Workshop Practices (ME151)

Topics to be covered:

- Introduction
- Safety Precautions
- Machine Shop
- Carpentry Shop
- Fitting and Welding Shop
- Smithy and Forging Shop

Prasenjit Dey, Ph.D., Assistant Professor, Dept. of Mechanical Engg., NIT Goa

Objectives

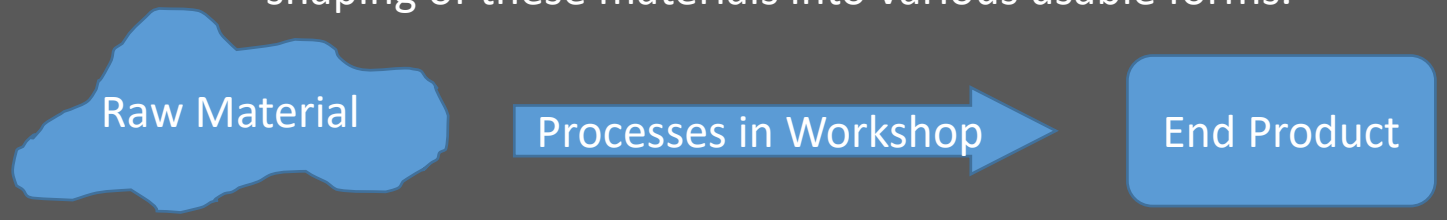
- To develop a skill in dignity of labour, precision, safety at work place, team working and development of right attitude.
- To acquire skills in basic engineering practice
- To identify the hand tools and instruments
- To gain measuring skills
- To develop general machining skills

In addition;

1. Workshop Practice helps you to know how the work on shop floor is carried out.
2. To impart knowledge and skill to use tools, machines, equipment, and measuring instruments.
3. To impart knowledge and skill on Safe handling of machines and tools.

Introduction

It provides the basic working knowledge of the production and properties of different materials used in the industry. It also explains the use of different tools, equipments, machinery and techniques of manufacturing, which ultimately facilitate shaping of these materials into various usable forms.



In general, various mechanical workshops know by long training how to use workshop tools, machine tools and equipment.

Processes:

1. Primary shaping processes
2. Machining processes
3. Joining processes
4. Surface finishing processes
5. Processes effecting change in properties.

All are done in different sections (shops) of Workshop

Processes

1. Primary shaping processes

Some of these finish the product to its usable form whereas others do not and it requires further working to finish the component to the desired shape and size.

Wire drawing lead to the directly usable articles, which do not need further processing before use.

e.g. Casting,forging, bending, rolling, drawing, power metal forging, etc

2. Machining processes

Large number of components need further processing after primary processes known as secondary operation to obtain desired shape and dimensional accuracy. These operations require the use of one or more machine tools, various types of cutting tools and cutters, job holding devices, marking and measuring instruments, testing devices and gauges etc.

e.g. Turning,Threading. Drilling, Boring, Planning, Shaping, Sawing, Milling, Grinding, Slotting, etc.

3. Joining processes

These processes are used for joining metal parts and in general fabrication work. Such requirement usually occur when larger lengths of standard sections are required or several pieces are to be joined together to fabricate a desired structure.

e.g. Welding, Soldering, Brazing, Riveting, Screwing, Pressing, etc.

4. Surface finishing processes

These processes should not be misunderstood as metal removing processes in any case as they are primarily intended to provide a good surface finish or a decorative and/or protective coating on to the metal surface, although a very negligible amount of metal removal or addition may take place. Thus, any appreciable variation in dimensions will not be effected by these processes.

e.g. Buffing, Polishing, Lapping, Belt grinding, Metal spraying, Painting

5. Processes effecting change in properties

These processes are employed to impart certain specific properties to the metal parts so as to make them suitable for particular operations. Most physical properties like hardening, softening and grain refinement etc., call for particular heat treatment. Heat treatments not only effect the physical properties, but in most cases also make a marked change in the internal structure of the metal. So is the case with cold and hot working of metals.

e.g. Heat treatment, Cold working, Hot working

For doing all the processes, you have to ensure the safety first
(Note: "accidents do not occur, they are caused")

1. Safety first, work next.
2. Know your job and follow instructions.
3. Avoid wearing clothing that might catch, moving or rotating parts. Long sleeves of shirts, long hair, neck tie and jewellery are definite hazards in the shop.
4. Wear safety shoes. Do not wear canvas shoes; they give no resistance to hard objects dropped on the feet.
5. Keep the area around machine or work clean.
6. Keep away from revolving work.
7. Be sure that all gaurds are in place.
8. One person only should operate the machine controls.
9. Use tools correctly and do not use them if they are not in proper working condition.
10. Wear safety goggles when working in areas, where sparks or chips of metal are flying.
11. Get to know who in-charge of first aid is and where boxes are placed and where the first aid can be found in case of emergency.

