

# Lathe Induction

This is a CJ18A Mini-Lathe.

It is suitable for small-scale, light engineering work. The principles of operation are similar to any other lathe.

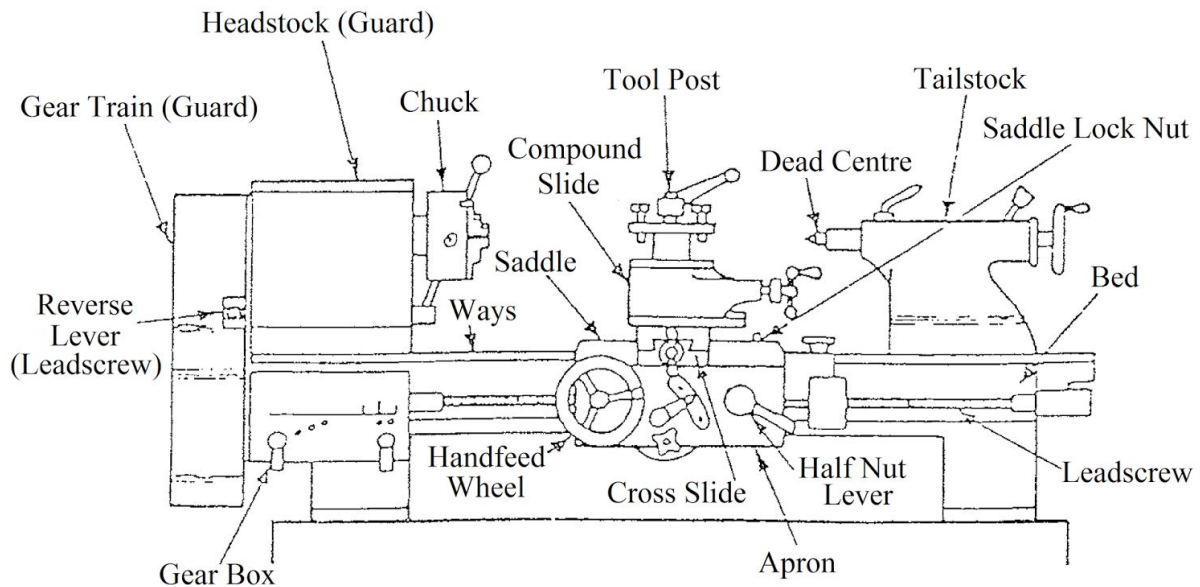
It is a metalworking lathe. Good results can be had from brass, mild steel or aluminium. The lathe must not be used for turning wood.



## Identification of the parts of the lathe and what they do

The **bed** and the **ways**. These cast-iron parts form a solid base for the lathe. The **saddle**. This supports the slide and the cutting tools.

**Leadscrew, hand-feed wheel and locking nut.** The hand wheel allows for coarse positioning of the saddle. The leadscrew provides a powered drive for the saddle, but this isn't covered in the basic induction.



## **Headstock**

### **Chuck, chuck key, chuck guard.**

There are two chucks: a 3-jaw chuck and a 4-jaw chuck. Use of the 4-jaw chuck isn't covered in the basic induction. Each chuck has a different key.

The 3-jaw chuck can hold metal rod up to 19mm diameter, of any length.

For material greater than 19mm, it should be no more than 80mm long, or have a length no more than about 4 times the diameter.

The chuck guard hinges down to give protection from the moving chuck.

At the back of the headstock cover are two lever controls. One engages the leadscrew clockwise or anti-clockwise, with the centre position neutral. The other lever selects high or low ratio for the gears turning the chuck. Best not move these levers.

## **Motor controls**

**Em-stop** The green I button (under the yellow flap) must be pressed to turn on power to the lathe. Power will not switch on unless the clear plastic chuck guard is in the 'down' position.

Emergency stop is achieved by pressing on the red button.

**Speed** The rotary control determines the turn speed of the chuck. The motor will not start unless the rotary control has been turned to minimum, where it clicks off. Then you can turn the rotary control clockwise to set the motor speed. The speed display is intermittent.

**Direction** A three-position switch on the front panel sets the direction of chuck movement. It is marked L, 0, R. For normal operation, set it to L.

## **Tailstock**

The tailstock can be positioned by sliding on the ways. It is locked in position with a lever behind the tailstock.

It has two main functions. One is to support a long workpiece, at the opposite end to the chuck. The other is to allow a drill bit to bore into the workpiece towards the chuck.

**Live and dead centres** A live centre rotates, a dead centre does not. Both have a point at one end to engage with a recess in the workpiece, and both have a morse taper to fit into the tailstock. They are used to support the right-hand end of a long workpiece.

**Feed wheel** The hand wheel at the right-hand end of the tailstock is used for moving the taper towards the chuck. A mm scale is graduated on the feed mechanism.

**Drill chuck** A morse taper with a drill chuck can take a drill bit to make a longitudinal hole in the workpiece. Before using the drill bit, an indent must be made into the centre of the workpiece, otherwise the drill will wander.

**Centre drill** This is a rigid drill bit which will not wander from the true centre of rotation. It's used to make an indent to start a drilling operation.

## ***Compound slide***

**Saddle lock.** When the saddle is in a suitable position, lock the saddle to the bed by tightening the saddle lock.

**Feed handles.** The handle on the right advances the cutting tool lengthwise towards the chuck. The handle facing you is for moving the cutting tool radially towards the centre of the workpiece.

