ENGINEERING PRACTICE ILLUSTRATED

AN INDISPENSABLE REFERENCE BOOK FOR WORKSHOP, INSPECTION DEPARTMENTS, DRAWING OFFICE, STORES, ETC. ETC.

ALL MACHINE PARTS, TOOLS EQUIPMENT & INSTRUMENTS IDENTIFIED ON SIGHT WITH THE AID OF THIS INVALUABLE BOOK.
MARKING OUT

FIG. 1
Scriber and Straight Edge.

FIG. 2
Screw Jack.

FIG. 3
Centre Line on Inserted Block.

FIG. 4
Use of Packing Wedges for Marking Out Irregular Work.

FIG. 5
'Standard Rule for Scribing Block.'

FIG. 6
Use of Square for Marking Out.

FIG. 7
Trammels.

FIG. 8
Adaptor for Inner Circles Marking.

FIG. 1
Centre Punch.

FIG. 2
Dividers.

FIG. 3
Automatic Centre Punch.

FIG. 4
Centre Punching Contours.

FIG. 5
Correct and Incorrect Drilling to Centre Punches on Periphery.
MEASURING DEVICES

FIG. 1. HEIGHT GAUGE.

FIG. 2. VERNIER GEAR-TOOTH CALIPERS.

FIG. 3. INSIDE CALIPERS, SETTING TO RULE

FIG. 4. CHECKING WITH VERNIER.

FIG. 5. OUTSIDE CALIPERS.

FIG. 6. CALIPERS WITH GRADUATION.

FIG. 7. FINE ADJUSTMENT.

FIG. 8. FINE ADJUSTMENT.

FIG. 9. COMBINATION OF INSIDE AND OUTSIDE CALIPER WITH VERNIER RULE.

FIG. 10. PLUG GAUGE.

FIG. 11. RING GAUGE.

FIG. 12. TAPER GAUGES.

FIG. 13. SCREW THREAD PLUG-GAUGE, RIGHT END CORE DIAMETER GAUGE.
CHECKING INSTRUMENTS

FIG. 1
LEVEL WITH CONCENTRIC MARKINGS.

FIG. 2
HYDRAULIC LEVEL.

FIG. 3
APPLICATION OF LEVEL BOX ON ROUND OBJECTS.

FIG. 4
SET SQUARE.

FIG. 5
USE OF SQUARE AS STRAIGHT EDGE.

FIG. 6
USE OF SQUARE FROM FACE PLATE.

FIG. 7
TEST GAUGE 120°.

FIG. 8
BEVEL GAUGE.

FIG. 9
VERNIER PROTRACTOR.

FIG. 10
DOVE TAIL GAUGE.

FIG. 11
FORM GAUGE.

FIG. 12
FORM GAUGE.

FIG. 13
FORM GAUGE.

MEASURING DEVICES

FIG. 1
MICROMETER.

FIG. 2
SCREW THREAD MICROMETER.

FIG. 3
SPINDLE, SLEEVE AND THIMBLE.

FIG. 4
INSIDE MICROMETER.

FIG. 5
FIXED INSIDE GAUGE.

FIG. 6
WRONG POSITION OF MICROMETER.

FIG. 7
RIGHT POSITION OF MICROMETER.

FIG. 8
INSIDE MICROMETER FOR LARGE BORES.
MEASURING DEVICES

FIG. 1. TEST INDICATOR.

FIG. 2. INTERNAL MECHANISM.

FIG. 3. DIAL INDICATOR.

FIG. 4. TRUEING SHAFT.

FIG. 5. COMPARATOR DIAL GAUGE.

FIG. 6. INTERNAL MECHANISM.

FIG. 7. HYDRAULIC TEST INDICATOR.

CHECKING INSTRUMENTS

FIG. 1. SURFACE PLATE.

FIG. 2. Scribing Block.

FIG. 3. Scribing Block with Adjustment.

FIG. 4. Vernier Height Gauge.

FIG. 5. Odd Legs.

FIG. 6. Odd Legs, Marking Out Centre.
MEASURING DEVICES

FIG. 1. PLUG GAUGE 'GO'.

FIG. 2. PLUG GAUGE 'NO GO'.

FIG. 3. PARALLEL TEST.

FIG. 4. OFFICIAL TEST FOR FLATNESS PARALLEL MARKS - FLAT.

FIG. 5. LIMIT GAP-GAUGE 'GO'.

FIG. 6. LIMIT GAP-GAUGE 'NO GO'.

FIG. 7. CHECKING GAUGE WITH SLIPS.

FIG. 8. SCREW PITCH GAUGES.

FIG. 9. SETTING GAUGE FOR THREADING TOOL.

FIG. 10. WIRE GAUGE.

FIG. 11. FEELER GAUGES.

FIG. 12. DRILL GAUGE.

CHECKING INSTRUMENTS

FIG. 1. STRAIGHT EDGE.

FIG. 2. TRIANGULAR SURFACE GAUGE.

FIG. 3. PLUG GAUGE 'NO GO'.

FIG. 4. SURFACE PLATE.

FIG. 5. SURFACE PLATE.

FIG. 6. SPIRIT LEVEL WITH V-BASE.

FIG. 7. SPIRIT LEVEL BAR, 2 LEVELS AT RIGHT ANGLES, WITH V-BASE.

FIG. 8. SPIRIT LEVEL, CURVED.

FIG. 9. ADJUSTABLE LEVEL, USE OF WEDGE FOR ALIGNMENT.

FIG. 10. APPLICATION OF SPIRIT LEVEL BAR.

FIG. 11. APPLICATION OF SPIRIT LEVEL BAR.
PRECISION MEASURING INSTRUMENTS

FIG. 2. TAPE RULE.

FIG. 3. VERNIER CALLIPER GAUGE.

FIG. 4. INSIDE MEASUREMENT WITH VERNIER.

FIG. 5. INSIDE MEASUREMENT WITH VERNIER.

FIG. 6. VERNIER WITH FINGER ADJUSTMENT.