After following all the safety precautions, Accident happens

(Note: Various acts relating to accidents are spelt out in workmen's compensation Act-1923, The factories act-1948 and Fatal Accidents Act-1855. These acts describe the regulations for fencing and guarding the dangerous machinery, items and employer's liabilities)

Common source of accidents	*Common methods of protection*
1. Unsafe working position.	1. Safety by position.
2. Improper or defective tools or their improper use.	2. Safety by construction.
3. Improper acts- which result in violation of safety rules and non-observance of safety precautions.	3. Safety by using interlock guards.
4. From revolving parts.	4. Safety by using fixed guards.
2. Revolving cutting tools, circular saw blades.	5. Safety by using automatic guards.
3. Revolving drums, crushers, spiked cylinder and armed mixers, etc. Revolving shafts, spindles, bars and tools like drills,reamers, boring bars and chucks, etc. sharp edges or nips of belt and chain drives	6. Safety by using distance guards.

Broadly, it can happen due to anyone of the following reasons

1. Carelessness of the operator.
2. Lack of knowledge of the operator about the machine tool or job.
3. Lack of interest in the work.
4. Excessive confidence of the operator.
5. Operating a faulty machine.
6. Use of improper tools.
7. Running the machines at higher speeds or higher loads than recommended.
8. Improper or loose dress of the operator.
9. Improper lighting and ventilation in the workshop.
10. Lack of discipline among the operators.
11. Keeping objects in improper places, so as to interfere with free movement.

Machine Shop

Machine shop is a place in which metal parts are cut to the required size and put together to form mechanical units or machines. The machines so made are to be used directly or indirectly in the production of necessities and luxuries of civilization. Machine shop is the base of all mechanical production.

- In machine shop, we do Machining which is any of the various processes in which a piece of the work piece is cut into desired final shape & size by a controlled material removing process.
- The machining operations like turning, facing, drilling, threading, boring, knurling, taper turning, grinding, shaping are the ones which are carried out in the machine shop.

(Note: So we can say that machine shop is there for performing the different types of machining operations using different machines such as drilling machine, radial drilling machine, lathe machine, Milling Machine, Shaper etc.)

- In this shop either the old parts are machined as per the given job details or new jobs as per the old samples which are used as reference.

