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SPECIAL PURPOSE MACHINE FOR MULTIPLE OPERATION ALONG & ACROSS THE AXIS OF CYLINDRICAL JOB

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ABSTRACT

This article intends to develop a proto type model SPM which can do multifarious operations like Turning along the axis of shaft, milling flat surfaces parallel to axis for holding the shaft with spanner & make drilled holes across the shaft axis at any location and make keyway groove on the periphery of shaft parallel to the axis at any position in length wise on the turned cylindrical job. This can be possible by providing different tools like milling cutters, drilling bits, reamers etc on vertical motor mounted spindle in turn mounted on same bed of lathe opposite to turning tool post location. Here turning operation will carried out by horizontal spindle rotation of machine where as auxiliary operations like milling, drilling, reaming, & key way grooving can be performed by 3D motion of vertical spindle. So in this special purpose machine (SPM), job change over time will reduce to absolute zero as different auxiliary operations can be performed on same turned shaft by same machine.

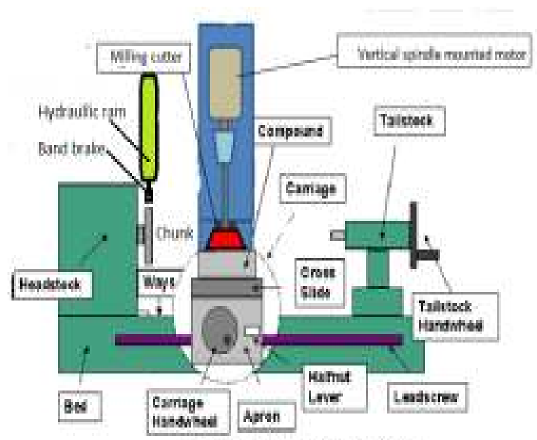
KEYWORDS: Special Purpose Machine (SPM)

This is a special purpose machine(SPM) which is intended to do jobs of different operation along the axis & across the axis on the same shaft which is turned already on same machine with in a same work holding device.This is a simple lathe with extra vertical mast fabricated to carraige at back side. In this SPM different auxilliary tools like milling cutter,drilling bit, etc. will get three different motion .As motor is mounted on platform Which get vertical motion over two vertical LM guide due to vertical rack & pinion arrangment & actuating servo motor at the base.This motion is considered as Z-axis motion.

This vertical mast along with vertical mounted motor can move side wise as carraige moves along the bed .This motion along the bed is considered as the X-axis motion.

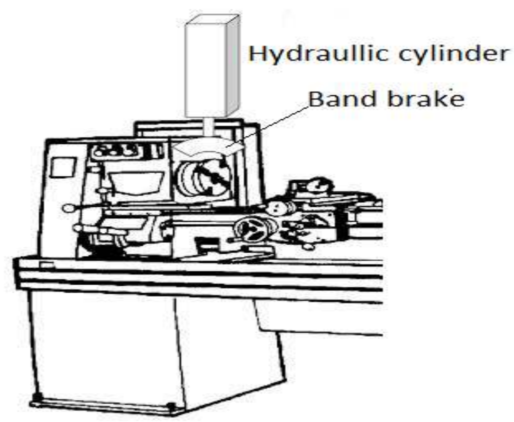
In this set up cross slide has extended backward & mast is erected at extreme end of the cross slide.This cross slide can move to & fro on two parallel LM guide across the bed & that gets drive from another servo motor mounted below. This motion across the bed is considered as Y-axis motion.

In this process for simple turning operation three motions are available at tool tip to maintain different parameters like cutting speed, tool feed, & depth of cut to produce shaft. & similarly for auxiliary operations vertical tool has got three perpendicular motion along with spinning.



LATHE CUM SPM FOR AUXILLIARY OPERATION

So as a whole ,above set up is called SPM as It can do turning & sucessive auxilliary operations on by one in a single set up machine as per fixed programme.



