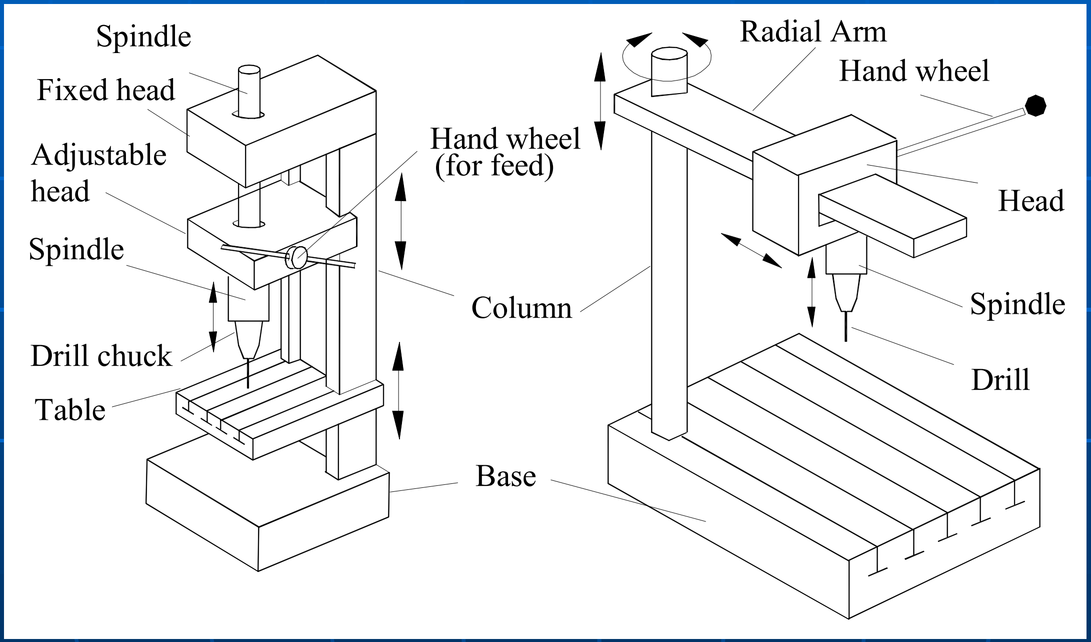
DRILLING AND ALLIED OPERATIONS

INTRODUCTION

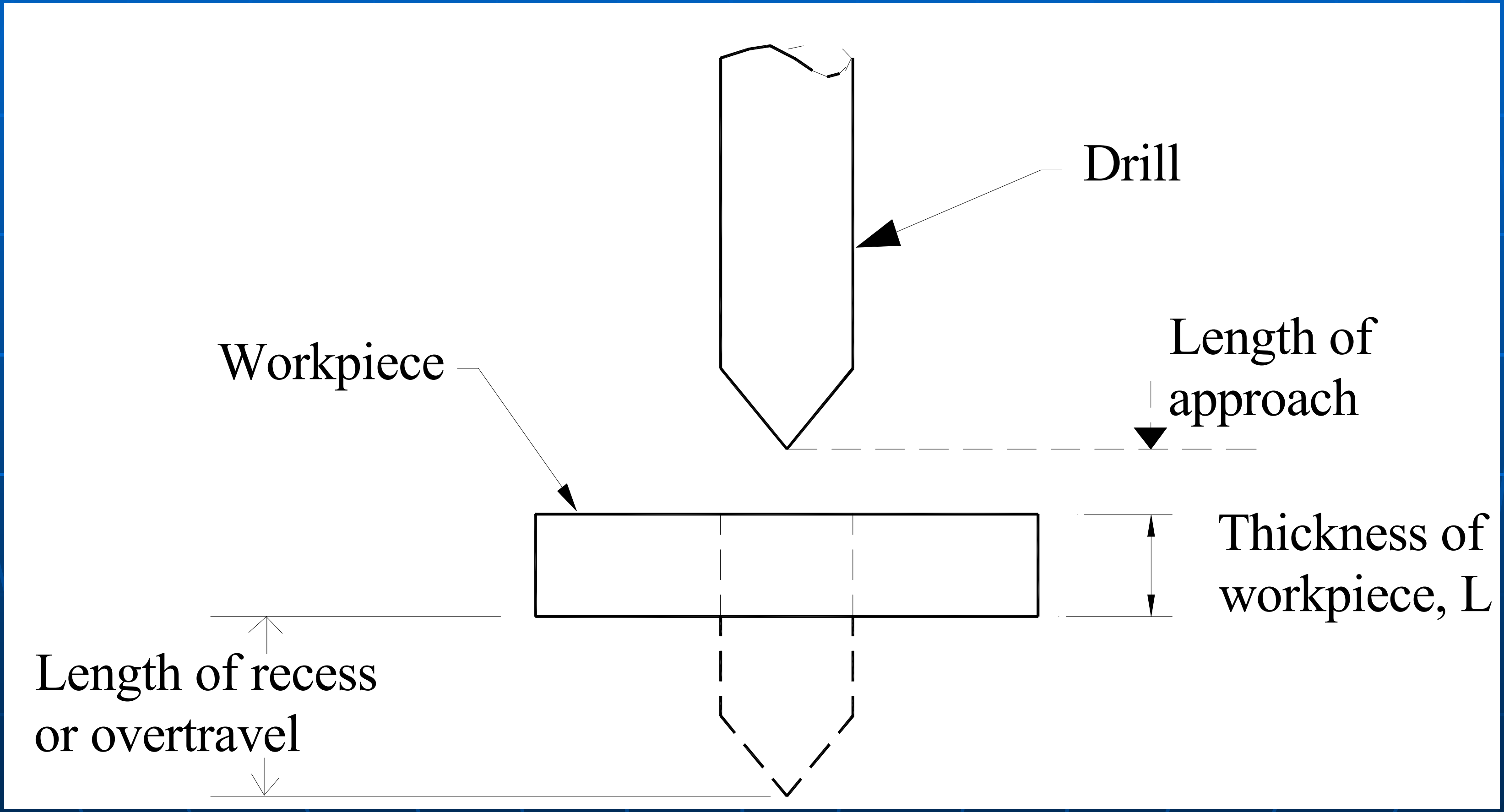
DONE WHEN PARTS ARE REQUIRED TO BE ***FASTENED MECHANICALLY***

USUALLY DONE ON *DRILLING MACHINE* USING DRILL TOOL

DRILLING MACHINE



DRILLING OPERATION