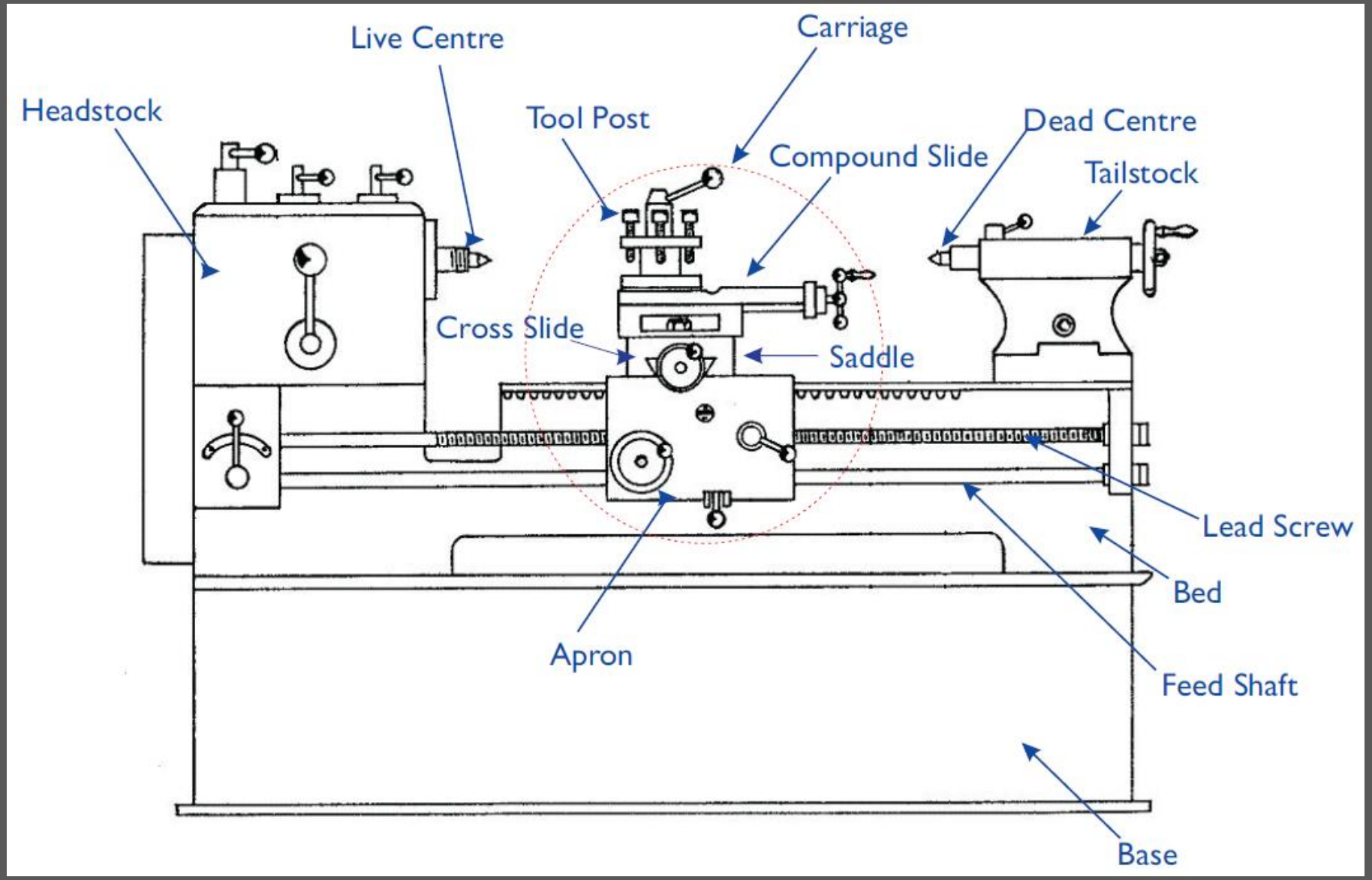
LATHE Machine

The lathe is used for producing cylindrical work. The workpiece is rotated while the cutting tool movement is controlled by the machine or an operator.

Lathes may be operated directly by people (manual lathes) or computer controlled lathes (CNC machines) that have been programmed to carry out a particular task.

The main function of a lathe is to remove metal from a piece of work to give it the required shape and size. This is accomplished by holding the work securely and rigidly on the machine and then turning it against a cutting tool which will remove metal from the work in the form of chips.

Construction of lathe



The Bed

The lathe bed forms the base of the machine. the headstock and tailstock are located at either end of the bed and the carriage rests over the lathe bed and slides over it.

The lathe bed is the main guiding member of the lathe machine so it must satisfy the following condition.

- It should be sufficiently rigid to prevent deflection
- It must be massive with sufficient depth and width to absorb vibration
- It must resist the twisting
- To avoid distortion

For this point of view, the bed material should have high compressive strength, should be wear-resistant and absorb vibration.

Cast iron alloyed with nickel and chromium forms a good material suitable for lathe bed.

The Headstock

The headstock is secured permanently on the inner ways at the left-hand end of the lathe bed.

It comprises essentially a hollow spindle and mechanism for driving and altering the spindle speed.

The Tailstock

The tailstock is located on the inner ways at the right-hand end of the bed.

This has two main use:
It supports the other end of the work it holds a tool for performing an operation such as drilling, reaming, tapping etc.

Carriage Assembly

The carriage assembly of the lathe comprises of a number of components which support, move and control the tool.

It consists of;

- a saddle,
- cross slide,
- compound rest,
- top slide,
- tool post and
- apron.

- Movement of the entire carriage assembly along the bed provides feed for the tool parallel to the lathe axis

- Movement of the cross slide along its guides on the saddle provides feed of the tool across the lathe axis and

- the movement of the top slide along its guide over the compound rest provides motion to the tool along a direction set by the compound rest.

(Note: The movement of the carriage and cross slide may be by hand or by power but the movement of top slide is only by hand.)

Tool post

− This is located on the top of compound rest to hold the tool and able to be adjusted to a convenient working position.

− The type and mounting of tool post depends on the class of work for which it is to be used.

− Following are the common types of tool post:

1. Single screw tool post
2. Four bolt tool post
3. Open side tool post
4. Four way tool post

Chucks

– A chuck is one of the most important device for holding and rotating a workpiece in a lathe.

– Workpieces of short length and large diameter or irregular shape which cannot be conveniently mounted between centers are held quickly and rigidly in a chuck.