CHUNK BAND BREAK ARRANGEMENT

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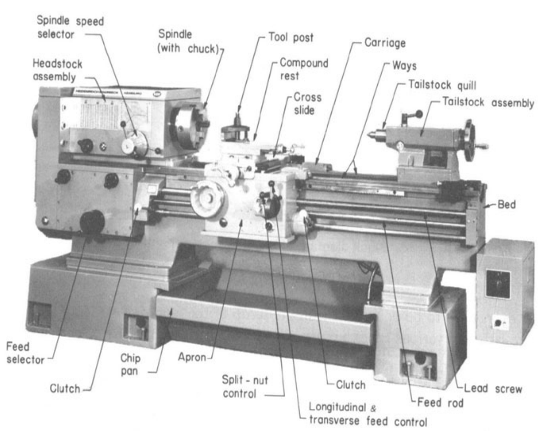
In case of turnning , chunk is free to rotate about its axis but when auxilliary operations are carried out chunk is locked by band brake which is mounted above the the chunck & In conjuction with hydraullic ram fitted to it & transimit movement to shoe to engage with chunk . This causes brakeing action on chunk.

LATHE

The lathe is a machine tool used principally for shaping articles of metal (and sometimes wood or other materials) by causing the work piece to be held and rotated by the lathe while a tool bit is advanced into the work causing the cutting action. The basic lathe that was designed to cut cylindrical metal stock has been developed further to produce screw threads. tapered work. Drilled holes knurled surfaces, and crankshafts. The typical lathe provides a variety of rotating speeds and a means to manually and automatically move the cutting tool into the work piece.

Turning is one of the most common of metal cutting operations. In turning, a work piece is rotated about its axis as single-point cutting tools are fed in to 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. 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. 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 alive or dead center. Work that is held at both ends is said to be "between centers." Additionally, longer work pieces may have a "steady rest "mounted between the headstock and tailstock to support the work.

Lathe cutting tools brought to the work may move in one or more directions. Tool movement on the lathe is accomplished using a combination of the lathe's "carriage", "cross slide", and "compound rest".

The carriage travels along the machine's bed ways, parallel to the work piece axis. This axis is known as the "Z" axis. Motion perpendicular to the work is called the "X" axis. On a lathe this motion is provided by the cross slide mounted on the carriage.

Regardless of the type of lathe, three key parameters determine productivity and part quality. These parameters are:

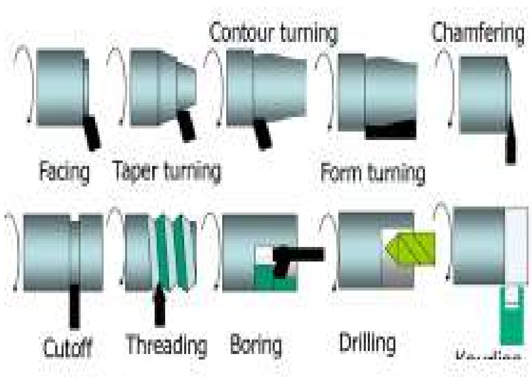
- the cutting speed
- the feed rate
- the depth of cut

The cutting speed is the speed of the work as it rotates past the cutting tool. The feed rate is the rate at which the tool advances into the work. The depth of cut is the amount of material removed as the work revolves on its axis. Other factors include the machinability of the stock, the type and the geometry of the cutting tool, the angle of the tool to the work.

EXTERNAL TURNING

Turning operations may be classified under following general headings as follows:

- Straight turning: reduces the work to a specified diameter equally along the work's axis.
- Taper turning: produces a taper along the axis of the work piece. Tapers are produced by either offsetting the tailstock from centerline or by using a "taper attachment." Some short, steep tapers can be obtained by using the compound rest alone.
- Contour turning or profiling: uses a single-point cutting tool to reproduce a surface contour from a template.
- Chamfering: to remove sharp edges,
- Grooving: to produce recesses and shoulders,
- Facing: to finish the ends of a work piece,
- Parting: to cut off finished pieces from the stock, and
- Thread chasing with tools to produce the desired thread form.