FIG. 7. USE OF POINTS TO MEASURE CENTRE DISTANCES.

FIG. 8. MEASURING BETWEEN BORES.

FIG. 9. VERNIER DEPTH GAUGE.

FIG. 10. USE OF VERNIER CALLIPER GAUGE AS DEPTH GAUGE.
PRECISION TOOLS

FIG. 1. VEE BLOCK.
FIG. 2. MARKING OUT WITH VEE BLOCK.
FIG. 3. CENTRE SQUARE.
FIG. 4. CENTRE SQUARE.
FIG. 5. MARKING OUT KEYWAYS.
FIG. 6. MARKING OUT KEYWAYS.
FIG. 7. KEYWAY TEMPLET.
FIG. 8. TEMPLATE FOR MARKING OUT FLANGE.
FIG. 9. MARKING TEMPLATE.

CLAMPING DEVICES

FIG. 1. STILSONS.
FIG. 2. PIPE GRIPS.
FIG. 3. PIPE GRIPS.
FIG. 4. TONGS.
FIG. 5. ROUND NOSE PLIERS, PIN VICE.
FIG. 6. FLAT NOSE PLIERS.
FIG. 7. HAND VICE INSIDE JAWS.
FIG. 8. HAND VICE POINTED JAWS.
FIG. 9. HAND VICE PARALLEL ACTION CLAMP.
FIG. 10. TOOLMAKER'S CLAMP.
FIG. 11. UNIVERSAL JAW "C" CLAMP.
FIG. 12. PARALLEL ACTION HAND VICE.
FIG. 13. FOLDING CLAMP, JAW PROTECTING CLAMP.
CLAMPING DEVICES

FIG. 1. MACHINE VICE.
1. REAR PART.
2. FRONT PART.
3. BOLT.
4. HANDLE.
5. SPINDLE.

FIG. 2. PARALLEL VICE.
1. BOLT.
2. HANDLE.
3. SPINDLE.

FIG. 3. SWIVEL VICE.
1. SWIVEL VICE FOR IRREGULAR WORK.
2. ADJUST JAWS.

FIG. 4. GRADUATED VICE WITH JOINT CLAMP JAW.
1. GRADUATED VICE.
2. JOINT CLAMP JAW.

FIG. 5. SWIVEL VICE WITH LEFT AND RIGHT HANDED CLAMPING SPINDLE.
1. SWIVEL VICE.
2. LEFT AND RIGHT HANDED CLAMPING SPINDLE.

FIG. 6. SWIVEL VICE END VIEW.
**PUNCH AND PRESS TOOLS**

- Fig. 1: Pin Punch
- Fig. 2: Hollow Punch
- Fig. 3: Blanking Tool
- Fig. 4: Strip Blanking Tool

**CHISELS AND SCRAPERS**

- Fig. 1: Cutting Action of Chisel
- Fig. 2: Angle (a) Too Small
- Fig. 3: Angle (a) Too Large
- Fig. 4: Flat Chisel
- Fig. 5: Cross Cut Chisel
- Fig. 6: Round Nosed Chisel
- Fig. 7: Scraper with Handle
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METAL CUTTING TOOLS

FIG. 1. TURNING TOOL FOR LATHE. 2) TOOL ANGLE. 3) CUTTING ANGLE. 4) CLEARANCE.
5) ROUGHING CUT-Screw CUTTING. 6) DEPTH OF CUT. 7) FINISHING CUT-Screw CUTTING.
8) ROUGHING TOOl-RIGHT HAND. 9) ROUGHING TOOL-LEFT HAND. 10) FINISHING TOOL.
11) RIGHT HAND. 12) FINISHING TOOL. 13) LEFT HAND. 14) FACING TOOL-LEFT HAND.
15) FACING TOOL-RIGHT HAND. 16) RADIUS TOOL. 17) PARTING TOOL. 18) BORING TOOL.
19) RECESSING TOOL. 20) HAND TOOL. 21) TIPPED TOOL-CORRECT GRINDING.
22) TIPPED TOOL-INCORRECT GRINDING. 23) TOOLHOLDER. 24) CIRCULAR FORM TOOL.
25) SINGLE POINT THREAD FORMER. 26) THREAD FORMER-TREBLE POINT.
27) USE OF THREAD FORMER.

FIG. 28. FLAT DRILL CUTTING BOTH WAYS. 29) FLAT DRILL HOLLOW GROUND.
30) FLAT DRILL WITH CENTRE. 31) FLAT DRILL WITH PILOT.
32) TWIST DRILL-HEEL. 33) TWIST DRILL-CUTTING EDGE. 34) TWIST DRILL-POINT.
35) TWIST DRILL-RELIEF. 36) STRAIGHT SHANK DRILL. 37) MORSE TAPER SHANK DRILL.
38) DRILL IN DRILL CHUCK. 39) MORSE SLEEVE.
40) CUTTING EDGES UNEQUAL. 41) CUTTING EDGES UNEQUAL-POINT OUT OF CENTRE.
42) POINT IRREGULARLY GROUND. 43) "D" BIT.
44) CENTRE DRILL. 45) BORING BAR.
METAL CUTTING TOOLS

FIG. 15
FIO. 23 AFTER BROACHING A KEYWAY. F IG .24- CUTTING ACTION.
FIG. 25 FLAT BROACH. FIG .26 RELIEVED TEETH.
FIG. 27 PROFILE BROACH. FIG. 28 BEFORE USE OF SQUARE BROACH.
FIG. 29 AFTER USE OF SQUARE BROACH.
FIG. 30 BROACHING MACHINE-SIDE ELEVATION.-
1. MACHINE HEAD. 2. CLAMP SCREW. 3. PACKING.
4. WORKPIECE. 5. BROACH. 6. PLUNGER. 7. CARRIER JAW.