– A chuck is attached to the lathe spindle by means of bolts with back plate screwed to the spindle nose.

– The different types of chucks are:

A. Four jaw independent chuck
B. Three jaw universal chuck
C. Combination chuck
D. Magnetic chuck
E. Collet chuck
F. Air or hydraulic operated chuck
G. Drill chuck

Types of lathe

Lathes are manufactured in a variety of types and sizes, from very small bench lathes used for precision work to huge lathes used for turning large steel shafts. But the principle of operation and function of all types of lathes is same.

The different types of lathes are:

1. Speed Lathe
2. Engine Lathe
3. Bench lathe
4. Tool room lathe
5. Capstan & Turret lathe
6. Special purpose lathe
7. Automatic lathe

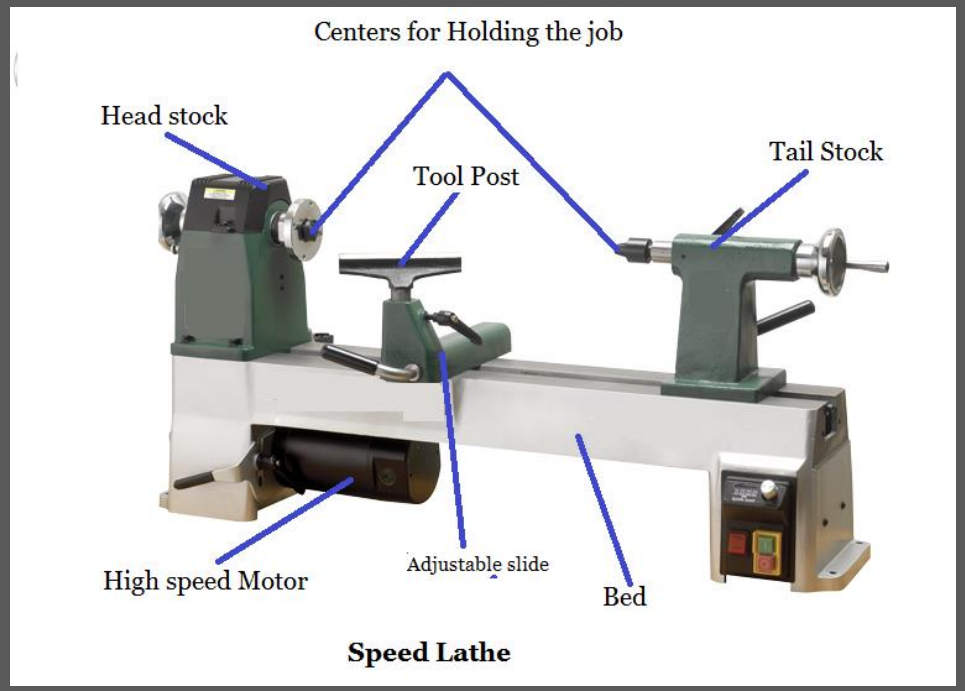
Speed lathe

– Speed lathe is the simplest type of lathe. It consists of bed, headstock, tailstock and tool post. There is no feed box, lead screw or carriage.

– Tool is mounted on the tool post and is fed into work purely by hand control. Due to this characteristic of lathe enables the designer to give high speeds range from 1200 to 3600 r.p.m.

– The headstock construction is very simple and only two or three speeds are available.

– The “speed lathe” has been so named because of the very high speed of the spindle speed.It is mainly used for wood working, spinning, centering and polishing etc.



Speed Lathe

Engine lathe

– It is the most common types of lathe and is widely used in workshop.

– Similar to the speed lathe, the engine lathe has got all the basic parts, e.g. bed, headstock and tailstock. But the headstock of an engine lathe is much more robust in construction and it contains mechanism for multiple speeds.

– The cutting tool may be fed both in cross and longitudinal direction with reference to the lathe axis with the help of carriage.

– Engine lathes are classified according to the method of power transmission to the machine.

