

Design and Development of Keyway Milling Attachment for Lathe Machine

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Abstract

In manufacturing industry there are different types of machining processes are required to convert raw material in to final product. Some of machining process required separate machine to carry out machining of product. It means not only consumption of space and overall time increases but also expenses will increases. 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 key way slot. In this paper discussed about the milling attachment for lathe machine through which we eliminated cost of slotting and milling. Machine operates through lathe machine. It consist of lathe machine slide, electric motor, power chuck, end mill cutter, dowel pin etc.

Keywords: lathe machine, milling operations, end mill cutter, lathe machine slide, key way.

Introduction

The development of this attachment relates to slotting, drilling, key way milling. For these machining processes it includes the lathe machine. The main objective of the attachment is to carry out key way milling on lathe machine. Basically Keyways are nothing but grooves which having different kind of shapes and those shapes cut along the axis of the cylindrical surface of shafts. In this key way, keys are going to fit and provide a positive method of locating and driving members on the shafts. The selection of keyway is totally depending on the application. In day to day life mostly Woodruff key, the square-ends machine key, and the round-end machine key are used.

Different machining operations like milling and drilling, with stationary work piece continuing machining from previous machine to next machine, in certain case if work piece required operations like turning, drilling and milling operations, then it have to move from one machine to another machine. Because of that different machines required different setting [1]

This milling attachment basically relates to machine tools and mostly relates to a rotary head milling attachment. Advantage of attachment is to be used in with horizontal lathe machines to carry out some milling operations. Object of this invention is to form keyway exact at centre of the shaft. The horizontal

axis of shaft and the vertical axis of end mill cutter are perpendicular to each other; also the vertical axis of shaft and vertical axis of tool are coinciding with each other.

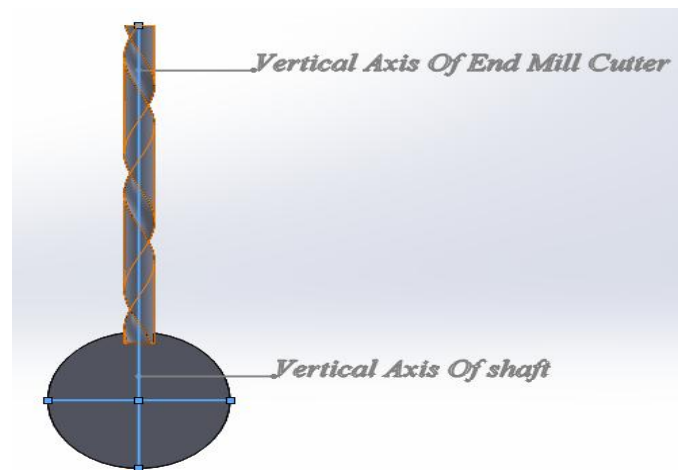


Figure 1: Axis of Shaft and Axis of End mill cutter both are coincide with each other.

As we can see in Figure 1, both vertical axis are coincide with each other and horizontal axis of shaft and vertical axis of end mill cutter are perpendicular to each other, by maintaining this setting on attachment we can get center aligned keyway which is shown in Figure 2(a) and we can eliminate general error which are shown in Figure 2(b).

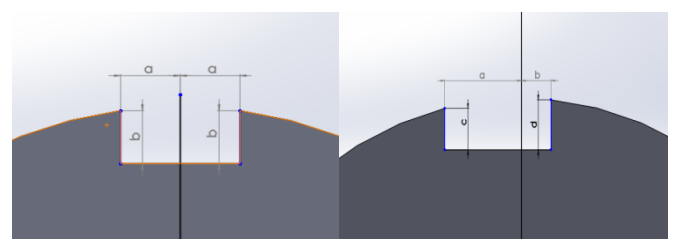


Figure 2 (a)

Figure 2(b)

Literature Survey

Darshanattarde et al.[2] 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

to finish 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.[3] 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 for gear manufacturing but it costly. For overcome the cost it is better to develop one attachment on lathe.

Now a days so many products are produce by new technologies. Some of these modern technologies consists 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.[4]. Instead of lead screw it is better to replaced by ball screw, because of this change accuracy is increases.

Design of machine elements [5] book played important role for the selection of bolt, nut and pins.

