- **Objectives: introduction and suggestions for progressing**
- **Intros and Interests?**
- **Safety rules**
- **Shop rules and procedures, rites and rituals**
- **Lathe history and significance**
- **Lathe layout and components**
- **Startup and shutdown**
- **Fixturing:**
  chucks and collets
  chuck removal
  collet installation
- **Tooling**
  the metal cutting process
  tool speeds and feeds
- **Drawings**
  Three view
  Tolerances
- **Precision**
  Micrometer handling
- **Example part demonstration**
- **Clean up**

Engine Lathe 1

The engine lathe is the original machine tool, its origins lost in deepest antiquity. It was the premier tool in the early Industrial Revolution, and today it is a mainstay of factories, laboratories and home shops. One can make cylindrical parts like washers, spacers, bearings and threaded parts. With more elaborate setups, things such as tapers, knurls, grooves and springs or coils are possible. As a production, prototyping or repair tool it is vital, and modern CNC machines are capable of astounding production feats. Lathes are used today to make contact lenses, ocean liner parts and space telescopes.

This class covers operation of the Ward 8A tool room lathe and basic lathe operations. This machine is 65 years old, but the operation is nearly identical to modern machines and, with a bit of extra attention, is capable of surprising accuracy; it still has a "good cut". There will be an emphasis on workmanship and precision as a goal.

The class will cover
- lathe introduction
- safety rules
- precision and accuracy
- tolerances
- micrometer operation
- names and functions of lathe components
- ergonomics for lathe operation
- chuck removal and collet set up
- speed control operation
- shut off and start up
- the cutting process
- order of operations
- facing
- drilling
- reaming
- turning
- parting
- slip fits
- part, tools and machine clean up

There are four prerequisites for the class:

-The Bridgeport class is a prerequisite without special arrangement.

-Pick up the safety and control layout hand-out for the lathe from the door of the machine shop and review the material.

-Watch this video which covers the same material as the class (but don't use hand files on the lathe, and always get checked out on a machine you are unfamiliar with):
http://techtv.mit.edu/videos/144-machine-shop-8

-Finally play with this nifty little app to learn how to read a micrometer:
http://www.stefanelli.eng.br/en/aka-micrometer-caliper-outside-inch-thousandths.html

Class limit: 2. Come ready to operate the machine, this is a hands-on lab class. Class fee is $15 plus one time $40 shop fee, which will include extra material for a take-away assignment needed for additional lathe assignments to be completed during supervised time.

SAFETY OPERATING PROCEDURES

Metal Lathe


Safety glasses must be worn at all times in work areas.


Sturdy footwear must be worn at all times in work areas.


Rings and jewelery must not be worn.


Long and loose hair must be contained.


Close fitting/protective clothing must be worn.


Gloves must not be worn when using this machine.

PRE-OPERATIONAL SAFETY CHECKS

1. Check workspaces and walkways to ensure no slip/trip hazards are present.
2. Locate and ensure you are familiar with the operation of the ON/OFF starter and E-Stop.
3. Check that the job is clamped tight in the chuck, tools are secure in machine.
4. Remove all tools from the bed and slides of the machine.
5. Ensure correct speed for machining process is selected.
6. Use good ergonomics for safe, comfortable operation.
7. Faulty equipment must not be used. Immediately report suspect machinery.
8. Keep your mind engaged for safe, concentrated work.

