	3.16

Conclusion

1) This project is successfully developed a compact portable mechanism for converting rotary motion of the lathe spindle into reciprocating motion of the cutting tool. Using this mechanism different key ways can be produced.
2) From the results obtained from the operational testing of project model we concluded that the project model satisfies the working practical conditions.
3) In this project we have successfully designed & developed the internal keyway attachment for the lathe machine. The attachment is very much economical, as it is used on lathe machines. It was the great opportunity to us to work on such industrial based project, and that too in development field.

Future Scope

- Automation can be done to give exact feed rate.
- Digital indicator can be used to get dimensional improvement.
- Accuracy of key way produced by this attachment is poor than shaping machine due to design error, optimum design of this machine will give more accuracy and reliability.
- Tool holding device has limitation to hold work piece of smaller size. By modifying it, attachment can be used to produce key way to large component and also to produce external key way.

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