

Terms used in machining and the machines used in these tasks

Underlining indicates that this term is also defined in this paper

Illustrations of many of the machines are placed on the last two sheets

Bar-autos

These were special lathes for mass production of components. A feed mechanism held a length of bar or tube up to five metres long and this material was fed through the headstock to a chuck or collet. A variety of tools were setup by a tool-setter to machine the required component and part it off from the bar/tube when it was finished. The whole process being controlled by cam systems which sequenced the tools and the amount that they machined from the raw material. The finished component dropped into a container and the machine automatically started on the next component. The machine minder fed fresh bar/tube into the machine, removed the containers of machined components and notified the tool-setter if the settings needed adjustment.

Belt Drive System

Many machine tools were driven by flat belts from overhead shafting driven by some suitable source of power. When more than one machine tool was driven from such a source there was a need to disengage the machines when they needed to be stopped. The most common form of disengagement was to use a “fast and loose” which was a pair of pulleys on the machine with one spinning freely on bearings while the other drove the machine. A wide pulley on the overhead shafting meant that a simple guide could move the drive belt from the fast pulley to the loose pulley to disengage drive and back again to start the machine tool. Belt systems could vary the speed of the machine by having different diameter pulleys and reverse the drive by twisting the belt but they presented a hazard if not carefully guarded.

Boring Machine

A machine tool for boring holes in a work-piece or machining the internal surface of a work-piece. In some cases the work-piece was rotated while the non-rotating tooling was moved to carry out the operation. In other cases the tooling would rotate and either it or the work-piece would be moved to effect the required operation. Various gear drives were used to move the tooling relative to the work-piece and produce a more uniform finish than would be produced by the operator controlling the cutting by hand.

illustrated

Broaching

This process formed the internal shape of components by drawing a cutter through a hole already created through the centre of the component. The broach was a long tapered cutter with many teeth moving from the size of the existing hole to the required profile in a series of steps, as many as was required to keep the force of cutting the profile within that provided by the broaching installation. **illustrated**

Capstan Lathe

A lathe with a turret, mounted on a travelling saddle on the bed plate, which could hold a number of tools set to carry out a sequence of machining operations. Each time the moving saddle was reversed by the operator, the capstan rotated to bring the next required tool into its machining position ready for the next forwards movement. Finally a separate parting off tool would cut the component from the bar/tube. The finished item would drop into a bin and the lathe would be ready to machine the next component. Large numbers of these machines will be seen operated by women in documentary films about industrial production in World War Two. **illustrated**

Centres

Work-pieces can be supported in lathe if they have sockets of conical shape machined in one or both ends which match conical centres in the headstock/tailstock. If both ends are supported in centres then drive to the work-piece is provided by clamping a fitting, known as a carrier, to the work-piece which engages with an arm on the headstock's rotating shaft.

Chuck

Many machine tools hold the work-piece in a chuck which can be of three jaws where the jaws move in and out together to grip round objects or of four jaws where the jaws are individually moved in and out to grip an irregular object. In the latter case, great care is needed to set the work-piece up correctly and ensure that it is safely gripped. In other machines such as drilling machines the tool is held in a chuck.

Collet

A tubular fitting inside a tapered housing which would grip a round piece of material or component when drawn into the taper. These were often fitted into headstocks or drilling machines because they were quicker and easier to operate than a chuck.

Drilling Machine

Most drilling machines are characterised by a column fitted with an adjustable table to carry the work-piece or a machine vice and having the drive system to a tool holder. Drill bits would be either held in a chuck or a specialised holder such as a morse taper fitting with a drive system that allowed the drill bit to be raised and lowered. Power would be either by hand or more commonly an electric motor or belting from an overhead belt drive system with various arrangements to change the speed of rotation of the drill bit. **illustrated**

Faceplate

A rotating plate fitted to the headstock shaft of a lathe, often with slots and holes for fixing devices, to which the work-piece is attached so that it can be machined.

Filing Machine

A machine looking a little like a drilling machine in which a file was inserted through a hole in the work-piece, supported on a table. The file was held top and bottom and was oscillated up and down while the work-piece was moved by the operator to file the required shaped hole. It had the advantage, for a semi-skilled operator, of filing at right angles to the surface of the table and thus at right angles to one surface of the work-piece.