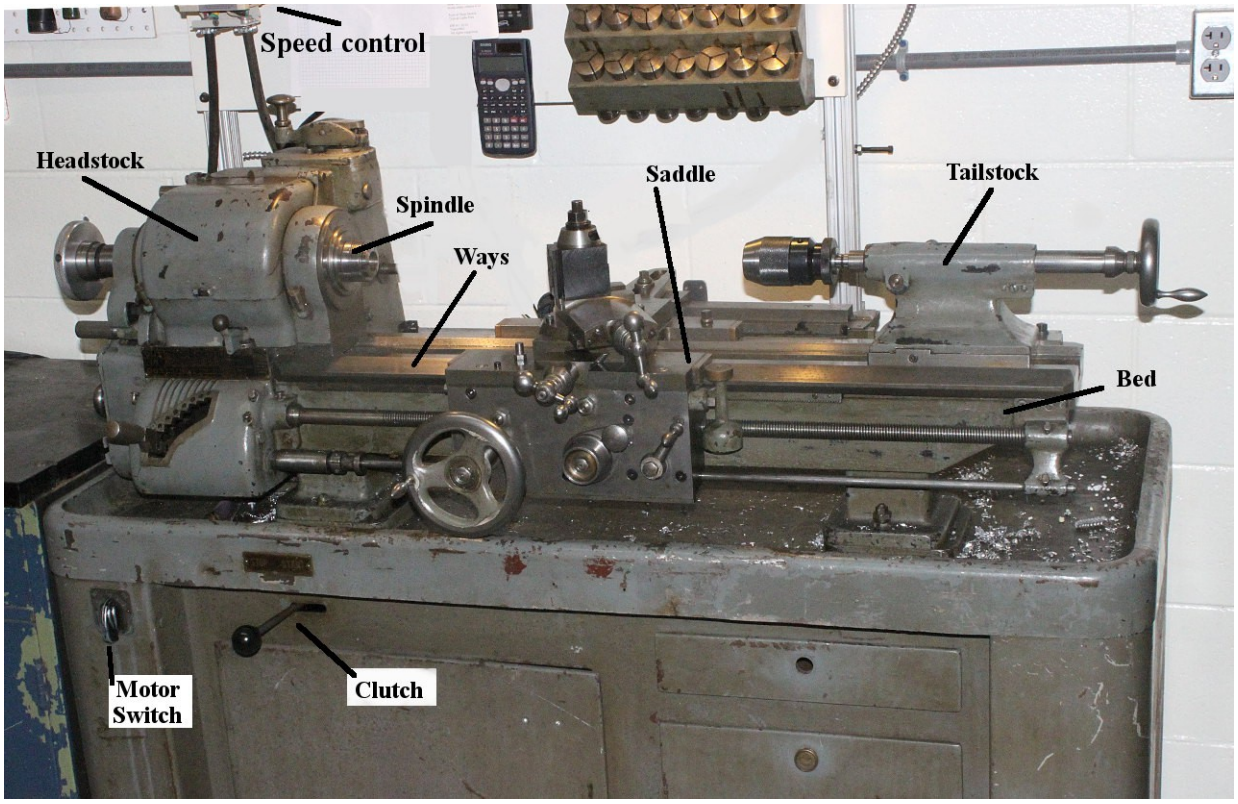
OPERATIONAL SAFETY CHECKS

1. Never leave the lathe running unattended.
2. Before making adjustments or measurements, switch off and bring the machine to a complete standstill.
3. Check spindle is free to rotate before starting - every time.
4. Do not attempt to slow/stop the chuck or revolving work by hand.
5. Avoid letting swarf build up on the tool or job. Stop the machine and remove it.
6. Never leave the chuck key in the chuck.
7. Do not store tools and parts on top of the machine.
8. Switch off the machine and remove the tool when done.
9. Leave the machine and tools in a safe, clean and tidy state.

POTENTIAL HAZARDS

- Flying objects – breaking tools, chips and splinters, loose objects.
- Cutting tool injury when cleaning, filing or polishing
- Rotating machine parts - entanglement
- Metal splinters/swarf, sharp part edges
- Eye injuries
- Back injuries

Engine Lathe I



Speed control: Used to adjust rotation rate of spindle.

Headstock: Provides the housing for drive belts and gears, holds spindle bearings rigidly in place.

Spindle: Long hollow shaft set in accurate bearings, rotates part with a powerful motor along a horizontal spin axis.

Motor Switch: Used to select high speed/low speed, also reverse (don't use). Set switch straight up for OFF, one notch clockwise for low speed, two clicks clockwise for high speed.

Clutch: Used to engage motor: pull to left to stop, pull to right to run.

Bed: Long, very stiff casting used to guide support machine and provide a coordinate system aligned with rotation axis. Top surface is accurately made into **Ways** which support and guide the saddle and tailstock.

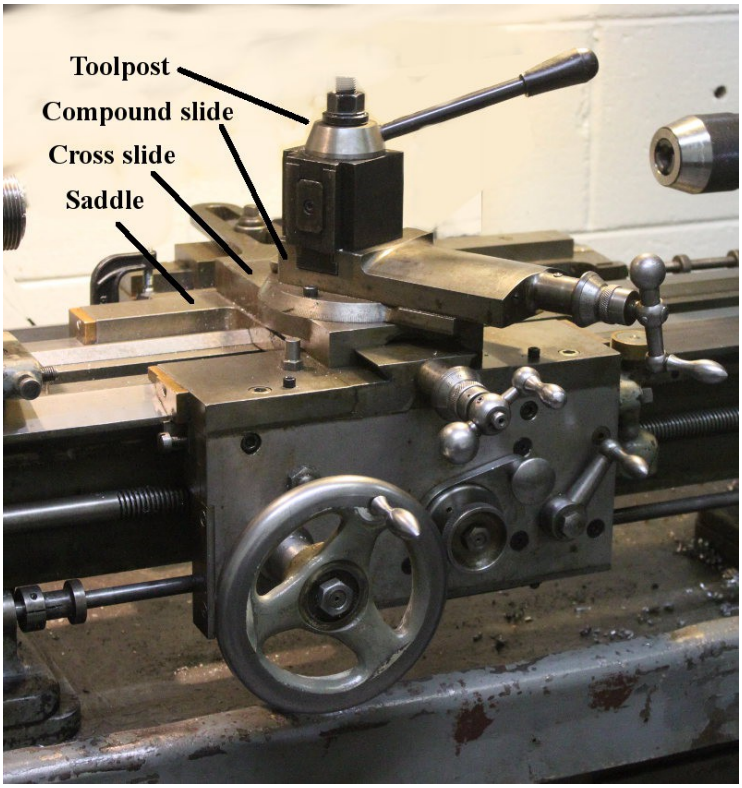
Tailstock: Used to support long workpieces and also hold drilling tools.