Assignment: Remaining Types of lathe

Prasenjit Dey, Ph.D., Assistant Professor, Dept. of Mechanical Engg., NIT Goa

Lathe Operations

− Operation performed by holding the workpiece between centers or by chucks are:

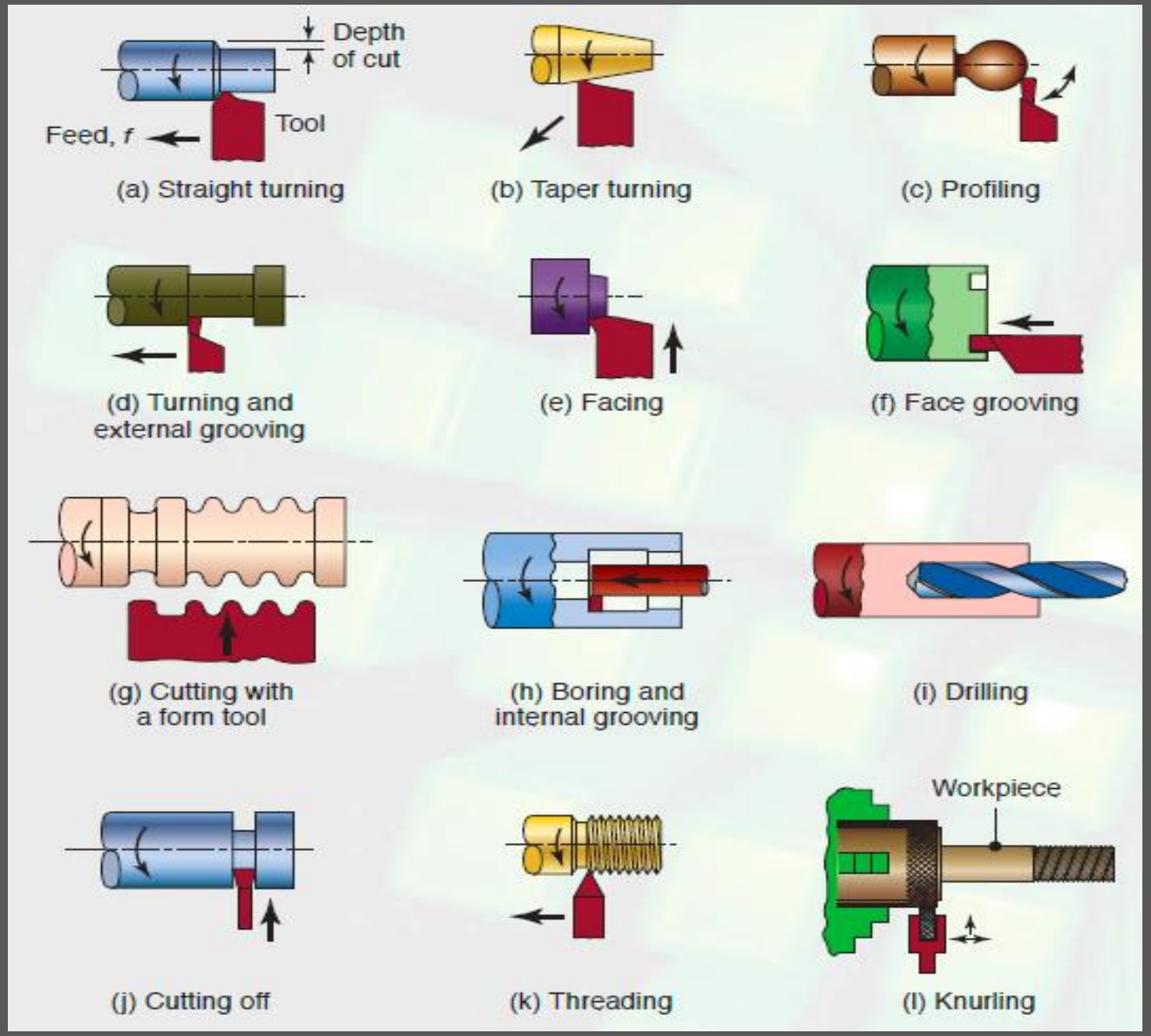
1. Straight turning
2. Shoulder turning
3. Chamfering
4. Thread turning
5. Facing
6. Knurling
7. Filing
8. Taper turning
9. Eccentric turning
10. Polishing
11. Grooving
12. Spinning
13. Spring winding
14. Forming

− Operation performed by holding the workpiece by a chuck or a faceplate or an angle plate are:

1. Drilling
2. Reaming
3. Boring
4. Counter boring
5. Taper boring
6. Internal thread cutting
7. Tapping
8. Undercutting
9. Parting off

− Operations performed by using special attachments are:

1. Grinding
2. Milling


Depth of cut
Feed, f
Tool
(a) Straight turning
(b) Taper turning
(c) Profiling
(d) Turning and external grooving
(e) Facing
(f) Face grooving
(g) Cutting with a form tool
(h) Boring and internal grooving
(i) Drilling
(j) Cutting off
(k) Threading
Workpiece
(l) Knurling