TYPES OF MILLING

There are two basic types of milling, as shown in the figure:

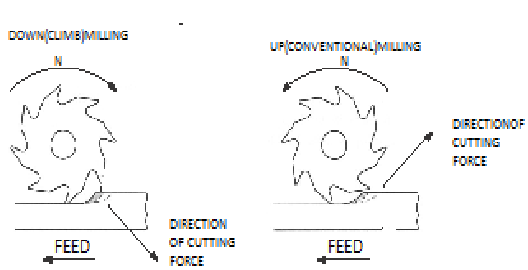
Down (climb) milling, when the cutter rotation is in the same direction as the motion of the work piece being fed, and

Up (conventional) milling, in which the work piece is moving towards the cutter, opposing the cutter direction of rotation:

Two types of peripheral milling. Note the change in the cutting force direction.

In down milling, the cutting force is directed into the work table, which allows thinner work parts to be machined. Better surface finish is obtained but the stress load on the teeth is abrupt, which may damage the cutter.

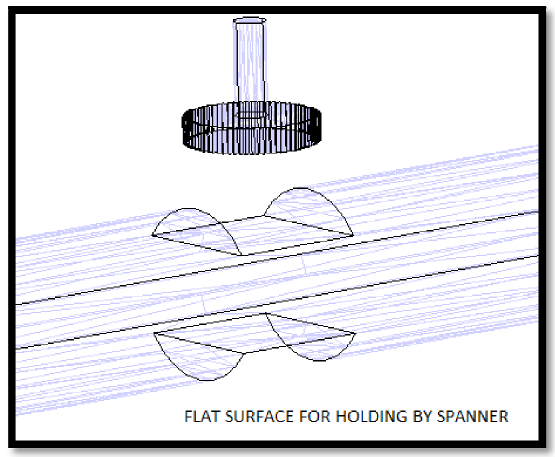
In up milling, the cutting force tends to lift the work piece. The work conditions for the cutter are more favorable. Because the cutter does not start to cut when it makes contact (cutting at zero cut is impossible), the surface has a natural waviness.



MILLING OPERATION

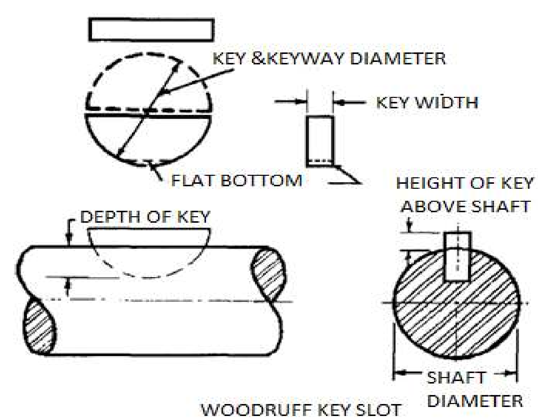
Milling operations may be classified under four general headings as follows:

- Face milling. Machining flat surfaces which are at right angles to the axis of the cutter,
- Plain or slab milling. Machining flat surfaces which are parallel to the axis of the cutter.
- Angular milling. Machining flat surfaces which are at an inclination to the axis of the cutter.
- Form milling. Machining surfaces having an irregular outline.
- Tapering. Tapering is to cut the metal to nearly a cone shape with the help of the compound slide.
- Parallel Turning**.** This operation is adopted in order to cut the metal parallel to the axis
- Parting. The part is removed so that it faces the ends.