A lathe with multipurpose including special valve polishing device and camshaft lap device was patented by Gary F. Thompson. In this attachment it includes two pair which is axially parallel. The main function of rotatable rollers were to bear against and full support during machining.[6]

OnkarDhepe et al. invented one attachment which fulfil requirement of keyway machining and other milling operation with same job setting. Because of same job setting overall time is reduced.[7]

Experimental Set-up and Procedure:

Support design

When we first started to design this attachment, that time we decided to Fabricate 'H' shape mild steel box for attachment purpose. But by doing further studies on the design of 'H' shape mild steel box, we came to know that, If we use 'L' shape fabricated mild steel box instead of 'H' shape, it will look better & require less material. If we use the 'H' shape mild steel box, the following points may occur,

1. It will require more material than L shape
2. It will require more space than L shape
3. The design will be complicated.

So, due to these we decided to fabricate 'L' shape mild steel



Figure 3: 'L' Shaped Support

Cross slides

Vertical cross slide

When we started to thinking about the cross slides, our need was that, we should use a cross slide which will be strong, easy for operation, easy to balance the weight, so we decide touse the 'SHIMOGA' type vertical cross slide which satisfies our all needs.

Base cross slide:After selecting the vertical cross slide, now we started thinking of base cross slide. We needed that kind of base cross slide, which can carry more load, it should be strong enough to carry the whole attachment load, so we selected the 'SHIMOGA' type base cross slide, which satisfies our needs. We are going to mount these base cross slides on our ordinary lathe machine, & on this base cross slide we are going to attach our whole assembly

Electric motor:For giving the rotational motion to the keyway cutter we needed the electric motor as per our requirements as below,

Table 1: Specification of Electric Motor

Power (HP)	Speed (rpm)	Phase	Winding
0.5	1440	Three	Copper

First time we selected the single phase motor, but after more studies on it, we replaced it by 3 phase motor. We selected the 3 phase motor for giving motion to the tool in both directions (i.e.Forward& reverse direction).

Fabrication

The fabrication process is shown below, step by step,

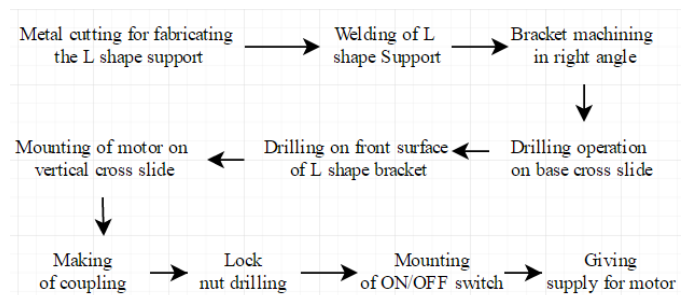


Figure 7: Fabrication Sequence

The 1st step during the fabrication process was, Metal cutting for the L shape support. The details of metal cutting is as below,

- Flat Ms(Black) 125x16
- X 390-1 NOS
- X 235-1 NOS
- Ms Plate 16 thick
- X390x235-1 NOS

After, the metal cutting poces the next step was welding process. The L shape was 1st formed by only spot welding & after that it was made strong by rigid welding.

The next step was the machining process of L shape bracket in right angle. The machining was carried out on a big milling machine. These process was carried out for having a smooth

surface for mounting the cross slide on it. The drilling operation was carried out for mounting the vertical cross slide on the front side of the L shape bracket, for getting the vertical movement of the tool. Total 4 holes were drilled on front side of L shape bracket.

After the drilling operation the next step was to mount the electric motor on the vertical cross slide. This was done by drilling the holes in cross slide, & then one plate is placed in between the vertical cross slide and the electric motor for exact fitting of motor. Total 4 holes were drilled.

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After the process of motor mounting, the next step was to make a coupling. The coupling was made because, to attach the drill chuck to the motor shaft.

One end of the coupling was attached to the motor shaft & at the other end the drill chuck is attached by press fit. One hole is provided on coupling for locking purpose. Also there is a spanner flat on coupling. The details of coupling are as follow,

Table 2:Details of coupling

Shaft diameter	Length	Bore	Thread	Thread length	Spanner flat
40mm	60mm	14 by 1.30 mm	1.5 inch	20mm	28

After the coupling process, next step was to mount the whole attachment on lathe, for this purpose we required to drill a hole to the base slide at center, for the lock nut attachment. This, operation was carried out on vertical drilling machine. The details of drilling is as below, 8mm drill throughout and 12 mm bore in 6 mm length. After the all above process, the next step was to mount the ON/OFF switch for operating the motor. This was attached to the left side of the attachment, by drilling two holes in L shape support. The switch has one handle, by using which we can rotate the motor in forward & reverse direction.



