

Fitting and Machining Book By Ron Culley (L341)

The contents include the following:

- * Useful facts and figures:
 - o Mathematical signs and common abbreviations
 - o Conversion factors for common English units
 - o Conversion table, mm-inch
 - o Areas and related formulae of plane figures
 - o Volumes
 - o Geometrical propositions
 - o Right-angled triangles
 - o Trigonometry tables
 - o Useful tapers and angles
 - o Machine tapers
 - o Mechanics - The Principle of Work; Levers; Pulleys and Wheels; Screws; Wedges; Pascal's Law
- 1. Workshop hints
 - * General hints
 - * Metal fret
 - * Hardening and tempering a small object
 - * Press fit assembly
 - * Turning a sleeve bearing
 - * Chatter
 - * Setting to marked centre in the lathe
- 2. Safety in the workplace
 - * Accidents; Causes; Prevention
 - * Personal safety; Eyes; Ears; Manual Lifting
 - * First aid
 - * Orderly workshop habits; Personal Cleanliness; Horseplay; Industrial Housekeeping
 - * Workshop safety
 - * Equipment safety; Hand Tools; Machinery; Electrical Equipment; Ladders; Compressed Air; Cranes
 - * Firefighting; Types of fire
- 3. Engineering drawing-How to read and use
 - * Types of drawing; General Arrangement Drawings; Assembly Drawings; Detail Drawings; Drawing Re-issues
 - * Types of Line-Their Application and meaning
 - * Projection; Orthographic; Isometric
 - * Sections
 - * Scales
 - * Conventional representations, symbols and abbreviations; Representations; Symbols and Abbreviations
 - * Dimensions; Units used and Placement for Dimensions; Dimensions for Screw Threads; Auxiliary Dimensions; Chamfers; Dimensions Not to Scale and Breaklines; Tabular Dimensions; Use of Other Markings
 - * Tolerances; General Dimensions; Screw Threads; Geometric Tolerance Symbols
- 4. Limits-Fits and tolerances
 - * Types of fit; Clearance Fits; Interference Fits; Transition Fits; Summary
 - * Basis for Fits; Individual Measuring; When the Hole is Produced by a Fixed Tool; When Standard Sized Shafting is Used; Summary
 - * Tolerances; Variations in Size; Interchangeability of Parts
 - * Definitions; Standard System of Limits and Fits; Tolerances; Designations of Holes, Shafts and Fits
 - * Selective Assembly
 - * Machining Tolerances; Working to Drawings; Working from Tables; Working to Tolerances
 - * Accuracy of Process, Surface Finish and Tolerance; Surface Finish; Relationship between Surface Finish and Tolerance; Surface Finish, Tolerance and the Machine Process; Special Cases Needing Very Good Surface Finish
 - * Standards of linear measurement; Direct Standards; Derived Standards
 - * Geometric tolerances; Selected Use; Specifications on Drawings; Applications of Geometric Tolerances
- 5. Materials-Metals
 - * Uses of common metals; Iron; Copper; Lead; Zinc; Aluminium; Nickel and Chromium; Tin
 - * Ferrous metals; Cast iron; Steel; Alloy steels
 - * Non-ferrous metals; Copper and Copper Alloys; Nickel and Chromium Alloys; Nickel-chromium Alloys; Aluminium and Aluminium Alloys; Magnesium and Magnesium Alloys; Titanium and Titanium Alloys; Zinc and Zinc Alloys
 - * Bearing materials; Friction and Wear; Properties of Bearing Materials; Selection of Bearing Material; Some