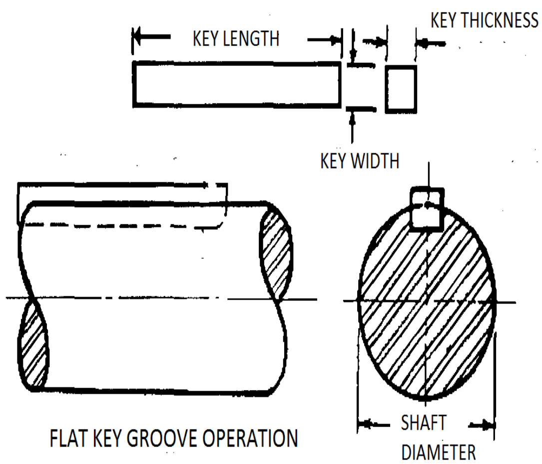
WOODRUFF KEY SLOT

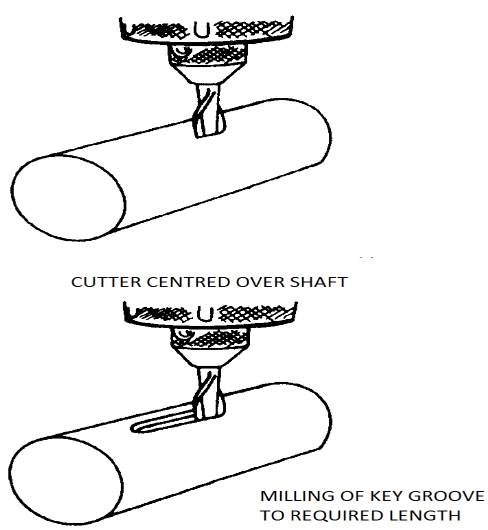
The Woodruff keys are semi cylindrical in shape and are manufactured in various diameters and widths. The circular side of the key is seated into a keyway which is milled in the shaft. The upper portion fits into a slot in a mating part, such as a pulley or gear. The Woodruff key slot milling cutter in figure must have the same diameter as that of the key. Woodruff slot can be made along the axis. Shaft keyways for Woodruff keys are milled with Woodruff key slot milling cutters in Figure.



SQUARE-END KEYWAYS

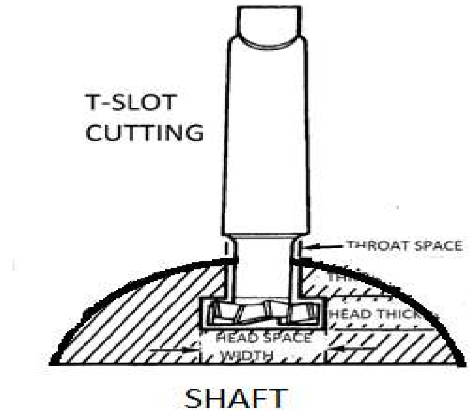
Square-end keyways can be cut with a plain milling cutter or side milling cutter of the proper width for the key Round-end keyways must be milled with end milling cutters as In Figure so that the rounded end or ends of the key may fit the ends of the keyway. The cutter should be equal in diameter to the width of the key. This type of key way groove can made along the axis at peripheral surface of shaft





T-SLOT MILLING

Cutting T-slots in a work piece is a typical milling operation. The size of the T-slots depends upon the size of the T-slot cutter which will be used. Dimensions of T-slots and T-slot bolts are standardized for specific bolt diameters. T-slot can be made along axis of shaft.

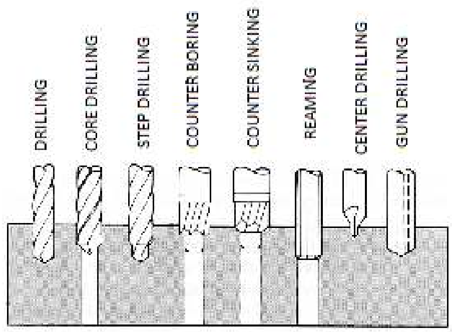


DRILLING OPERATION

Drilling is used to drill a round blind or through hole in a solid material. The drilling machines normally produce holes through holes and the single straight holes but even then there are lot of types, different types of drilling machines for different purposes for different size and shape. Drilled holes can be made across the axis at any location over the shaft.