FIG. 22 BEFORE BROACHING A KEYWAY.
FIG. 23 AFTER BROACHING A KEYWAY. FIG. 24 CUTTING ACTION.
FIG. 25 FLAT BROACH. FIG. 26 RELIEVED TEETH.
FIG. 27 PROFILE BROACH. FIG. 28 BEFORE USE OF SQUARE BROACH.
FIG. 29 AFTER USE OF SQUARE BROACH.
FIG. 30 BROACHING MACHINE-SIDE ELEVATION.-
1. WORKPIECE. 2. MACHINE HEAD. 3. BROACH.
4. COUPLING SLEEVE. 5. PLUNGER. 6. STOP RING.
7. CLAMP SCREW. 8. PIN FOR LOCKING.
SHEET METAL TOOLS

- ELECTRIC SOLDERING IRON (BIT)
- SOLDERING IRON OR SOLDERING BIT
- SOLDERING IRON BIT WITH SHAPED HEAD
- HALF MOON STAKE
- HATCHET STAKE
- GROOVING STAKE
- LONG HORSE HEAD
- COMBINED FUNNEL AND SIDE STAKE
- BEAK IRON OR HORN
- ROUND HEAD ANVIL (FLAT)

SHEET METAL TOOLS

- METAL CUTTING SHEARS OR "SNIPS"
- "GILBOW" SNIPS OR UNIVERSAL SNIPS
- BLOCK SHEARS
- ROUND FACE HAMMER
- CREASING IRON
- SQUARE HORSE HEAD
- ROUND HEAD ANVIL (CONVEX)

SOLDERING TOOLS

- SOLDERING IRON BIT
- SOFT SOLDERING IRON OR SOLDERING BIT
- METAL CUTTING SHEARS OR "SNIPS"
- "GILBOW" SNIPS OR UNIVERSAL SNIPS
- BLOCK SHEARS
- SAME AS SNIPS
- "SNIPS BLADES BENT SNIPS"
- METAL CUTTING SHEARS OR "SNIPS"
- "GILBOW" SNIPS OR UNIVERSAL SNIPS
- BLOCK SHEARS

RIVETING TOOLS

- 1 RIVETING SNAP
- 2 FULLERING TOOL
- 3 DOLLY (DOLLY BAR)
- ONE-SHOT RIVETING HAMMER
- SLOW HITTING RIVETING HAMMER
- FAST HITTING RIVETING HAMMER
- YOKE RIVETER
- COMPRESSION RIVETER
- CLOSE QUARTERS RIVETING HAMMER
FIG. 1. ANVIL.
1. FACE (HARDENED).
2. ROUND HORN.
3. SQUARE HORN.
4. HOLE FOR STAKE.

FIG. 2. ANVIL FOR SMALL WORK.

FIG. 3. HAND HAMMER.

FIG. 4. HEAVY HAMMER.

FIG. 5. HEAVY HAMMER.

FIG. 6. DRAWING DOWN.

FIG. 7. SETTING.

FIG. 8. BENDING ON ANVIL.

FIG. 9. SQUARING ON ANVIL.

FIG. 1. SETT HAMMER.

FIG. 3. SPLITTNG. HOT SETT.

FIG. 4. PUNCHING, DRIFT.

FIG. 5. PUNCHING.

FIG. 2. CUTTING OF STOCK.

FIG. 6. FORGING A HOOK.

FIG. 7. USE OF SWAGES.

a) DRAWING.
b) SETTING ONE END TOE.
c) SQUARING.
d) BENDING & STRAIGHTENING.
FORGING

FIG. 1.
FORGE WITH SIDE BLAST.
1. HEARTH.
2. AIR EXIT.
3. AIR LINE.
4. CAST IRON PLATE.
5. SHEET IRON HOOD.
6. QUENCHING TROUGH.
7. COAL CONTAINER.
8. CHIMNEY.

FIG. 2.
FORGE WITH UNDER BLAST.
1. AIR LINE.
2. BRANCH LINE.
3. WIND CHAMBER.
4. VALVE.
5. SLAG HOLE.

FIG. 3.
FORGE TONGS.
a. RING BIT.
b. FLAT BIT WITH GROOVES.
c. FLAT BIT WITH LIPS.
d. PLIERS OR PICK-UPS.
e. HOLLOW BIT.

FIG. 1. COAL FURNACE.
1. GRATE.
2. HEARTH.
3. FLUE.
4. FIRE BRIDGE.
5. WATER COOLING.
6. CHARGING DOOR.
7. FUEL DOOR.

FIG. 2. MUFFLE FURNACE.
1. MUFFLE.
2. FUEL DOOR.
3. GRATE.
4. PREHEATING AIR BLAST.
FORGING

FIG. 1
MECHANICAL HAMMER.
1. CAM WHEEL.
2. STAMP.
3. ANVIL.

FIG. 2
DROP HAMMER WITH FRICITION BELT.
1. REVOLVING DISC.
2. BELT.
3. HANDLE.
4. DROP STAMP.

FIG. 3
PNEUMATIC HAMMER
1. AIR CYLINDER.
2. CAM ROD.
3. STAMP.
4. DROP STAMP.

FIG. 4
PNEUMATIC HAMMER
1. AIR CYLINDER.
2. AIR CUSHION.
3. CRANK.
4. LOOSE AND FIXED PULLEY.
5. DROP HAMMER.

FIG. 5
SPRING HAMMER.
1. ADJUSTABLE ECCENTRIC.
2. TREADLE.
3. LEAF SPRINGS.
4. STAMP.
5. ADJUSTMENT OF STROKE.
6. SPRINGS.
7. LOOSE PULLEY.
8. FIXED PULLEY.

FIG. 6
HYDRAULIC FORGING PRESS.
1. BASE BLOCK.
2. PISTON.
3. CROSS BAR.
4. PRESSURE BLOCK.
5. ELEVATING CYLINDER.
6. VALVE.
7. RESERVOIR.
8. STEAM CYLINDER.
9. CONNECTING ROD.
10. HYDRAULIC CYLINDER.
CASTING EQUIPMENT

Fig. 1. Hand Metal Pourer.

Fig. 2. Fork Metal Pourer.

Fig. 3. Crane Metal Pourer Front Elevation.