They are both graduated, each division being 0.001 inch. We work in mm and four divisions represent 0.1mm. For the radial feed handle, these measurements indicate changes in the workpiece *diameter*.

Both controls are subject to *backlash*. This means they are only reliable in one direction of movement. If you turn a wheel 1 division further than you intended, you must turn it back by (say) 8 divisions, then turn it forward by 7.

Take some time to become familiar with the use and the direction of the two feed handles, as turning the wrong one, or turning one in the wrong direction, or turning one too far can ruin the workpiece.

**Tool post** Supports the toolholder.

**Toolholder** A removable assembly which holds a cutting tool.

## ***Cutting tools***

Although there are many types of cutting tool, on this lathe we use only two types. One is capable of facing and roughing.

The other cutting tool is for parting-off the turned workpiece from the waste.

## **Operation**

***Clothing*** Expect to get oil and metal shards on your clothing, or wear an apron. Beware of loose clothing and long hair, which could get caught in the machine.

***Eye protection*** Never operate the lathe without eye protection. We have plain safety glasses. If you wear glasses for eyesight reasons, these will protect you. You might choose to protect your glasses by wearing safety glasses over them.

***Checking for clean surfaces*** You should clean the lathe twice: once before you start and once when you have finished. The pre-start clean-up catches swarf that the previous user missed and reminds you how important it is to leave the lathe in a good condition when finished.

***Checking the tool height*** Keep the cutting tools in their respective tool holders and they will probably remain at the correct position. To check them, first fit the dead centre into the chuck. Then fit a toolholder on to the tool post. With the saddle lock tightened, use the feed handles to bring the cutting tool edge to the point of the dead centre. If the positions

coincide, the tool is at the correct height. The cutting edge must be at the height of the turning centre. Repeat for the other tool, then remove the dead centre.

**Clamping the chuck** The metal you are going to turn should be something cylindrical. Place it in the chuck jaws with the minimum length protruding (no more than 3x the diameter, as a guide) and tighten with the key. Tighten firmly without excessive force. Then insert the key into a second jaw and tighten a little more. Turn the chuck by hand to confirm the workpiece is central. Once the workpiece is clamped, it should not be removed until all turning and drilling operations have been completed. You can't return a workpiece to the jaws and expect it to still be true.

**Turning speeds** The correct turning speed depends on the type of metal and the diameter of the workpiece. An experienced lathe operator knows when it's right. We must guess, watch, listen and learn as we go. You might generally start at 300-350 rpm.

**Coolant or grease** We have no coolant, but we have some cutting lubricant in a can. We also have oil in an oilcan. Brass cuts easily enough without needing anything. Steel benefits from a drop of oil on the cutting surface, from time to time. Aluminium easily gets hot, and probably needs lubricant or oil for best results. Plastics such as acrylic, nylon or Delrin have to be kept cool, so cut at slow speeds and give plenty of rest periods. They will not need lubricant.

**End facing** The first action will be to flatten the end of the rod. If it's been sawn by a hacksaw, it will not be anything like a plane surface to begin with. With the chuck rotating at a moderate speed, bring the cutting tool to the end of the workpiece, then gently advance the tool toward the centre. Listen to the noises it makes, and respond by reducing the cut if there's any indication of overload. Retract the tool from the centre, move it about 1mm toward the chuck, and cut again toward the centre. Repeat until the end of the workpiece is flat and true.

**Turning** Set the tool close to the end of the workpiece and advance it radially towards the centre until it just touches. Then move the cutting tool towards the chuck, and a thin layer of material will be turned off. Initially, this may be irregular, depending on how much the rod is an imperfect cylinder. Repeat the process until the outer surface has an even dimension about its centre.

Continue until the workpiece diameter is reduced to the required size. For best results, try to move the feed handle at a constant speed, and make your final horizontal passes with very small radial increases. If the outer surface is still rough when finished, hold a strip of sandpaper or emery cloth against the workpiece while letting the chuck run at normal speed.

**Measurement** Stop the lathe by turning the speed control to zero, and use calipers or a micrometer to get a reading.

**Drilling** If an internal (axial) hole is wanted, it is best done before reducing the outer diameter of the workpiece, but after you have turned off the outer skin so that it is well-balanced and true. There are two stages of drilling.

First, fit a centre drill into the drill-chuck taper and move the tailstock to a position where the centre drill can contact the end face of the workpiece. Then advance the taper to cut a couple of mm into the workpiece, using a drop of oil lubricant.

Second stage involves removing the centre drill and fitting the required size of drill bit. Use the feed wheel to advance the drill into the workpiece, retracting and clearing the drill flutes every time you feed a distance about 2 times the drill diameter. Use oil generously as a lubricant. In the case of a large drill (8mm or more), start with a small drill and work up in stages to get to the required size.

**Parting** This is the process of separating the workpiece from the rest of the material (the waste). Change the tool from the cutting tool to the parting tool. Move the tool close to the chuck, to the point where the cut is to be made. Run the chuck at about half the speed you were using to turn, and gradually advance the tool to the centre of the workpiece. This produces a steep-sided cut. At some point the workpiece will fall away from the waste, leaving a narrow stub attached to the waste or to the workpiece. In any case it can be filed away.

**Cleaning up afterwards** Clear away all the cuttings and swarf you have generated. There's a dry paintbrush to use for this process. Clear all the debris using the dustpan and brush provided and empty it all into the kitchen wastebin. Return the toolholders to the accessory box, put away the chuck key, measuring tools and donate any waste material to the material bin, or take it home. Switch off the lathe light and switch off the lathe mains power at the wall socket.