- Core drilling is used to increase the diameter of an existing hole;
- Step drilling is used to drill a stepped (multi-diameter) hole in a solid material;
- Counter boring provides a stepped hole again but with flat and perpendicular relative to hole axis face. The hole is used to seat internal hexagonal bolt heads;
- Countersinking is similar to counter boring, except that the step is conical for flat head screws:
- Reaming provides a better tolerance and surface finish to an initially drilled hole. Reaming slightly increases the hole diameter. The tool is called reamer;
- Center drilling is used to drill a starting hole to precisely define the location for subsequent drilling. The tool is called center drill. A center drill has a thick shaft and very short flutes. It is therefore very stiff and will not walk as the hole is getting started;

Gun drilling is a specific operation to drill holes with very large length-to-diameter ratio up to L/D ~300. There are several modifications of this operation but in all cases cutting fluid is delivered directly to the cutting zone internally through the drill to cool and lubricate the cutting edges, and to remove the chips



DIRECTION OF FEED

It is usually regarded as standard practice to feed the work piece against the milling cutter. When the work piece is fed against the milling cutter. the teeth cut under any scale on the work piece surface and any backlash in the feed screw is taken up by the force of the cut.

As an exception to this recommendation. it is advisable to feed with the milling cutter when cutting off stock or when milling comparatively deep or long slots. The direction of cutter rotation is related to the manner in which the workplace is held. The cutter should rotate so that the piece springs away from the cutter; then there will be no tendency for the force of the cut to loosen the piece. No milling cutter should ever be rotated backward; this will break the teeth. If it is necessary to stop the machine during a finishing cut, the power feed should never be thrown out, nor should the work piece be fed back under the cutter unless the cutter is stopped or the work piece lowered. Never change feeds while the cutter is rotating.

CUTTING OILS

The major advantage of using a coolant or cutting oil is that it dissipates heat, giving longer life to the cutting edges of the teeth. The oil also lubricates the cutter face and flushes away the chips, consequently reducing the possibility of marring the finish.

OBJECTIVES

There also several objectives of the above SPM which is given below

- To Increased productivity and improved control of machine.
- Far superior repeatability.
- To reduced machine downtime.
- Fast machining cycles.
- High accuracy, high feed-rate.
- To increased accuracy and part finished due to controlled
- job change over time is zero

CONCLUSION

By developing automation in conventional lathe machine by using vertical mounted motor, the machine works as a SPM. Also Cost of machine is minimizes approximate 4 times below the original advanced CNC.

Automated new developed advanced lathe setup cost is high as compare with standard lathe machine but production rate is too much high. So it is very useful for mass production.

The accuracy of the job manufactured in lathe cum SPM machine is also high so repeatability and dimensional stability of manufactured part is achieved. At last some complex job which is not manufactured in conventional lathe machine can be manufactured in new developed lathe cum SPM machine. In this experimental work job change over time is absolutely zero.

REFERENCES

Roy V. and Kumar S., 2013. From Inst. Eng. India Ser. C, **94**(2):187–195, DOI: 10.1007/s40032-013 -0064-2.

Special issue on Recent Advances in Flexible Automation, International Journal of Innovative Computing, Information and Control, **4**(3), March 2008 - ICIC International °c 2008, ISSN 1349-4198 Department of Mechanical Engineering, University of Auckland, Private Bag 92019, Auckland, New Zealand.

Moses M. and Ashok D., 2013. Mechatronic from School of Mechanical and Building Science, VIT University, Vellore, India 978-1-4673-6150-7/13/$31.00 ©2013 IEEE

http://www.automation-drive.com/cnc-lathe-machine.

Win Z.E.E., Win T.N.Jr. and Winn S.L., 2008. Design of Hydraulic Circuit for CNC Lathe Machine Converted from Conventional Lathe Machine; World Academy of Science, Engineering and Technology, **2**:380-384.