Common Bearing Materials

6. Materials-plastics
 - * Synthetic rubbers
 - * Applications of some common plastics
 - * Properties and uses of thermoplastics
 - * Properties and uses of thermosetting materials
 7. Heat treatment
 - * Metals; Structural Changes in Iron on Heating and Cooling; Ferrous Metals in use today
 - * Tool steels; Schedule of Tool Steel Composition
 - * Heat treatment of steels; Features Determining Successful Heat Treatment
 - * Heat treatment of tool steels; Heating of Austenitize; Quenching, to Harden; Tempering
 - * Constructional steels; Group 1 steels; Group 2 Steels
 - * The Heat treatment of Non-ferrous metals; The Hardening of Non-ferrous Alloys by Heat Treatment
 - * Useful books for reference
 - * Glossary of terms
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 - * Functions; Cooling; Lubricating; Chip Removing; Preventing Corrosion; Additional Properties
 - * Types; Alkaline Solutions; 'Soluble' Mineral Cutting Oils; Oilless Cutting Fluids; 'Straight' Cutting Oils
 - * Using cutting fluids; Flow and Temperature; Choosing a Cutting Fluid; Method of Supply; Application; Filtering, Sterilizing and Reclaiming; Care of Electrical Equipment
 9. Lubricants
 - * Types; Lubricating Oils; Greases
 - * Applying lubricants; Methods; Frequency of Application
 10. Cutting speed and feed rate
 - * Cutting speed; Cutting Speed and Tool Life; Factors Affecting Cutting Speed; Cutting Speed and r.p.m.
 - * Feed rate; Factors Affecting Feed Rate; Feed Rate Recommendations
 11. Cutting tools
 - * General principles; Orthogonal Cutting; Inclined Cutting
 - * Cutting tool angles: Normal rake; Inclination; Direction of Cutting; Approach Angle and Side Cutting-edge Angle; End Relief Angle; Nose Radius; Clearance Angles
 - * Guide to the selection of lathe tools
 - * Cemented carbide tools; manufacture; Classification; Selection of Insert; Tool Design and Type of Clamping; Operating Conditions and Tool Life; Tool Failures and Remedies
 - * Tools made from other materials; Cemented Oxide Tools; Diamond Tools; Comparing Tool Materials
 12. Benches and bench vices
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 - * Engineers' vices; Types; Location of the Bench Vice; Special jaws; Care and Use of the Vice
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 14. Screw threads
 - * Uses
 - * Screw thread terms
 - * Common V-thread forms; ISO metric; Whitworth; British Association; Unified; V-thread calculations; Screw Thread Table
 - * Square-thread forms; Acme-thread forms; Trapezoidal-thread forms; Buttress-thread forms; Worm-thread forms
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 - * Chisels and chipping; Common Types; Cutting Angles; Using a Chisel
 - * Spanners; Types
 - * Wrenches; Pipe wrenches
 - * Pliers; General purpose; Cutting; Circlip
 - * Tinsnips; Hacksaws; Keys; Screwdrivers; Hammers; Punches; Wheel or bearing pullers; Pop riveting tools;
- Clamps
16. Drills and reamers
 - * Drills; Types; Accessories; Nomenclature; Operation
 - * Reamers; Types; Nomenclature; Tolerances; Operation Of Reamers Sharpening; Storage
 17. Threading tools
 - * Taps and dies; Tap range; Sets of Taps; Nomenclature; Sharpening; Using a tap
 - * Screw extractors; Tap wrenches
 - * Dies; Adjustable Button Dies; Die Nuts; Using a Die
 18. Work-holding methods
 - * Holding workpieces on machines
 - * Clamping principles; Clamping Devices; Application of Force; Height of Packing; Position of Clamps;

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* Types of clamps and accessories; Clamps for Machining; Machine Vices; General Purpose Clamps

19. Marking and measuring tools

* Scribes; Using a Scriber

* Dividers; Hermaphrodite calipers; Trammels

* Surface gauges; Types; Setting; Using; Uses

* Punches; Parallel strips; V-blocks; Angle plates; Screw jacks; Steel rules

* Micrometers; Outside Micrometer Calipers; Inside Micrometer Calipers; Micrometer Depth Gauge; Screw-thread Micrometers; Care of a Micrometer