DRILLING OPERATION

- PURPOSE OF LENGTH OF APPROACH AND OVERTRAVEL

- BLIND HOLES DOES NOT REQUIRE OVERTRAVEL

CONDITIONS ON DRILLING MACHINE

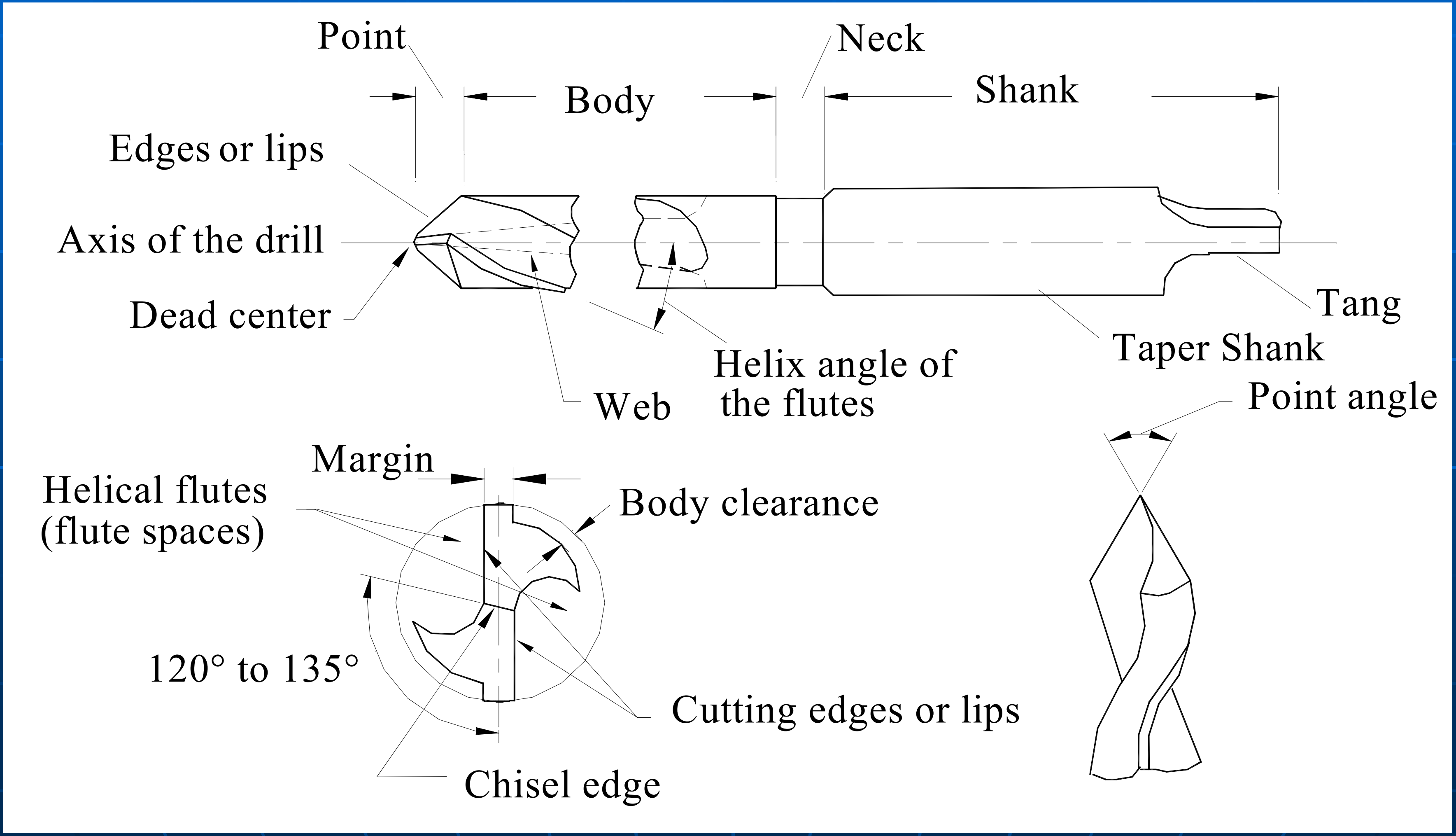
SPEED V = (π D N) / 1000 m/min

Where D is in mm, N is in rev/min.

FEED expressed as mm/rev.