Saddle: Rides on top of bed along spin axis and supports cross axis.

Procedures

Start up: Power on three phase, set speed on *Speed Controller*, turn *Motor Switch* clockwise to select hi or lo speed range, pull C*lutch* lever to right to start spindle.

Power down: C*lutch* to left, *Motor Switch* straight up, power off three phase.



Saddle: Travels right to left during a turning operation.

Cross Slide: Travels in and out during a facing operation.

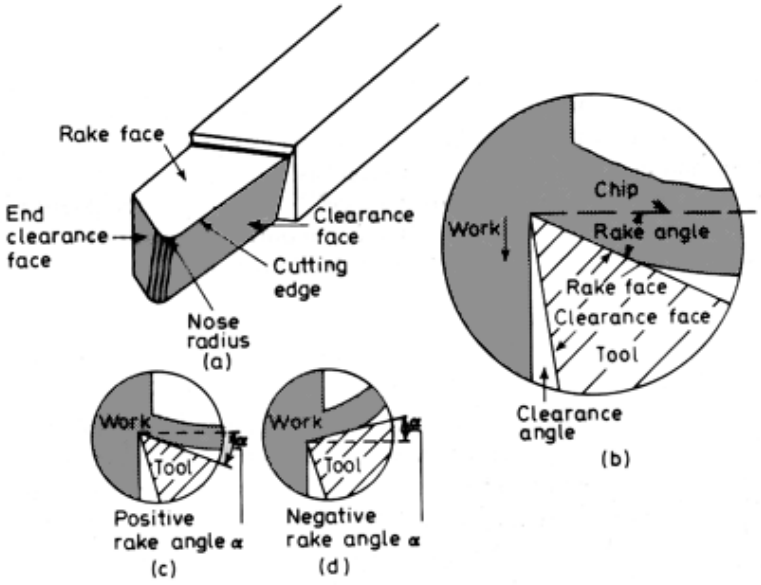
Compound Slide: Can be set at arbitrary angle for cutting tapers.

Toolpost: Holds cutting tool, allows quick and accurate tool changes.

Speed	Diameter		
SFPM	1”	1/2”	1/4”
20	76	153	306
50	191	382	764
100	382	764	1528
300	1146	2292	4584

Speeds in small letters are beyond machines capability, use 1000 RPM
Speeds below 123 RPM require gear change, consult machine supervisor.

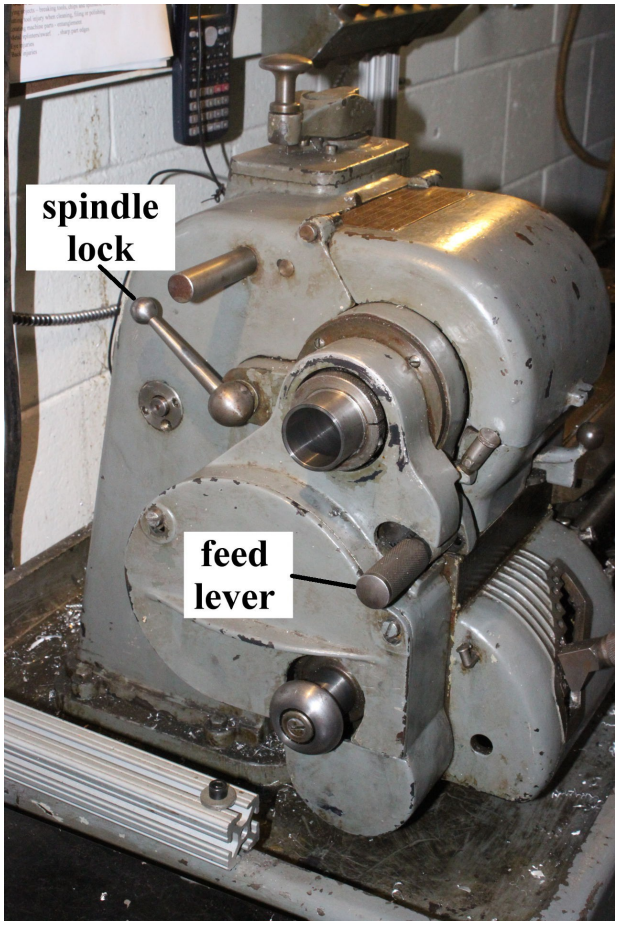
Steel: carbide tools, 200 SFPM, HSS tools 70 SFPM
Aluminum: carbide tools 300 SFPM, HSS tools 200 SFPM