Fig. 4. Crane Metal Pourer Side Elevation.

DIE CASTING

Fig. 1. Die Casting Mechanism.
1. Steel Mould - Right Half.
2. Steel Mould - Left Half.
3. Cooling Channels.
5. Melting Pot.
6. Connecting Channel.
7. Piston.
8. Pin.
10. Stop.
11. Ejector Plate.

Fig. 2. Aluminium Die Casting Mechanism.
1. Container.
2. Molted Lead.
3. Molted Aluminium.
4. Valve.

Fig. 3. Use of Air Pressure in Die Casting.
1. Container.
METAL CASTING

FIG. 1 HANDWHEEL.

FIG. 2 MOULD FOR HANDWHEEL.

FIG. 3 MOULD AFTER METAL IS Poured.

FIG. 4 ROPE WHEEL.

FIG. 5 IMPRINT IN TOP BOX.

FIG. 6 MOULDING WITH BOTH HALVES.
1. PATTERN, 2. TEMPORARY TOP BOX, 3. BASE BOX.

FIG. 7 FINISHED CASTING IN MOULD.

FIG. 8 PULLEY MOULDING

FIG. 9 MOULDING THE TOP HALF OF PULLEY.

FIG. 10 FORMING THE WEBS.

FIG. 11 COMPLETED MOULD AND CASTING.
1. BASE, 2. PIVOT, 3. COLLAR, 4. TEMPLATE BRACKET, 5. TEMPLATE, 6. BOAT, 7. WIRE HOOKS, 8. RIBS, 9. DISTANCE PIECES, 10. WEB SEGMENT, 11. HUB CORE.
CASTING & PATTERN SHOP DETAILS

FIG. 1. RELIEVED PLATE.

FIG. 2. SPLIT WHEEL.
1. RIM.
2. SPOKES.
3. HUB.
4. CLIP WITH LOAM.

FIG. 3. TAPERED CASTING.

FIG. 4. POINTED RAM.

FIG. 5. CASTING FOR T. FITTING.
1. HANDLES.
2. MOUNTING.
3. BOTTOM HALF.
4. TOP HALF.
5. BOLTS.

FIG. 6. FLAT BOTTOMED RAM.

FIG. 7. TROWEL.

FIG. 8. TWEEZERS.

FIG. 9. PATTERN.
1. PATTERN.
2. BASE.
3. BOTTOM PART.
4. TOP PART.
5. MOULD NECK.
6. VENT.
7. WEIGHTS.

FIG. 10. FINISHED CASTING WITH FLASH.
1. PATTERN HALF - BOTTOM.
2. BOTTOM HALF OF BOTTOM.
3. TOP HALF OF PATTERN.
4. TOP HALF OF BOTTOM.

FIG. 11. MOULD AFTER POURING.
1. FOUNDY FLOOR.
2. MOULD NECK.
3. RUNNERS.
LAPPING

FIG. 1.
LAPPING WITH HINGED HAND LAPPING TOOL.

FIG. 2.
LAPPING ON STEEL DISC WITH EMERY CLOTH.

FIG. 3.
SPLIT LAP TAPERED BACK.

FIG. 4.
LAPPING DISC.

FIG. 5.
LAPPING ON STEEL PLATE WITH ABRASIVE DISC.

FIG. 6.
DRESSING WITH DIAMOND.

MOUNTING & DRESSING
OF GRINDING WHEELS

FIG. 1.
SIMPLE MOUNTING WITH WASHERS

FIG. 2.
MOUNTING ON TAPER, LOCK NUT BUSH WITH PACKING.

FIG. 3.
MOUNTING OF A CUP WHEEL.

FIG. 4.
USE OF CORRUGATED DISC WHEEL DRESSER.

FIG. 5.
DRESSING WITH CARBORUNDUM WHEEL.

FIG. 7.
DRESSING FROM TAIL STOCK.

MAGNETIC CHUCK.
TYPES OF GRINDING WHEELS

- FIG. 1. PLAIN FLAT
- FIG. 2. STRAIGHT CUP
- FIG. 3. CHAMFERED CUP
- FIG. 4. DOUBLE FLARING CUP
- FIG. 5. DISC OR SAUCER WHEEL
- FIG. 6. DOUBLE CONICAL WHEEL
- FIG. 7. FLARING CUP WHEEL
- FIG. 8. SHAPE FOR GRINDING SPIRAL FLUTE MILLING CUTTERS
- FIG. 9. WHEEL FOR GRINDING FLUTE OF TWIST DRILLS
- FIG. 10. DISC WHEELS FOR GAUGE GRINDING

CUTTER GRINDING

- FIG. 1. RADIAL PRESSURE ONLY
- FIG. 2. LATERAL MOVEMENT OF TOOL
- FIG. 3. FLAT WHEEL FOR CUTTER GRINDING
- FIG. 4. CUP WHEEL FOR CUTTER GRINDING
- FIG. 5. FINGER BELOW CUTTER CENTRE LINE
- FIG. 6. FINGER ON CUTTER CENTRE LINE
- FIG. 7. DON'T USE HOLLOW SIDE OF WHEEL
- FIG. 8. USE BEVELED SIDE OF WHEEL
MILLING

FIG. 1 MILLING UP-CUT METHOD.
FIG. 2 MILLING DOWN-CUT METHOD.
FIG. 3 FINISHING.
FIG. 4 ROUGHING.

FIG. 5 REGRINDING MILLING CUTTER.
FIG. 6 REGRINDING RELEIVING CUTTER.
FIG. 7 GRINDING GAUGE.

FIG. 8 ROLLER MILL PARALLEL FLUTES.
FIG. 9 ROLLER MILL SPIRAL FLUTES.
FIG. 10 INTERLOCKED ROLLER MILL.

FIG. 11 ROLLER MILL WITH SWARF CUTTING NOTCHES.
FIG. 12 HIGH SPEED ROUGHING MILL.
FIG. 13 FACE CUTTER.