DEPTH OF CUT = (Drill diameter)/ 2 mm

DRILL TOOL

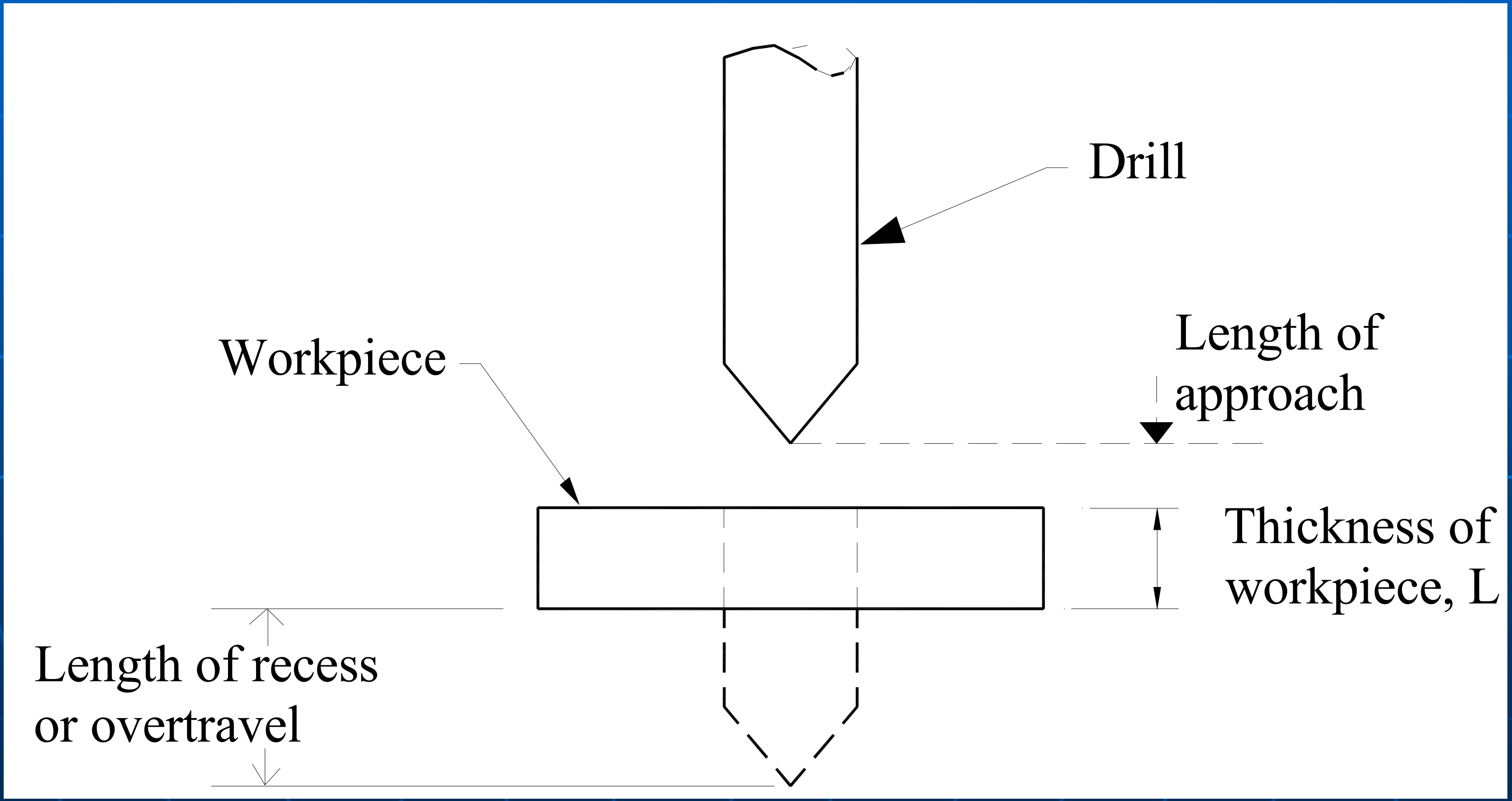


Point
Neck
Body
Shank
Edges or lips
Axis of the drill
Dead center
Tang
Taper Shank
Helix angle of the flutes
Web
Point angle
Margin
Helical flutes (flute spaces)
Body clearance
120° to 135°
Cutting edges or lips
Chisel edge