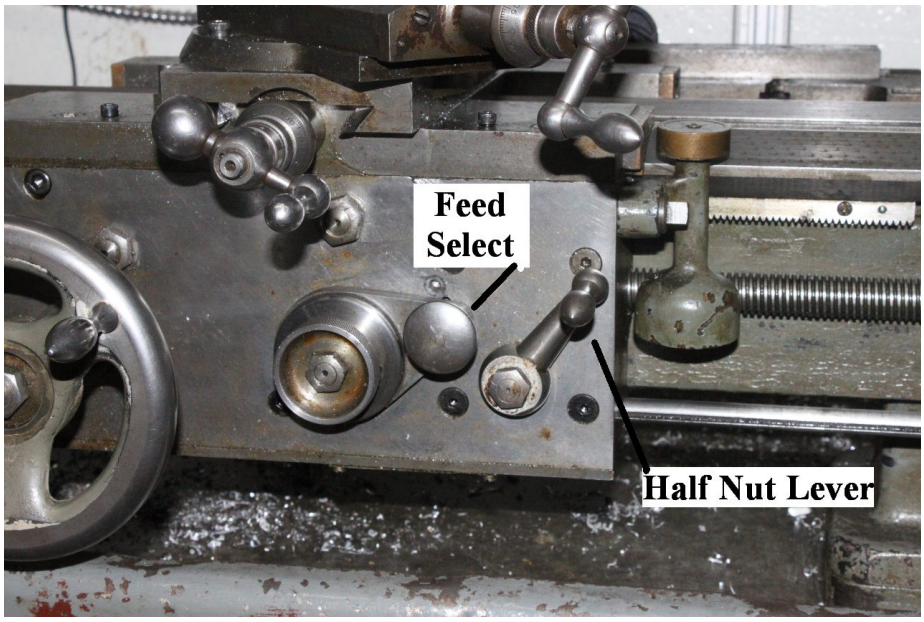
Speed Control:
Press *LO/RE*, make sure local indicator is illuminated.
Display will show something like F40.00; use the arrow keys to find the "F" display if necessary.
Press *Enter* to enter "change speed" mode.
Use *up* and *down* arrows to change speed setting.
Press *Enter* to enable changes.
Press *Run* if necessary to start controller.

Lathe Speed Control settings		
RPM	LOW speed	HI Speed
123	20	
186	30	
249	40	
312	50	
371	60	20
561		30
750		40
941		50
1127		60

To set lathe speed consult the chart above. For example to set the speed to 249 rpm use the first (LOW) speed setting of the ***Motor Switch*** and set the ***Speed control*** to read F40.00. To set the machine to 561 rpm use the second (Hi) setting of the ***Motor Switch*** and set the ***Speed control*** to read F30.00. Do not set the speed controller slower than 20 or faster than 60 without supervision..



To lock out rotation: pull *spindle lock* lever towards the front of the machine.
To dis-engage feed put both *feed levers* in middle position.
To dis-engage threading pull *half nut lever* up



Waiver (Tool room Lathe – Yellow Course)

Member:

In accordance with the TinkerMill membership policy, I accept all responsibility for my own safety when operating the TinkerMill Machine Shop equipment. I understand that it is my responsibility to evaluate each machine before use to ensure that it is in proper working order. I understand that these machines can cause serious injury if used improperly. I will not hold TinkerMill or the instructor of this course liablefor any physical harm or financial loss that I suffer as a result of my use of this equipment. I understand that I am financially responsible for any damage I cause to the equipment or tooling, and I will report any such damage to TinkerMill management immediately.

Print Name: _____

Signature: _____ Date: _____

Instructor:

I acknowledge that the (above) member has demonstrated sufficient skill in

operating the Tool Room Lathe to meet the requirements of this course.

Print Name: _____

Signature: _____ Date: _____