Grinding Machine

These came in many forms: surface, horizontal, vertical, cylindrical, etc with some universal grinders covering several different functions. All used a rapidly rotating grinding stone against the work-piece which was moved in appropriate directions by power operated traversing mechanisms. Flat components being ground on a surface grinder would often be held on a magnetic chuck. Centerless grinders were able to give a highly accurate finish to round components which floated about two grinding stones as they rotated.

Headstock

The fitting on a lathe supporting the shaft which rotates the work-piece on a faceplate, between centres or in a chuck and which may contain a gear box or pulleys as parts of a belt drive system. **illustrated**

Honing

A finer finish, than machining or grinding, could be obtained by honing with very fine shaped grinding pads or grinding paste on shaped pads. A good example of honing is the polishing of the bores of cylinders in engines or hydraulic rams.

Lathe

A machine in which a work-piece is rotated while being subject to turning or spinning. The work-piece may be held on a faceplate, in a chuck or between centres. The lathe is one of the oldest forms of machine tool, used for metal working or wood turning. Power can be from the machinist using a treadle, other humans turning cranks, treadmills etc or by animal, water, steam or electric motor. The required speed of rotation can be produced by gearing or by a belt drive system. Tools can be hand held using a tool rest or fastened into a tool post. Other fittings on the lathe bed can support the work-piece along its length and the tailstock can support the work-piece or hold drills, reamers, boring bars etc. Lathes were developed which could be set up to be operated by semi-skilled operators working on production and these included capstan lathes and bar-autos. **illustrated**

Machine Vice

A work-piece being machined on many machine tools would be held in a machine vice, usually a screw vice with a flat base which might be hand held for light work but more usually be bolted down to the machine's table or bed plate.

Magnetic Chuck

Small work-pieces, particularly those with flat bases or of flat plate, can be held magnetically to a device fastened to the machine's carriage or bed plate. The magnetic field to hold the work-piece was created by either mechanically turning a series of magnets under the device's top plate or using an electromagnet built into the device.

Milling Machine

Milling is the process of machining using a rotating cutter, with teeth, to machine surfaces, slots and voids in a work-piece. Millers can have vertical or horizontal spindles or can be universal where the spindle and its housing/gear system can pivot through 90°. The work-piece is fastened to some form of carriage with a variety of traversing features, both hand and power operated. The rotating cutters come in many different forms to suit tasks varying from machining flat surfaces, slots for keys and similar to intricate shapes under hand or powered control. The cutters have many different means of mounting to suit such a variety of tasks so that milling machine technology is a pretty broad field. **illustrated**

Morse Taper

Drill bits, chucks, tapping devices and other tools used in drilling machines or lathes could have a tapered spindle which would be gripped in a tapered housing. Tool changes could be quite quick and alignment of the tool ensured. The item in a morse taper was released by a bar inserted through the tapered housing just above the end of the taper to be released.

Planing Machine

A machine with a travelling carriage to support the work-piece below a cutting tool which could be traversed sideways to machine a flat surface. There was usually a device which allowed the tool to be raised slightly on the return movement of the carriage so it only cut in the one direction. Small planing machines could be hand powered but usually they were power operated with power also operating the traverse. **illustrated**

Reaming

Where holes need to be finished to an accurate diameter, or with a good finish, a reamer would be used which had sharpened cutting blades, formed around a cylindrical body. The reamer could be held in a machine or a hand stock.

Screw Die

External threads would be cut into cylindrical sections of a work-piece by a thread cutting die held in some suitable holder, or die stock. This usually allowed the die to be progressively reduced in cutting diameter from the size of the finished cylindrical section to the finished thread size.

Screw Tap

Threads would be tapped in a hole in a work-piece with a screw tap, often in sets of three giving progressive forming of the thread. The tap would be held in a machine or in a hand stock.

Shaping Machine

A horizontal reciprocating tool holder carries a cutting tool while the work-piece is moved progressively sideways or vertically on a power traverse. The tool tips up or sideways on the return stroke so it only cuts in one direction. **illustrated**

Slotting Machine

A machine similar to a filing machine moves a cutter vertically while the work-piece is moved below it on a traversing table. It is best for machining simple slots and the most obvious is the key-ways machined in the bores of gears and pulleys.

Spinning

Round, hollow metal objects such as cups and plates can be formed from sheet material by clamping a disc of metal against a rotating former of the required shape for the inside of the product. Then a blunt tool, or possibly some form of roller ended tool, is used to draw the metal over the former rather as a potter forms clay on a potter's wheel. Great skill is required to avoid creases in the metal as it is formed to shape.