MRR IN DRILLING OPERATION

- MRR = $(\pi D^2 / 4) f N$ mm^3/min

MACHINING TIME



MACHINING TIME

- MACHINING TIME IS GIVEN BY

$$t = L / fN \quad \text{min}$$

Where L is in mm

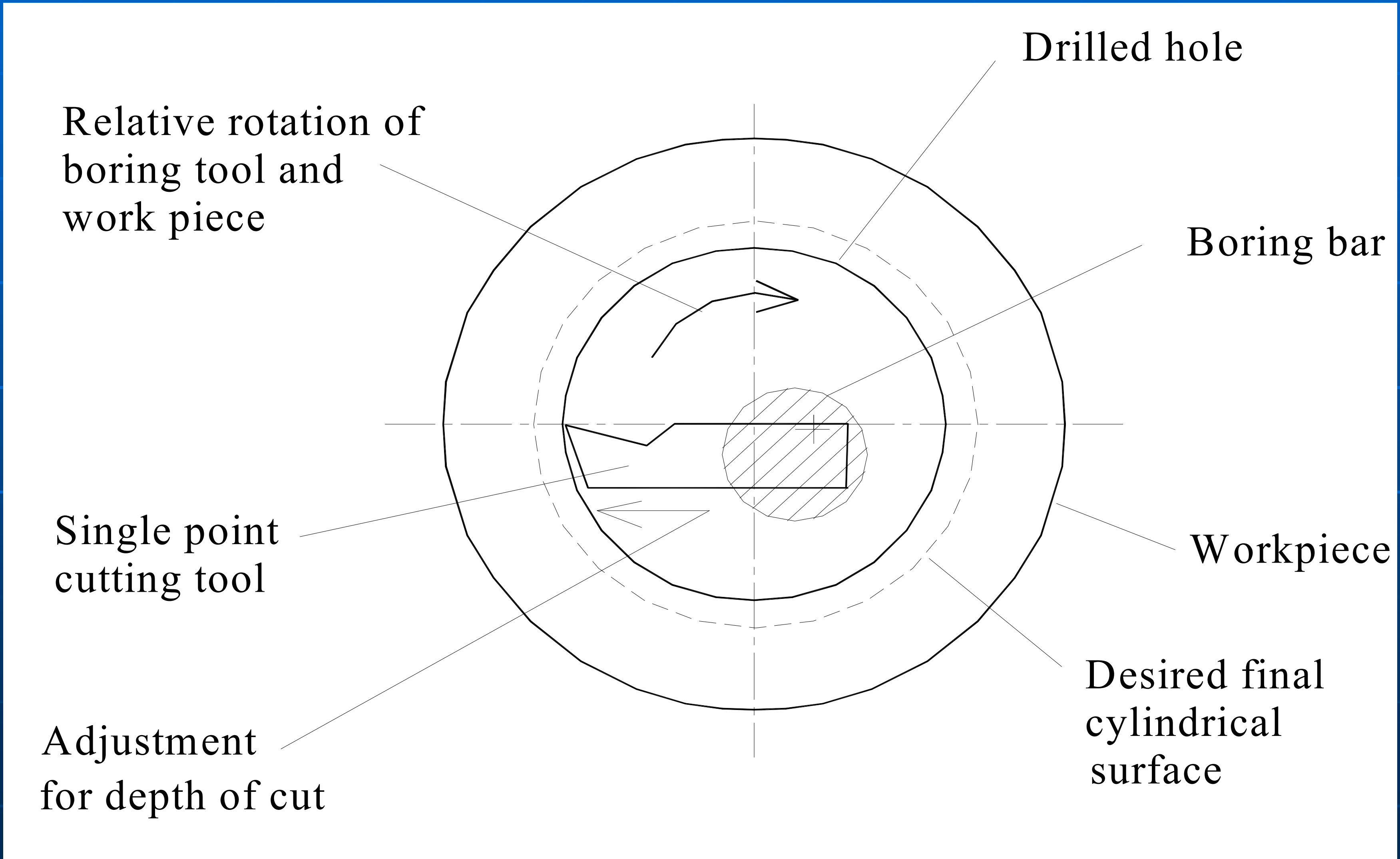
f is in mm/rev

N is in rpm

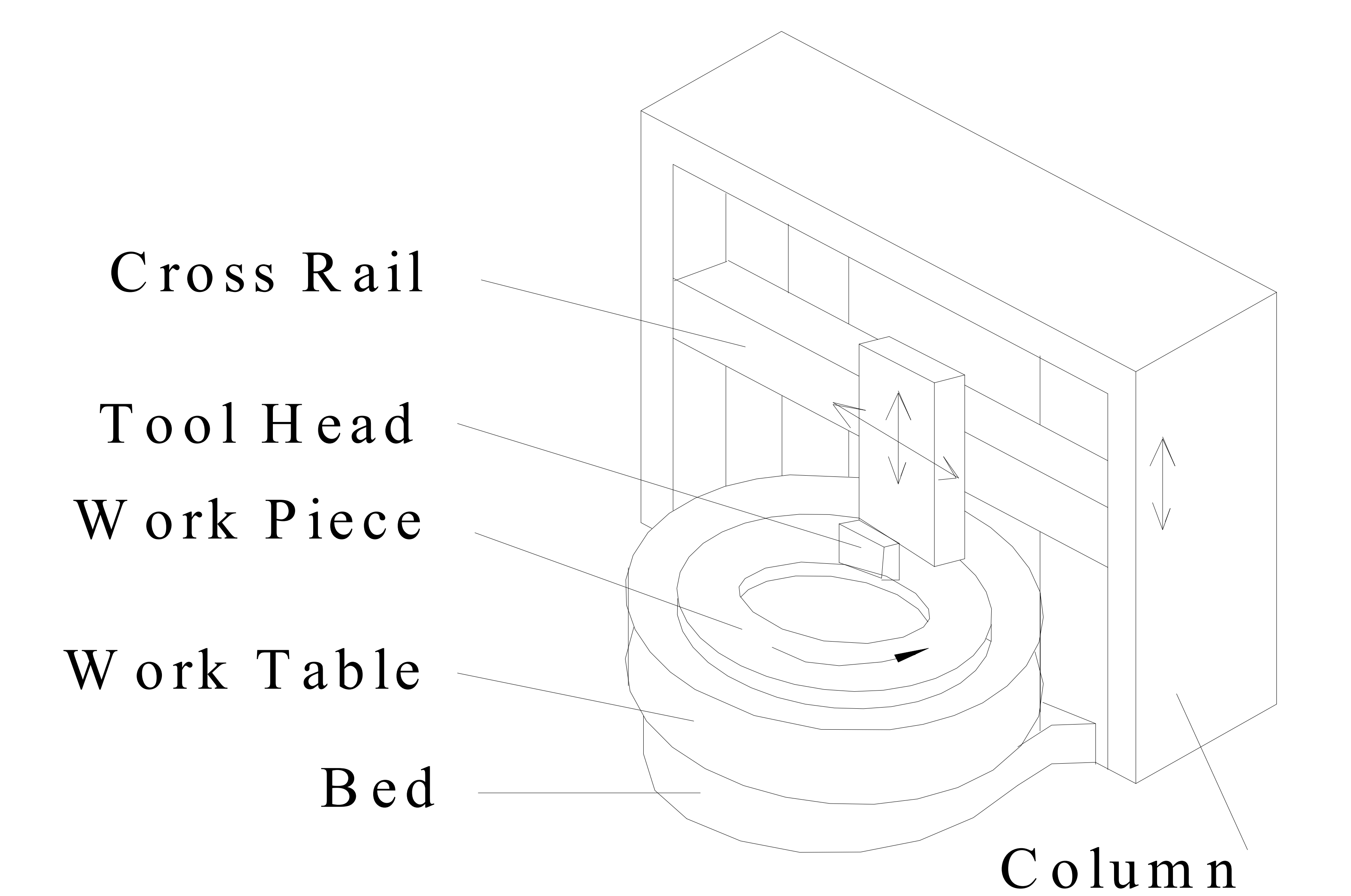
BORING

- To ***ensure correct location*** of a hole by making it concentric with the axis of rotation
- To ***increase diameters*** of holes
- To ***enlarge*** previously drilled hole
- To make holes of sizes for which drill tool is not available say 22.75 mm