* Verniers; Principle of a Vernier; Vernier Calipers; Vernier Height Gauges

* Calipers; Taking a Measurement

* Straight edges

* Try squares; Testing a Try Square; Using a Try Square; Care of the Try Square

* Combination set; Toolmakers square

* Protractors; Vernier Protractors

* Box square and keyseat clamps

* Bevel gauges; Using a Bevel Gauge

* Depth gauges; Telescoping gauges; Small hole gauges; Screw pitch gauges; Centre gauges; Feeler gauges; Radius gauges; Toolmakers buttons; Centre finder and wiggler

* Indicators; Lever Indicators; Dial Indicators; Care of Indicators

20. Introduction to precision measurement

* Systems of measurement

* Errors in workshop measurement; Common Sources of Error

* Comparative measurement; Use of a Dial Gauge; Use of a Floating Carriage Micrometer

* The use of gauge blocks; Composition of Gauge Sets; How to Use Gauge Blocks; Accuracy; Accessories; Using an Optical Flat to Test Flatness of Gauge Blocks

* Use of length bars

* Use of balls, rollers and discs in precision measurement; Checking External Tapers; Checking Internal Tapers; Checking Small Internal Tapers; Checking Dovetail Slides; Checking Taper Angles

* Use of sine bars in precision movement; Construction; Principle and Application; Accuracy of Sine Bars; Sine Centres

* Use of spirit levels in precision measurement; Construction and Use; Reading a Level

* Use of clinometers in precision movement; Mechanical Clinometers; Optical Clinometers

* The digital readout system

21. Operational planning

* Planning machining operations; Importance of Planning; Information Needed; Planning Procedure

22. Principles of marking out work

* Purpose of marking out

* Types of line; Datum Lines; Centre Lines; Outlines

* Tools and equipment

* Marking-out procedure; Inspection Before Marking Out; Preparing the Work

* Permanent establishment of lines

23. Cut-off machines

* Power hacksaws; Reciprocating Hacksaw; Automatic Bar-Feed Reciprocating Hacksaw

* Horizontal band saw

* The abrasive cut-off saw

* The friction saw

* The cold circular saw; The Blade

24. The vertical handsaw

* Description; Machine Capacity

* Operating the band saw; Drive System; Job Selector; The Table; Installing the Blade

* Attachments

* Welding blades; Welding Operating; Annealing Operation

* Selection of blades; Pitch of Teeth; Blade Size

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* Types of drilling machine; Bench Drill; Pillar Drill; Radial Drill; Multi-spindle Drill

* Setting up and holding work; Using a Machine Vice; Clamped to the Machine Table; Clamped to an Angle Plate; Clamped on V-blocks

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* Units of a centre lathe; The Bed; The Headstock; The Tailstock; The Saddle or Carriage; Feeding Mechanism