MILLING CUTTERS & HOBS

FIG. 14 SLOTTING CUTTER.
FIG. 15 SIDE AND FACE CUTTER.
FIG. 16 ANGLE MILLING CUTTER.

FIG. 17 CONVEX MILL.
FIG. 18 GEAR CUTTER.
FIG. 19 WORM HOB.

FIG. 20 END MILL.
FIG. 21 INSERTED TOOTH MILLING CUTTER.
FIG. 22 GANG MILLING.
SURFACE & CIRCULAR GRINDING

FIG. 1. HORIZONTAL GRINDING.
FIG. 2. VERTICAL GRINDING WITH CUP WHEEL.
FIG. 3. USE OF CLAMP PIECES FOR NON-MAGNETIC WORK.
FIG. 4. USE OF IRON BASE FOR NON-MAGNETIC WORK.
FIG. 5. WORK ON ROTARY TABLE.
FIG. 6. TRAVERSE MOTION OF WORK.
FIG. 7. TRAVERSE MOTION AND DOWNFEED OF GRINDING WHEEL.
FIG. 8. FORM GRINDING. DOWN FEED ONLY APPLIED.

CIRCULAR & INTERNAL GRINDING

FIG. 9. FORM GRINDING TAPER, NO TRAVERSE.
FIG. 10. GRINDING A LONG TAPER WITH TRAVERSE.
FIG. 11. GRINDING SHORT TAPER WITH TILTED WHEEL.
FIG. 12. SHORT END OF VENT TUBE TOWARDS WHEEL.
FIG. 13. LONG END OF VENT TUBE TOWARDS WHEEL.
FIG. 14. RECESSION FOR GRINDING AND FITTING WOOD KEYS TO KEYWAYS.
FIG. 15. INTERNAL GRINDING.
FIG. 16. INTERNAL GRINDING. WORK FIXED, WHEEL ROTATES AROUND INNER SURFACE OF WORK.
MILLING

FIG. 1. RESPECTIVE MOVEMENT OF CUTTER AND WORK.

FIG. 6. MILLING TROCHOID.

FIG. 7. MILLING KEYWAY WITH END MILL.

FIG. 8. MILLING KEYWAY WITH SLOTTING CUTTER.

FIG. 9. MILLING DIAPHRAGM SLOT.

FIG. 10. MILL SPURGEAR.

FIG. 1. CENTRE PUNCH.

FIG. 2. CENTRING WITH JENNY DIVIDERS.

FIG. 3. "CENTRE PUNCH. 60°"

FIG. 4. CENTRE DRILL.

FIG. 5. CORRECT CENTRE.

FIG. 6. TURNING ON MANDREL BETWEEN CENTRES.

FIG. 7. EXPANDING MANDREL.

FIG. 8. FIXED TYPE STEADY.
1. STEADY BASE.
2. CLAMP.
3. HINGED TOP-PLATE.
4. JAWS.
5. ADJUSTING SCREWS.

FIG. 9. TRAVELLING STEADY.
1. STEADY.
2. FIXING SCREWS.
3. JAW.
4. ADJUSTING SCREWS.

FIG. 10. FORM MILL FOR TWIST DRILLS.
TAILSTOCKS

FIG. 1
ISOMETRIC VIEW OF TAILSTOCK.

FIG. 2
SECTION THROUGH TAILSTOCK.
(a) THREADED SHAFT WITH NUT.
EJECT CENTRE ONLY THROUGH SCREWING BACK SLIDING MEMBER BY MEANS OF HANDWHEEL (55) AFTER RELEASING CLAMPING AT 56.

FIG. 3
FRONT VIEW-
SECTION.
(b) TAILSTOCK
(c) OFFSETTING.

FIG. 4
OFF-SETTING BACK CENTRE FOR TAPER TURNING.

BEFORE PARALLEL TURNING MAKE SURE 'O' MARKS COINCIDE ON TAILSTOCK.
50. TAILSTOCK CLAMPING LEVER.
51. ECCENTRIC BOLT.
52. CLAMPING PLATE.
53. SLIDING MEMBER.
54. LATHE CENTRE.
55. HANDWHEEL.
56. CLAMPING LEVER TO SLIDER.
57. OFFSET SCREW.

FIG. 1
CLAMPING OF WORK ON THE LATHE.

FIG. 2
SELF CENTRING 3-JAW CHUCK.
ALL THE JAWS ARE MOVING SIMULTANEOUSLY.

FIG. 3
FOUR JAW CHUCK WITH INDEPENDENT JAWS.
CLAMPING IRREGULAR WORK IN 4-JAW CHUCK.
THE JAWS ARE ADJUSTABLE SINGLY.

FIG. 4
TURNING BETWEEN CENTRES.
(a) WORK.
1 CARRIER.
2 CATCH PLATE.
3 DRIVING STUD.
FIG. 1. DRILLING MACHINE SIDE VIEW.

FIG. 2. DRILLING MACHINE FRONT VIEW.

FIG. 3. MULTISPEED PRECISION LATHE HEADSTOCK END.

FIG. 4. SECTION THROUGH NORTON GEAR BOX.