BORING OPERATION



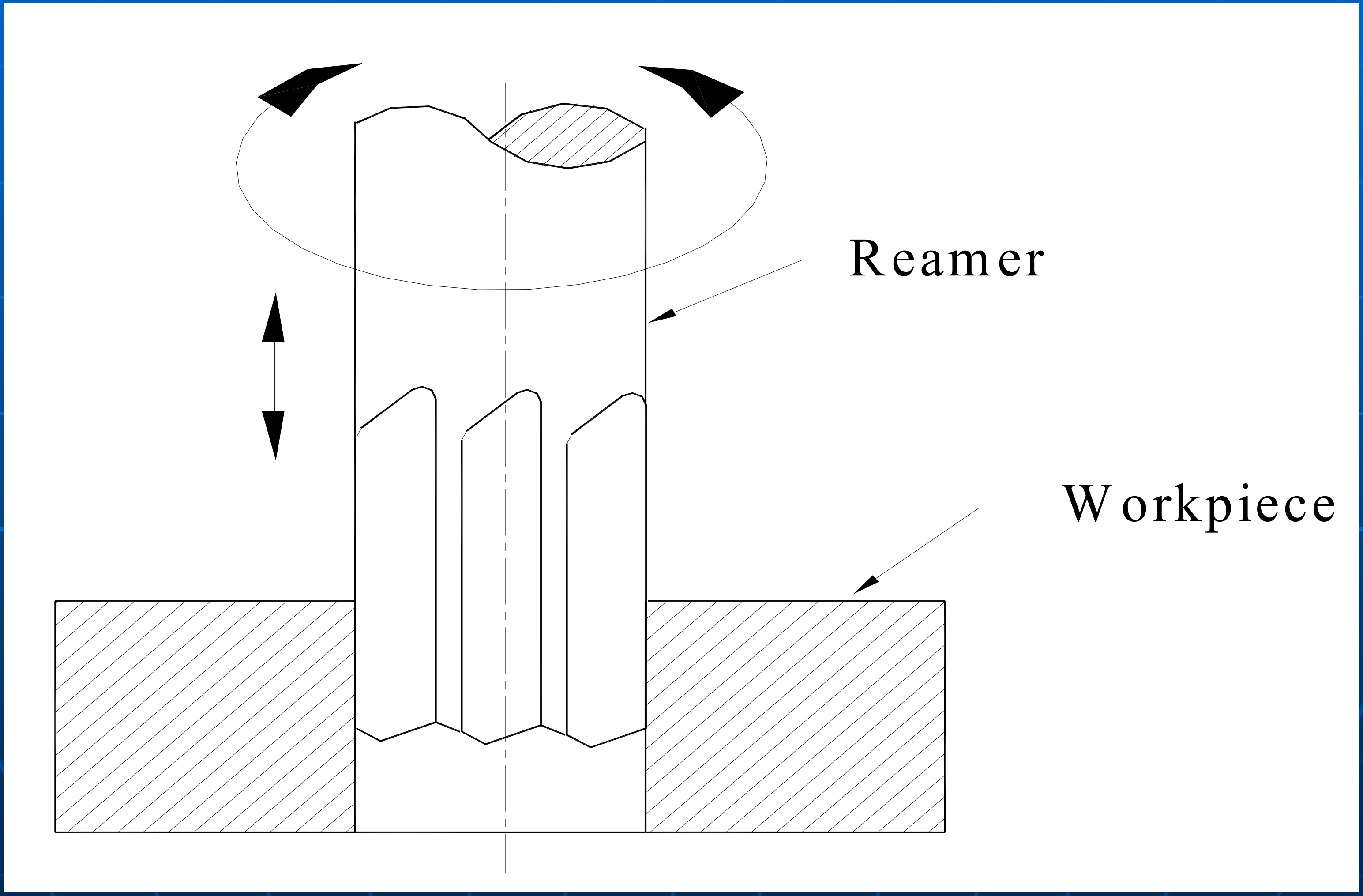
BORING OPERATION



REAMING

- CARRIED OUT TO MAKE THE HOLE ***DIMENSIONALLY MORE ACCURATE***
- TO IMPROVE ***SURFACE FINISH***
- CARRIED OUT USING A ***REAMER***