Figure 4:Setup With ON / OFF Switch

Coloring was the important step of fabrication. The coloring was done for two purposes,

- For avoiding the corrosion of metal.
- And also for good looking of the attachment.



Figure 5:Coloring of Setup

After mounting the ON/OFF switch, the next step was to give the electric supply for the motor. For this purpose cable was used, of 4 core 2.5 amp and 4 meter long.

Result and Discussion

After developing setup finally it is ready to take some test on different materials. For testing we chose three different materials like Mild Steel, Aluminium and Brass. Following figures shows the keyway on shaft for different material.

Mild Steel

The 1st trial we had taken on M.S bar. The specification of M.S bar is as below,

Table 3: Specification of M.S bar

Sr. No	Material	Diameter	Length
1	M.S	38mm	150mm



Figure 6: Machining on Mild Steel

The 2nd trial we had taken on Aluminum bar. The specifications of Aluminum bar is as below,

Table4: Specification of Aluminum bar

Sr. No	Material	Diameter	Length
1	Aluminum	38mm	100mm



Figure7: Machining on Aluminum

The 3rd trial we had taken on Brass bar. The specifications of Brass bar is as below,

Table5: Specification of Brass bar

Sr. No	Material	Diameter	Length
1	Brass	38mm	100mm



Figure8: Machining on Brass

After carrying out the groove machining surface roughness was measured of all above materials. With the help of "Surface roughness test".

Surface roughness tester.

The SRG-4500 is the latest addition to our growing line of precision surface roughness testers and profilometers. This surface roughness tester is "state of the art" with a full slate of advanced features along with precision and accuracy that you demand.

Extremely sensitive and highly accurate readings from the SRG-4500 Phase II surface roughness tester are offered via 15 popular surface roughness scales including Ra, Rq (Rms),Rt,Rz,Rmax.

The SRG-4500 surface roughness tester utilizes an easy interface to allow for changes of in/mm (uin/um), cut off

length, sampling length, parameters, level of test (stylus position), digital filters and more.

Roughness parameters.

- Ra** – Arithmetic mean surface roughness
- Rmr(c)** – Material proportion of the profile:
- RSm** – Average groove width
- Rt** – Total height of the roughness profile
- Rzi**– Maximum height of the roughness profile:
- Rz1max** – Maximum surface roughness:
- Rz** – Surface roughness depth:

Result table.

Table 6:Surface roughness Aluminum bar.

EVA-L	λ_c	Ra	Ry	Rz	Rq
4.0mm	0.8mmX5	0.91 μ m	5.4 μ m	#3.7 μ m	1.12 μ m

Table 7:Surface roughnessBrass bar.

EVA-L	λ_c	Ra	Ry	Rz	Rq
4.0mm	0.8mmX5	2.03 μ m	11.0 μ m	8.0 μ m	2.49 μ m

Table 8:Surface roughness M.S bar.

EVA-L	λ_c	Ra	Ry	Rz	Rq
4.0mm	0.8mmX5	1.87 μ m	10.8 μ m	7.3 μ m	2.29 μ m

Table 9:Comparison of 3 different materials.

Parameter	M.S bar	Aluminum bar	Brass bar
Strength	Hard	Soft	Soft
Material cutting	Hard	Easy	Easy
Feed required	Less	More	More
Load on tool	More	Less	Less
Vibrations on attachment	More	Less	No vibrations
Coolant	More required	Less required	No needed

Conclusion

1. The Milling attachment is an effective tool for modern industrialization which will definitely help to improve the productivity and will help the industries to improve the quality of keyway operation.
2. The compact design of attachment will help to easy operation of keyway. The attachment will reduce the time of changing the job from one machine to another for keyway operation. It has wide range of application. By using this attachment we can locate the exact center of keyway.

3. The surface roughness is good for soft materials like, brass, aluminum & rough for material like M.S. Load on cutting tool is more for M.S material and it is less for materials like brass & aluminum.

4. In this project we have successfully designed & developed the milling attachment for the lathe machine. The milling attachment is very much economical attachment, 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

As we are observing that the Industrial Sector is growing day by day and new techniques are developing with moving days. In these existing techniques of key way milling attachment there is a main disadvantage of not getting the exact centre of key way. In our project we are using a special attachment for lathe for doing key way operation, in which we can get the exact centre of the key way. This helps to proper locking of the shafts. Our attachment will be very useful basically for small scale industry, because in small scale industry separate milling machines are used for keyway operation, which is a costly operation according to them. By using our attachment on lathe this operation would be less costly. One can also try for different mechanisms for obtaining the same type of attachment.

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