FIG. 5. INSIDE VIEW NORTON GEAR BOX.
GRINDING MACHINES

FIG. 1. UNIVERSAL GRINDING MACHINE.
1. FRAME.
2. TABLE.
3. WHEEL HEAD SLIDE.
4. WORK SPINDLE STOCK.
5. PULLEY FOR CENTRE WORK.
6. PULLEY FOR CHUCK WORK.
7. TAILSTOCK WITH SPRING-LOADED SLIDING SHAFT.
8. ADJUSTMENT OF SPRING TENSION.
9. LOCKING LEVER.
10. CLAMP FOR DRESSING DIAMOND.
11. SETSCREW TO TABLE FOR TAPER GRINDING.
12. WHEEL SPINDLE BEARINGS, SWIVELING ON BASE.
13. GRINDING WHEEL.
14. DRIVE PULLEY TO WHEEL.
15. WHEEL GUARD.
16. REVERSE STOPS.
17. CHANGE OVER LEVER.
18. STUD FOR TABLE SELFACT.
19. HANDWHEEL FOR TABLE TRAVERSE.
K1 TO R5 GEAR TRAIN.
20. RACK.
21. PULLEY FOR TABLE SELFACT.
22. TABLE AND WHEEL STOCK DRIVE.
23. REARVIEW.
24. INSIDE VIEW OF SELFACT MECHANISM.
25. DETAILS OF CHANGE OVER CONTROLS.
26. SHAFT.
27. COUPLING.
28 & 29. GEARWHEELS WITH CLUTCHES.
30. SPUR GEARWHEELS.
31. BEVEL GEAR, 30 CONNECTING ROD.
32. LEVER, 33. CONNECTING PIECE.
34. ROD, BLOCK.
35 & 36. CURVED LEVERS, SPRING.
37. HANDWHEEL TO GRINDING DISC SLIDE.
R1 & R2, GEARWHEELS, 5 WORM.
R3. WORM WHEEL, 2, 22. RACKS, 39. RATCHET WHEEL.
40. LEVER, 41. PAWL, 42. SETSCREWS.
43. SET JAW TO WHEEL FEED.
44. COOLANT TANK.
45. PULLEY FOR PUMP.
MACHINE TOOLS

FIG. 1
HORIZONTAL SURFACE GRINDER.
1. PILLAR. 2. OSCILLATING TABLE. 3. HEAD. 4. MOTOR
5. SWITCH. 6. TABLE TRAVERSE HANDWHEEL
7. TABLE SELF-ACT. B. SET CLAMPS FOR CHANGE OVER.
9. CROSS FEED HANDWHEEL. 10. CONTROL.
11. CROSSFEED ADJUSTMENT. 12. DOWNEED HANDWHEEL.
13. DUST GUARD. 14. ELECTRO-MAGNETIC CHUCK.
15. MAGNETIC CHUCK SWITCH.

FIG. 2
TREADLE LATHE.
1. HEADSTOCK. 2. HEADSTOCK SPINDLE. 3. PULLEY
4. FLYWHEEL. 5. TREADLE. 6. CRANKSHAFT.
7. ELECTRIC MOTOR. 8. TOOL REST. 9. SADDLE.
9a. CLAMPING HANDLES. 10. TAILSTOCK.
MACHINE TOOLS

FIG. 1.
LATHE HEADSTOCK.

1 HEADSTOCK.
2 HEADSTOCK SPINDLE.
3 STEPPED PULLEY.
4 CENTRE BOLT.

FIG. 2.
LATHE HEADSTOCK WITH ATTACHMENT FOR SPRING COLLETS.

1 HEADSTOCK.
2 HEADSTOCK SPINDLE.
3 CONE PULLEY.
11 DRAWBAR WITH HANDWHEEL. 16 STOP.
12 SPRING COLLET.

FIG. 3.
THREADING ADAPTOR WITH 7 PITCHES.

13 CONE BUSH.
14 THREADING SLEEVE.
15 THREADING ADAPTOR.

FIG. 4.
LATHE LEADSCREW DRIVE.

K) KNOB.
A) GEAR WHEEL ON HEADSTOCK SPINDLE.
20 CHANGE LEVER. 26 SWINGPLATE BOLT.
21 BOLT. 27 SWINGPLATE.
20, 23, 24, 25 CHANGE WHEELS.

FIG. 5.
SINGLE GEAR TRAIN.

FIG. 6.
DOUBLE GEAR TRAIN.
MACHINE TOOLS

**FIG. 1** CAPSTAN LATHE.
1. BAR STOCK.
2. COLLET.
3. COLLET LEVER.
4. GUIDE STAND.
5. CHUCK.
6. SET STOP.
7. TURRET.
8. STAR HANDLE.
9. CLAMP LEVER.
10. ADJUSTABLE SET RODS.
11. CROSS SLIDE.
12. TOOLSLIDE HANDWHEEL.
13. SPEED CHANGE-LEVER.

**FIG. 2** GAP LATHE.
1. STEPPED PULLEY.
2. HEADSTOCK SPINDLE BOX.
3. INTERNAL GEAR.
4. FACEPLATE.
5. SADDLE.
6. BASE PLATE.
7. SLOTTED DISC.
8. CHAIN.
9. ROLLERS.
10. PAWL.

**FIG. 3** VERTICAL BORING MACHINE WITH REVOLVING WORK TABLE.
1. PILLAR.
2. CRANK.
3. BEVEL GEARS.
4. SPINDLE.
5. CROSS ARM.
6. SLIDE.
7. SIDE ADJUSTMENT SPINDLE.
8. TOOLBAR.
9. VERTICAL ADJUSTMENT SPINDLE.
10. VERTICAL MOVEMENT LEVER.
11. TILTING CRANK.
12. DRIVE GEAR.
13. TURNTABLE GEAR.
MACHINE TOOLS

FIG. 1 CENTRE LATHE.
1. BED  2. HEADSTOCK.  3. TAILSTOCK.  4. HEADSTOCK SPINDLE.
5. SADDLE.  5a. SLIDE.  6. CHANGE GEARS.  7. LEAD SCREW.
8. RACK.  H. CENTRE HEIGHT.  L. CENTRE DISTANCE.

FIG. 2 LATHE HEADSTOCK DRIVE.
4. HEADSTOCK SPINDLE.  10. STEPPED PULLEY.  11. BACK GEAR.
12. LARGE BACKGEAR.  13. CATCH-PIN.  14. LARGE BACKGEAR.
15. SMALL BACKGEARS.  G. HOLLOW SHAFT.  A. SPLIT COLLAR.
16. LEVER.

FIG. 3 CATCH PIN SECTION OF LATHE HEADSTOCK.
10. STEPPED PULLEY.  12. GEAR.  13. CATCH-PIN.

FIG. 4 BACKGEAR SECTION OF LATHE.
E. ECCENTRIC LINING BUSHES.  G. HOLLOW SHAFTS.  14. LARGE GEAR.
16. LEVER.
LATHE SADDLES

(a) CIRCULAR SLOT TO TOOL TOP SLIDE.