REAMING PROCESS



- To produce more accurate holes, the sequence of operations will be

  CENTERING

  DRILLING

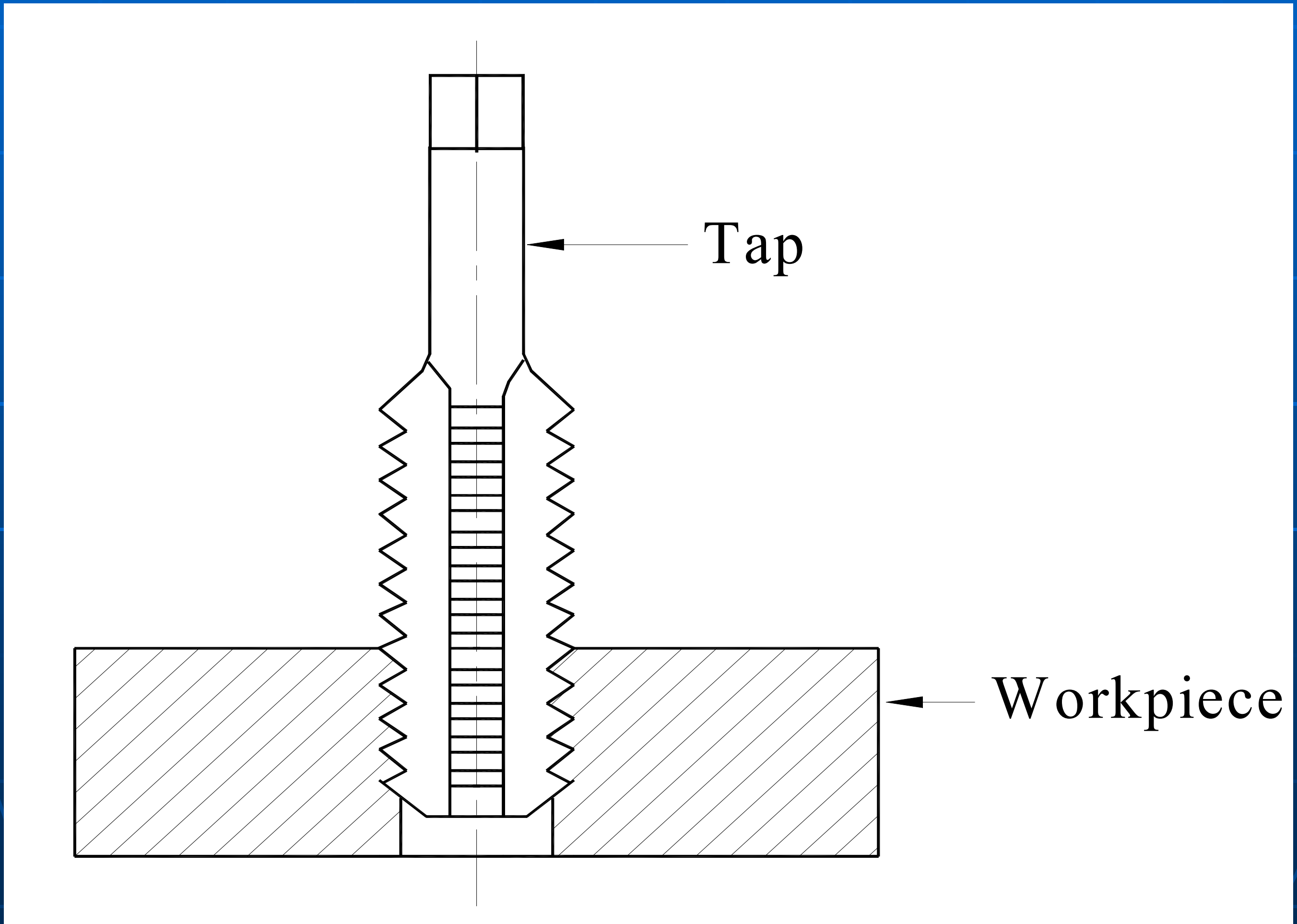
  BORING

  REAMING

TAPPING

- IT IS THE OPERATION OF CUTTING ***INTERNAL THREADS***
- CARRIED OUT USING ***TAP TOOL***

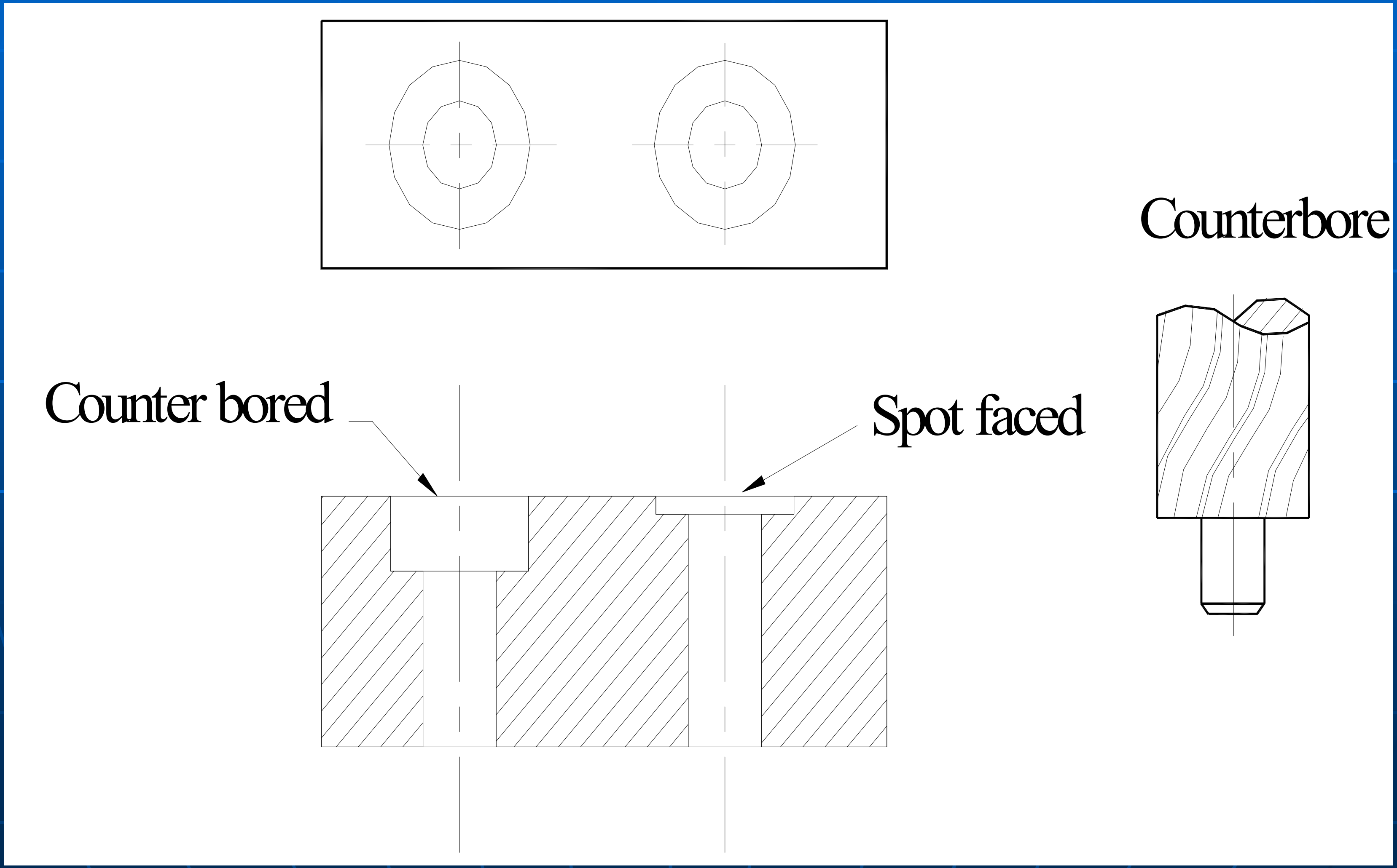
TAPPING PROCESS



TAPPING PROCESS

- IT IS A FORMING PROCESS
- EMPLOYS LOW OPERATING CONDITIONS
- ABUNDANT COOLANT IS USED
- CARRIED OUT ON DRILLING OR TAPPING MACHINES