Stock

A hand tool which would hold a screw tap or reamer in an adjustable square housing or a screw die in a circular housing with screws to reduce the diameter of the die.

Tailstock

The fitting on a lathe bed at the opposite end of the work-piece from the headstock which can hold various tools, centres etc. Often it has means of feeding what it is holding towards the headstock by a hand-wheel or similar device.

illustrated

Tool Post

A fitting on the bed of a lathe or other machine tool which held cutting or manipulating tools at the correct angle to the work-piece and which could move the tool under suitable control by hand-wheels, screws and other devices so the load on the tool did not deflect it from its proper operation.

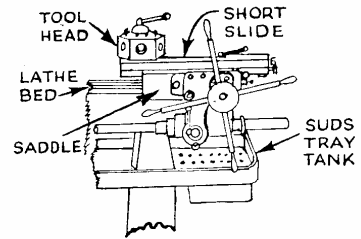
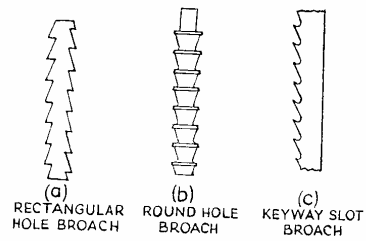
illustrated

Tool Rest

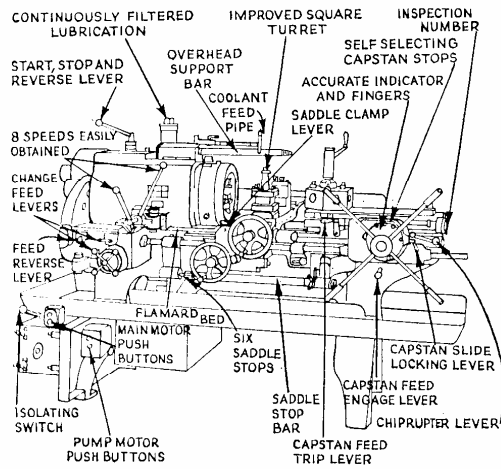
A support, usually fitted to the bed of a machine tool, on which the operator rested a hand held tool while cutting nor manipulating the work-piece.

Turning

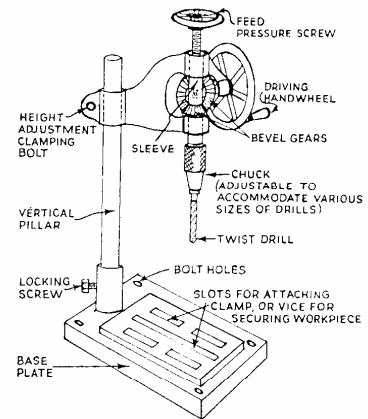
Both wood and metal can be machined across the face or along the length by turning but internal machining is limited by the arrangements for supporting the rotating work-piece and would more normally be undertaken on a boring machine.



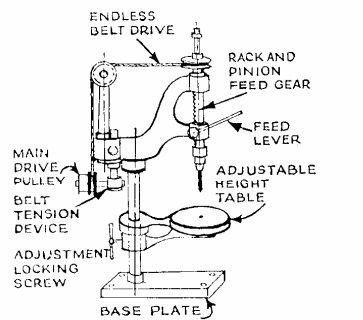
Saddle End of "Capstan" Lathe.



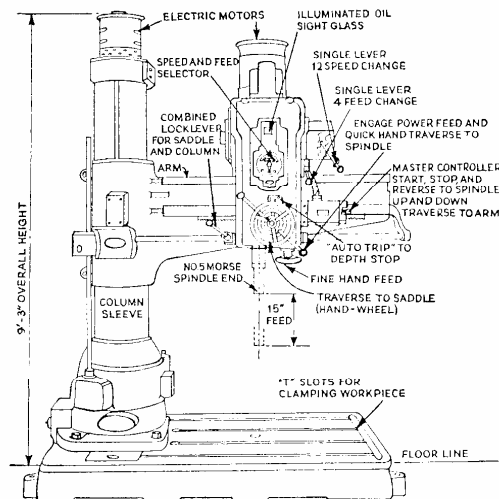
Capstan Lathe.