FIG. 1
SADDLE WITH APRON

(b) CROSS SLIDE.

33. HANDWHEEL FOR SLIDING.
34. HANDWHEEL FOR FACING.
31. LEVER TO CLASP NUT.
32. LEVER FOR SELF ACT.
5. CROSS SLIDE.

FIG. 2
CLASP NUT ARRANGEMENT.

7. LEAD SCREW.
28. TOP HALF OF CLASP NUT.
29. BOTTOM HALF OF CLASP NUT.
31. LEVER TO CLASP NUT.

FIG. 3
INSIDE VIEW OF LATHE SADDLE. (a) SLIDING. (b) FACING.

30. APRON. 31. LEVER TO CLASP NUT.

(c) RACK
(d) LEAD SCREW

HANDWHEEL FOR QUICK SETTING OF SADDLE OVER R4, R5, 6 TO RACK.

LATHE PARTS

FIG. 1
TOP SLIDE AND TOOL HOLDER.
40. HOLE FOR CLAMP SCREW.
42. TOOL HOLDER.
43. TOOL CLAMPING SCREWS.
44. HANDWHEEL.

(b). FIRST TIGHTEN TOOL CLAMPING STUD THEN CLAMP TOOL WITH CLAMPING SCREWS.

FIG. 2
TOOL HOLDER WITH SET SCREW.

FIG. 3
OVERHANGING LATHE TOOL.

(a) "a" MUST NOT BE TOO LARGE.

FIG. 4
CORRECT, CUTTING EDGE ON CENTRE LINE (CENTRE HEIGHT).

FIG. 5
INCORRECT, CUTTING EDGE ABOVE CENTRE LINE OF WORK.

FIG. 6
INCORRECT, CUTTING EDGE BELOW CENTRE LINE OF WORK.
MACHINE TOOLS

**FIG. 1**

VERTICAL MILLING MACHINE.
1. TABLE. 2. HEADSPINDLE. 3. VERTICAL SLIDE.
4. HANDWHEEL FOR VERTICAL ADJUSTMENT.
5. HANDWHEEL FOR VERTICAL ADJUSTMENT.
6. PULLEY. 7. GEARBOX. 8. HEADSPINDLE DRIVE.
9. FEED GEARBOX. 10. REVERSE DRIVE.

**FIG. 2**

HEAVY DUTY MILLING MACHINE.
1. TABLE. 2. BED. 3. HANDWHEEL FOR TABLE - TRAVERSE.
4. COLUMN. 5. SPINDLEBOX. 6. HEADSPINDLE.
7. HANDWHEEL FOR SPINDLE STOCK CONTROL.
8. GEARWHEEL FOR HEADSPINDLE DRIVE.
9. STEPPED PULLEY. 10. STEPPED PULLEY. 11. END SUPPORT.

**FIG. 3**

VERTICAL SPINDLE SURFACE GRINDING MACHINE
1. PILLAR. 2. OSCILLATING TABLE. 3. HEAD
4. TABLE HANDWHEEL. 5. TABLE SELFACT LEVER.
6. REVERSE SETSCREWS. 7. DOWNFEED HANDWHEEL.
8. AUTOMATIC DOWNFEED LEVER.
9. CROSS FEED ADJUSTMENT.
10. CROSS FEED REVERSE
MACHINE TOOLS

FIG. 1.
PLANING MACHINE
1 BED.  2 TABLE.  3 PILLAR.  4 CROSS RAIL.  5 TOOLHEAD.
A) FORWARD STROKE.  B) BACKWARD STROKE.

FIG. 2.
DOUBLE PILLAR PLANER
4 CROSS RAIL.
5 TOOLHEAD HOLDER.
41 SWIVELLING TOOLHEAD.
50 SPINDLE.  51 HANDLE.
52 BEVEL GEARS.

FIG. 3.
SINGLE COLUMN MULTI-TOOLHEAD PLANER
1' BED.  2' TABLE.  3' COLUMN.
4' ARM.  5' TOOLHEADS.
6' TOOLHEAD.  7' WORKPIECE.
8' ADJUSTABLE STEADY.
FIG. 1. TABLE DRILLING MACHINE.
1. COLUMN. 2. BASEPLATE. 3. STEPPED PULLEY.
4. STEPPED PULLEY. 5. HAND-LEVER. 6. GEARBOX.
7. BEVELGEARS. 8. DRILLSPINDLE. 9. FEED HANDWHEEL.
10. AUTOMATIC FEED COUPLING. 11. STEPPED PULLEY.
12. STEPPED PULLEY. 13. AUTOMATIC RELEASE.
14. HANDLEVER. 15. TABLE ARM. 16. ELEVATING CRANK.
17. CLAMP. 18. DRILL TABLE.

FIG. 2. FRONT VIEW TABLE DRILLING MACHINE.

FIG. 3. PLAN VIEW OF TABLE.
1. COLUMN. 2. BASEPLATE. 3. STEPPED PULLEY.
4. STEPPED PULLEY. 5. HAND-LEVER. 6. GEARBOX.
7. BEVELGEARS. 8. DRILLSPINDLE. 9. FEED HANDWHEEL.
10. AUTOMATIC FEED COUPLING. 11. STEPPED PULLEY.
12. STEPPED PULLEY. 13. AUTOMATIC RELEASE.
14. HANDLEVER. 15. TABLE ARM. 16. ELEVATING CRANK.
17. CLAMP. 18. DRILL TABLE.

FIG. 4. UNIVERSAL MILLING MACHINE.
1. COLUMN. 2. SPINDLE DRIVE-BACKGEARS. 3. ARBOR.
4. SLIDE BEARING. 5. OVERARM. 6. PULLEY. 7. PULLEY. 8. FEEDBOX.
9. TELESCOPIC SHAFT. 10. REVERSE GEARS. 11. KNEE BRACKET.
12. TABLE. 13. CROSS-SLIDE HANDWHEEL.
14. VERTICAL ADJUSTMENT HANDWHEEL. 15. BEVEL GEARS.
16. TABLE ELEVATION SPINDLE.
MACHINE TOOLS

FIG. 1. RADIAL DRILLING MACHINE.