COUNTERBORING AND SPOT FACING



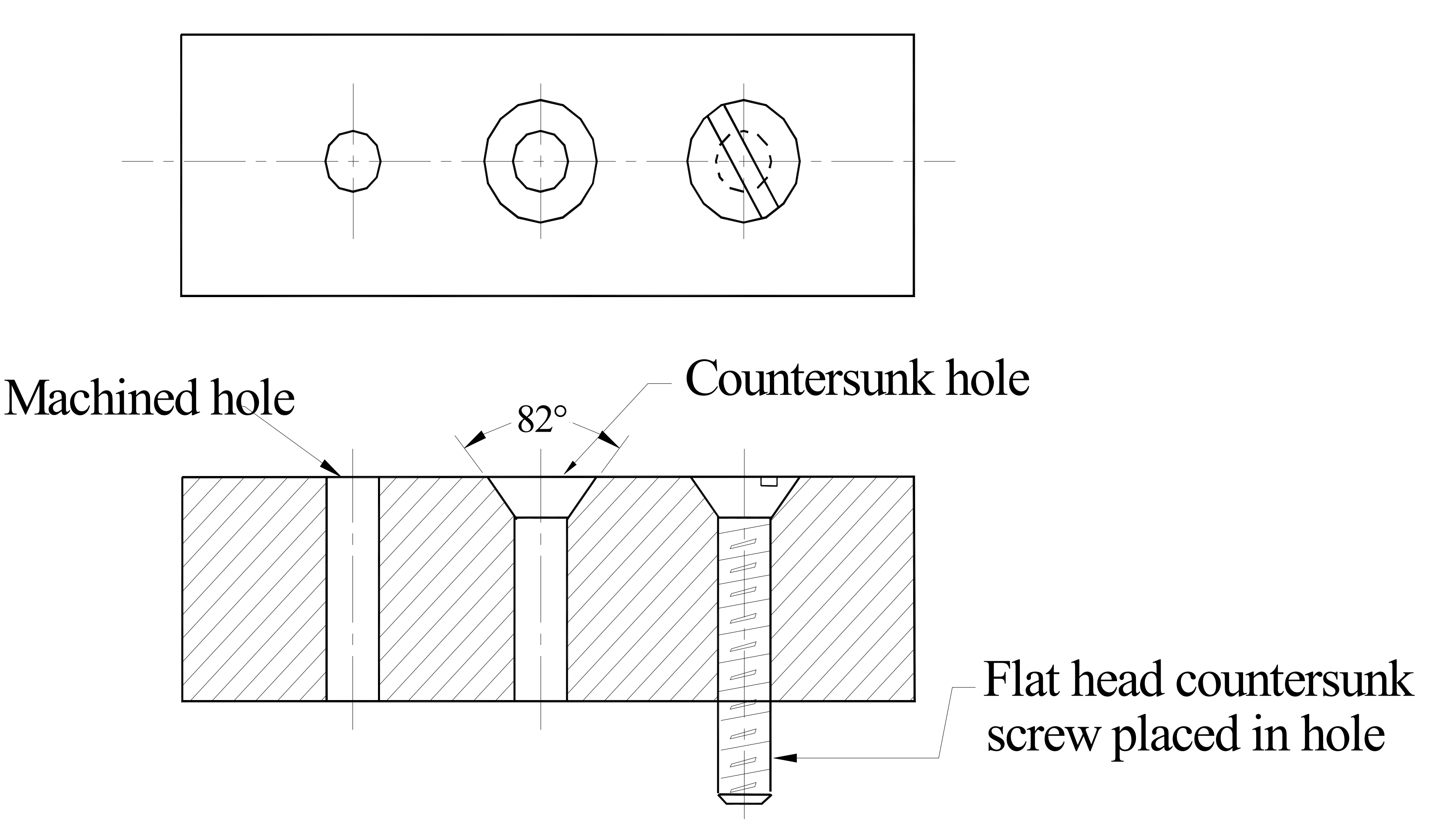
COUNTERBORING AND SPOT FACING

- ***COUNTERBORING*** IS DONE TO PROVIDE RECESS FOR BOLT HEADS OR NUTS

- ***SPOT FACING*** IS DONE TO PROVIDE SEATING FOR WASHER

- BOTH OPERATIONS CAN BE DONE BY THE SAME TOOL

COUNTERSINKING



COUNTERSINKING

- CARRIED TO PROVIDE SEATING FOR HEAD OF SCREW, USING COUNTERSINK TOOL

EXAMPLES

- ***Example 6.1*** A hole is being drilled in block of magnesium alloy with a 10 mm drill at a feed of 0.2 mm/rev. The spindle is running at 800 rpm. Calculate the MRR.
- ***Solution*:** Given data: D = 10 mm, f = 0.2 mm/rev, N = 800 rpm
- Substituting the values in Equation (2), we get

MRR = (π10^2/4)(.2)(800)

= 12,570 mm^3/min

EXAMPLES

- ***Example 6.2*** Calculate the time required to drill a 25 mm diameter hole in a workpiece having thickness of 60 mm to the complete depth. The cutting speed is 14 m/min. and feed is 0.3 mm/rev. Assume length of approach and over travel as 5 mm.

- ***Solution*:** Given data: D = 20 mm, Lj = 60 mm, v = 14 m/min, f = 0.3 mm/ rev. with usual notations.

- Substituting the data in the Equation (1), we calculate the drill rotational speed, that is
- or N = 178 rpm.

- Length of tool travel = Lj + Length of approach and over travel.
- = 60 + 5
- = 65 mm

- Substituting the values of f, L and N in Equation (3), we get
- $t = 65 / (0.3 \times 178)$
- = 1.21 minute.