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- * Parts of a capstan or turret lathe; The Mid-saddle; The Headstock; Stop Systems; Bar Feed Mechanism
 - * Work-holding methods; Bar Feed Work; Chuck Work
 - * Cutting methods; Single Cutting Operations; Multiple Cutting Operations; Combined Cutting Operations
 - * Cutting tools; Turret Tools; Mid-saddle Tools
 - * Setting an operations sequence
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- * Mounting and removing chuck, faceplate, driving plate and centre; Fitting the Chuck, Faceplate and Driving Plate; Remove the Chuck, Faceplate and Driving Plate
 - * Chuck work; Four-jaw Independent Chuck; Three-jaw Self-centering Chuck
 - * Faceplate work; Methods of Holding Work
 - * Turning between centres; General Description; Types of Lathe Centre; Centre Drilling; Aligning Lathe Centres; Setting the Workpiece Between Centres
 - * Setting the cutting tool; Overhang and Rigidity; Height of Cutting tool; Setting the Approach Angle
 - * Turning a stepped spindle; Turning the Diameters; Turning the Lengths
 - * Taper turning; Using a Form Tool; Using the Top-Slide; Using a Taper Turning Attachment; Taper Turning by Off-setting the Tailstock
 - * Form turning; Free-hand Form Turning; Form Turning with Tools
 - * Drilling in the lathe
 - * Threading with taps and dies; Using Taps with a Centre Hole; Tapping Using Small Taps; Threading with a Button Hole Die; Threading with Hand Dies
 - * Boring operations; Uses; Types of Tool; Shape of the Tool; Boring a Parallel Hole; Boring a Tapered Hole
 - * Reaming in the lathe; Work Preparation; Using a Machine Reamer; Using a Hand Reamer
 - * Knurling; Knurling Tools; Method of Use
 - * Parting off; Holding the Workpiece; Parting-off Tools; Procedure
 - * Work requiring steady rests; Fixed Steady Rest; Travelling Steady Rest; Problems with Unstable Work
 - * Work requiring use of mandrels; Mandrel use; Types
 - * Copy turning; Methods; The Hydraulic Attachment; Elements of Copy Turning; Masters; The Cutting Tool; Holding and Driving the Work; Setting Up; General Comments
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- * Preparing the blank
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 - * Grinding the screw-cutting tools; Tool Shape and Angles; Grinding the tool
 - * Setting the tool; Requirements; Procedure
 - * Registering the screwing tool; Tool Register
 - * Cutting external threads; Setting the Speed; Thread-cutting Methods; Cutting the Thread; Finishing Thread Ends
 - * Cutting internal threads; The Blank; Setting the Machine; Tool Sharpening and Setting; Cutting the Thread
 - * Multiple-start threads; Some Characteristics; Applications; Change Gear Calculations; Sharpening Tools; Setting Up the Tool; Indexing the Starts
 - * Worm gears
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 - * Parts of a vertical boring machine; The Bed; The Work Table or Chuck; The Cross-rail; The Toolhead; The Tool Blocks
 - * Use of vertical boring machines; Advantages; Machining Techniques; Types of Cutting Tool
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- * Construction and operation; Classification; Column-type Crank
 - * Methods of holding work; In the Vice; On the Table; In V-blocks; On Angle Plates
 - * Operating the machine; Setting the Stroke Length; Positioning the Stroke; Setting the Speed; Setting the Cut; Setting the Feed; Shaping the work
 - * Basic Shaping Operations; Square and Parallel Surfaces; Squaring the Ends; Shaping a Vertical Surface; Horizontal and Vertical Shaping; Shaping Angular Surfaces; Shaping a V-block; Shaping a Dovetail Slide
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- * Construction and operation; Classification ; General Purpose Slotting Machine
 - * Basic slotting operations; Holding the Workpiece; Slotting a Parallel Keyway; Slotting a Tapered Keyway; Cutting an Internal Slot; Slotting a Large Internal Cavity; Straight and Circular Slotting
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 - * Basic planing operations; Planing Horizontal Surfaces; Planing Vertical Surfaces; Planing Horizontal and Vertical Surfaces; Planing an Angular Surface
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- * Bed-type mills; Types of arbors and adaptors; Plain Arbor; Shell End Mill and Face Mill Arbor; Adaptors; Direct Mounting of Cutter to Spindle
 - * Types and uses of cutters; Types of Cutter
 - * Milling cutter design; Milled Type Teeth; Form-relieved-type teeth; Cemented Carbide Cutters; Inserted Tooth Cutters
 - * Methods of milling; Normal or Up-Cut; Climb or Down-Cut; Application to End Milling
 - * Mounting the cutter; Arbor-type Cutters; Shank-type Cutters
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 - * Method of holding work; On the Machine Table; In a Vice; In a V-block; In an Indexing Head
 - * Milling machine attachments; Vertical Attachment; Universal Attachment; Slotting Attachment; Other Attachments
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 - * Gearing systems; ISO metric 20 degrees Involute; British Standard 20 degrees Involute; American Standard 14 1/2 degrees Full Depth Involute; American Standard 20 degrees Full Depth Involute; American Standard 14 1/2 degrees Composite; American Standard 20 degrees Stub Tooth Involute; Summary of Gear Systems
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