FIG. 2. DIAGRAMATIC SCHEME OF RADIAL DRILLER.

FIG. 3. SPINDLE DRIVE OF RADIAL DRILLER.

FIG. 4. MOTOR DRIVE OF RADIAL DRILLER.

FIG. 5. BORING MACHINE.

FIG. 6. HEAVY DUTY PRODUCTION BORER.

FIG. 7. BORING MACHINE FOR HEAVY FIXED WORK.

FIG. 5

DIAGRAMATIC SCHEME OF RADIAL DRILLER.

IT f i g.

B O R I N G M A C H I N E  F O R  H E A V Y F I X E D  W O R K.

RADIAL DRILLER.
1) LENGTH OF WORK. 2) WIDTH OF WORK.
3) CIRCULAR MOVEMENT OF DRILLING HEAD.
4) RADIAL MOVEMENT OF DRILLING HEAD.
5) HEAD SWIVELLING MOVEMENT.
6) 1 PILBAR. 2 BARREL. 3 PILLAR SLIDE.
7) ARM. 5 SADDLE. 6 DRILL SPINDLE.
8) POWER SHAFT. 9 GEAR BOX.
9) HORIZONTAL SHAFT.
10) VERTICAL SHAFT.
11) VERTICAL SHAFT.
12) HORIZONTAL SHAFT. 13) MOTOR.

FIG. 4

MOTOR DRIVE OF RADIAL DRILLER.

1) BORING BAR. 2 COLUMN. 3 DRIVE BOX.
4) GUIDE COLUMN. 5 SLIDE ARM. 6 TOOLBOX.
7) GEARBOX. 8 SHAFT. 9 SHAFT.
10) BEVEL GEAR. 11 BEVEL GEAR. 12 SPUR GEAR.
13) SPUR GEAR. 14 TRAVERSE SPINDLE.

FIG. 6

HEAVY DUTY PRODUCTION BORER.

1) LENGTH OF WORK.
2) DISTANCE OF BORING BAR BEARINGS.
3) WORKTABLE. 2 BORING BAR.
4) PACKING PIECES.
5) BORING MACHINE FOR HEAVY FIXEDWORK.
6) TOOL BOX. 2 STEPPED PULLEY.
7) BEVEL GEAR. 4 BEVEL GEAR.
8) WORM. 6 WORM WHEEL.
9) HOLLOW BORING BAR.
10) HEAD SCREW. 9 BACK GEAR.
11) BACK GEAR. 11 BACK GEAR.
12) BACK GEAR.
13) HANDWHEEL FOR SETTING CUT.
14) LENGTH OF WORK.
15) DISTANCE OF BORING BAR BEARINGS.
MILLING ARBORS & DIVIDING HEADS

FIG. 1. ARBOR.
1. ARBOR
2. SLEEVES
3. LOCK NUT
4. NEDGE
5. SPINDLE
6. DRAWBOLT
7. BUSH

FIG. 2. SECTION THROUGH SPINDLE.

FIG. 3. WRONG WAY TO TIGHTEN LOCK NUT TO MILLING CUTTER.

FIG. 4. RIGHT WAY TO TIGHTEN LOCK NUT TO MILLING CUTTER.

FIG. 5. TRUEING CUTTER
MARK HIGH SPOT WITH PIECE OF CHALK AND TRUE CUTTER BY INSERTING PAPER SHIMMING AT #1.

KEY TO FIGS. NO.
1. HEAD SPINDLE
2. WORM WHEEL
3. WORM
4. DIVIDING CRANK
5. INDEX PLATE

FIG. 6. DIVIDING HEAD.
6. 7. & 8.
6. SETTING INDICATOR
7. BEVEL GEARS
8. SPUR GEARS
9. HOUSING
10. DRIVE

FIG. 7. SIDE ELEVATION AND SECTION OF DIVIDING HEAD.

FIG. 8. INDEX PLUNGER.
SPANNERS AND SCREW-DRIVERS

- SOCKET SPANNER WITH CROSS HANDLE
- CHAIN WRENCH OR PIPE TONGS
- HOOK SPANNER
- SOCKET OR SET SPANNER
- CRESCENT TYPE SPANNER
- SCREWDRIVER WITH REVERSIBLE ENDS
- GAS-PIPE HOOK
- SCREWDRIVER
- RATCHET SCREWDRIVER
- DOUBLE ENDED BOX SPANNER

SPANNERS

- SINGLE-ENDED SPANNER
- DOUBLE ENDED SPANNER
- MONKEY WRENCH
- BENT BOX SPANNER
- BOX SPANNER
- SPARKING PLUG BOX SPANNER
- TOMMY BAR
VARIOUS TOOLS

JOINER'S TOOLS

HAND COLD CHISEL (FLAT CHISEL)
CROSS CUT CHISEL
ROUND NOSE CHISEL
DIAMOND POINTED CHISEL
TAPER PUNCH
PARALLEL PUNCH
HOLLOW PUNCH
THREE-CORNER SCRAPER
FLAT SCRAPER
BENT HALF ROUND SCRAPER
HACKSAW
METAL PIERCING SAW
WASHER CUTTER
HOLLOW PLANE
GROOVING PLANE
TONGUING PLANE
TOOTHING PLANE

JOINER'S TOOLS

FIRMER CHISEL
BEVELED-EDGE CHISEL
FIRMER GOUGE
TURNING CHISEL
PARING GOUGE
TURNING GOUGE
RABBET PLANE
EXPANDING BIT
CENTRE BIT
FORSTNER BIT

MORTICE CHISEL
SOCKET CHISEL
PARING GOUGE
TURNING GOUGE
RABBET PLANE
EXPANDING BIT
CENTRE BIT
FORSTNER BIT

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