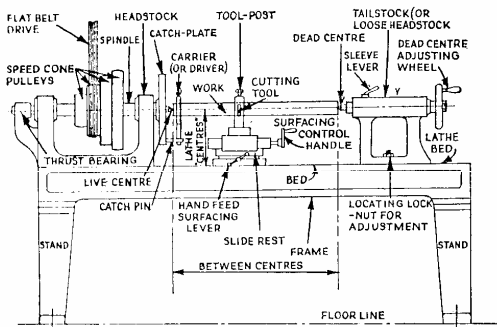
Bench Type Drilling Machine.



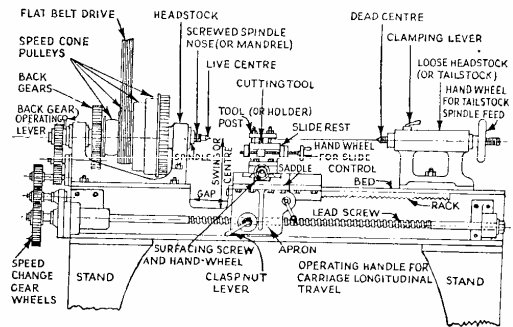
Sensitive Type Bench Drilling Machine.



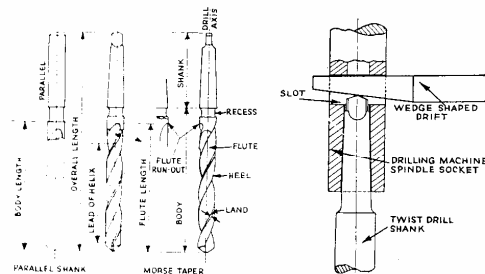
Radial Drilling, Boring, and Tapping Machine.



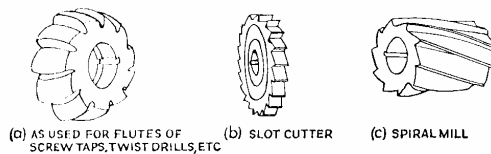
Elementary Plain Lathe (indicating names of parts).



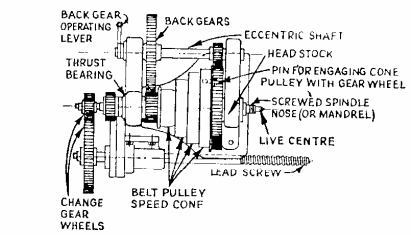
"Screw Cutting" Back Geared Gap Lathe (Belt Driven).



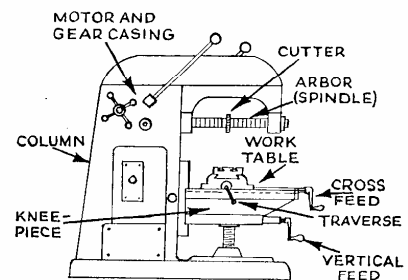
Twist Drill Terms.



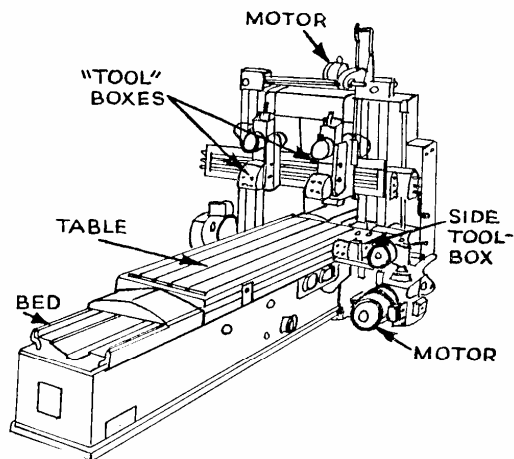
Milling Cutters.



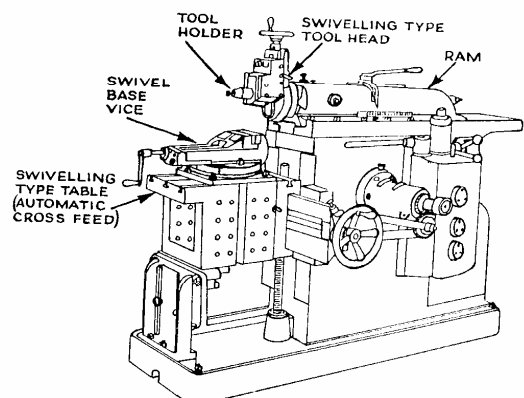
Plan View showing Back Gear Arrangement.



Typical Universal Milling Machine.



Typical Modern Planing Machine (All Electric 3 Tool-Box Type).



"Edgwick" 16''/20'' Shaping Machine.