EXAMPLES

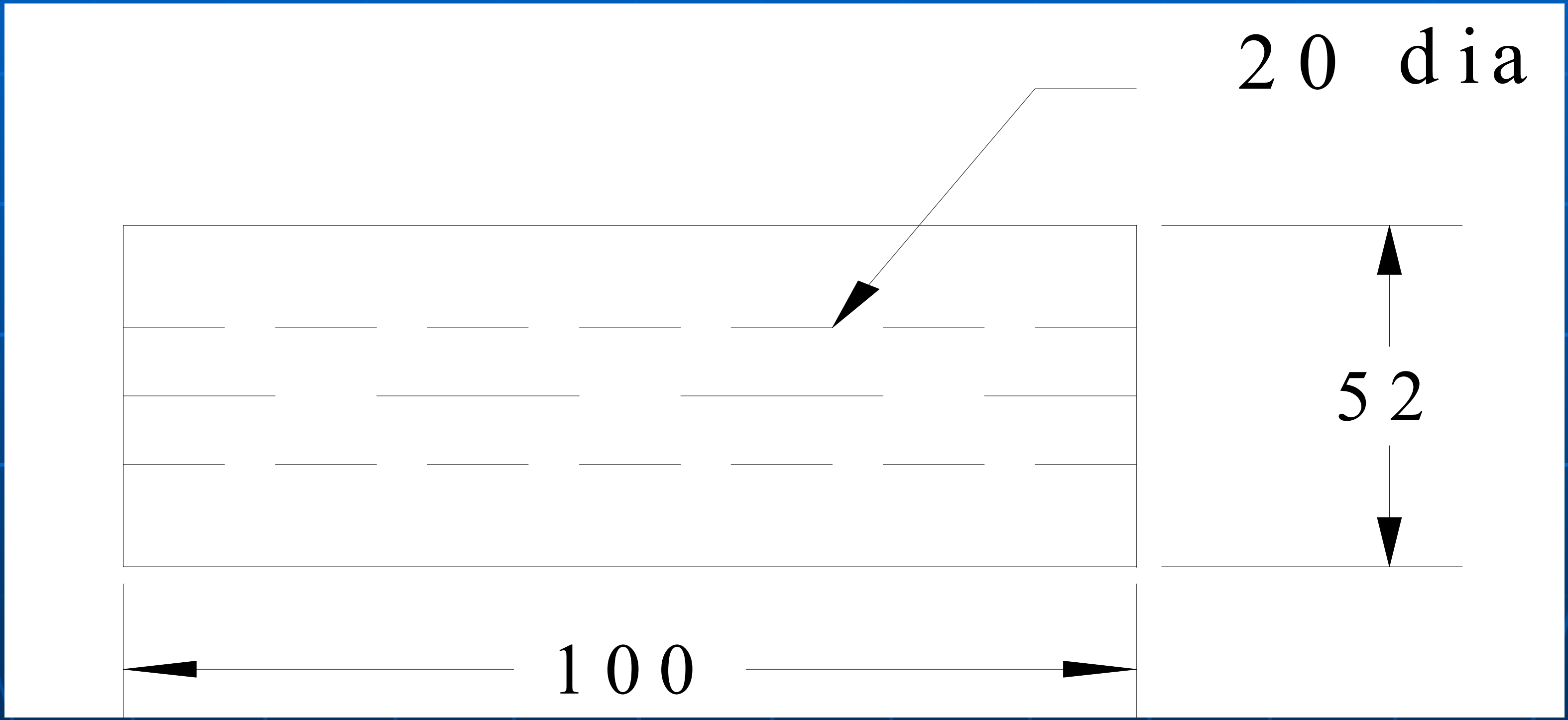
- ***Example 6.3*** A job shown in Figure (all dimension in mm) is to be produced from a raw material having 110 mm length and 60 mm diameter.

For turning and facing operations, rpm is 250 and for drilling rpm of the cutter are 200. Drilling operation is carried out on a drilling machine. Assume 2 passes for turning operation and 5 passes for facing operation. Assume feed of 0.5 mm/rev. for all operations. For drilling assume approach and over travel distance as 20 mm. Calculate

- Total time required to manufacture 1000 components.

- If the firm operates 8 hour a day and 300 days in a year, how many components can be produced in one year? Assume setup time per component as 25% of processing time.

EXAMPLES



EXAMPLES

- ***Solution***: For determining processing time for components requiring more than one operation, always first determine the best possible sequence for manufacturing the component. To manufacture component shown in Figure 6.9, which requires three operations – facing, drilling and turning – any of the following sequences can be used
- (a) Facing (b) Turning (c) Drilling
- (a) Turning (b) Facing (c) Drilling
- (a) Drilling (b) Turning (c) Facing
- (a) Drilling (b) Facing (c) Turning
- The total time required to manufacture the component would be the sum of all individual operations.
- Now, let us consider the first sequence, i.e. facing, turning and drilling and compute the time required to complete the job.

EXAMPLES

- Time for Facing:
- Length of tool travel = 60/2 = 30 mm.
- Tfacing = [L/(f×N)]×Number of passes
- = [30/(0.5×250)]×5
- = 1.2 minutes

- Time for Turning:
- after facing, the length of the job = 100 mm
- Tturning = [L/(f×N)]×Number of passes
- = [100/(0.5×250)]×2
- = 1.6 minutes

EXAMPLES

- Time for Drilling:
- Length of tool travel = Length of hole + Length of clearance
- = 100 + 20
- = 120 mm
- Tdrilling = $L/(f \times N)$
- = $120/(0.5 \times 200)$
- = 1.2 minutes

- Total time:
- Total processing time/component = Tfacing + Tturning + Tdrilling
- = 1.2 + 1.6 + 1.2
- = 4 minutes.

EXAMPLES

- Manufacturing time:
- Manufacturing time/component = Processing time + setup time
- $= 4 + 0.25 \times 4$
- $= 5$ minutes
- Total time for producing 1000 components (T):
- $T = 5 \times 1000 = 5000$ minutes
- Number of components
- that can be produced in one year:
- The company works 8 hr/day and 300 days in a year.
- Total working time $= 8 \times 300 = 2400$ hrs.
- Number of components produced in this period $= 2400 \times 60/5$
- $= 28000$ pieces

EXAMPLES

- <u>Alternate sequence of operations:</u>
- If the component is manufactured by the process sequence – drilling, turning and facing.
- Using the above procedure, we get
- Tdrilling = 130 / (0.5×200) = 1.3 minutes
- Tturning = [110 / (0.5×250)]×2 = 1.76 minutes
- Since, drilling and turning operations are already done on workpiece, length of tool travel for facing would be
- l = (52-20) / 2 = 16 mm

  Tfacing = [16 / (0.5×250)]×5 = 0.64 minutes
- Ttotal = 1.3 + 1.76 + 0.64
- = 3.7 minutes

EXAMPLES

- Manufacturing time = $3.7 + 0.25 \times 3.7$
- $= 4.625$ minutes
- Total time for producing 1000 components = 4625 minutes

- Number of components that can produced in one year = $2400 \times 60 / 3.7$
- = 38,912 pieces

- From this you can notice that different operations sequence will give different processing times. An optimal sequence is one, which gives lowest price.