ASSEMBLY FIXTURES
Simple Fixtures
Features

• Used in single or small lot production.
• These are universal fixtures.
• Usually they have machined locating surfaces and holes to receive fastening bolts.
• Ex. Vices, v blocks, angles, lifting jacks, match plates,
• Special fixtures are used in quantity production for special assembly operations and can be static or mobile.
Static fixture
• They do not have to meet the requirement of accurate work location the work being clamped with a force sufficient to prevent it from displacement by the action of the forces and moments arising due to assembling operation.

• They may or may not turn about an axis.
**Unitary Fixture**

- They are used to clamp one assembly at a time.

**Multiple Fixture**

- More than one assemblies can be done at a time on the same fixture.
WORK HOLDERS

• Here the assembly doesn't need the operator to check and align mating parts due to automatic accurate positioning.

• They increase productivity and are mostly automatic.

• They are used in welding and soldering, riveting gluing and other assembly joints.
Mobile fixtures

• The mobile fixtures are used in long run production in commercial quantities of small and medium sized products under a progressive industrial setup.
INDEXING FIXTURE

A fixture that changes position with regular step like movements.

In indexing fixture following factors are considered

1) The work piece should be positively located and clamped on the fixture independently of the indexing mechanism

2) The indexing device should be both rapid in action and positive in location

3) Care should be taken to prevent swarf affecting the accuracy or functioning of the indexing device
Construction & Working

The body of fixture, which is cast iron, is bored out to take two flanged bushes. Both of these bushes and the mating shaft are made from steel, and are hardened and ground.

The outside end faces of the bushes are ground and the flange on the shaft is adjusted to give a fine running fit between the moving parts.
Q. Design a milling fixture to cut slot of 3*3mm in a mild steel component as shown in figure.
Given data
\( d = \text{depth of cut} = 3 \text{mm} \)
\( b = \text{width of cut} = 3 \text{mm} \)

Design procedure
a. selection of fixture
b. selection of locating method
c. selection of clamping method
d. design of fixture body
a. Selection of fixture

• More than one similar w/ps. So string milling fixture is selected.
• Material – C45
• Brittle hardness=229HB
• Surface finish=0.025mm to 0.05mm
• Type of milling : Down milling
The chip formation in down milling is opposite to the chip formation in up milling. The figure for down milling shows that the cutter tooth is almost parallel to the top surface of the work piece. The cutter tooth begins to mill the full chip thickness. Then the chip thickness gradually decreases.
b. Selection of locating method

- w/p dia=40mm. So V block with $d_{max}=40mm$ is selected.(refer data book)
- a should be less than 60mm.
- Therefore, $a=50\text{mm}$, $b=40\text{mm}$, $c=40\text{mm}$. 
c. Selection of clamping

• To select clamping, clamping force should be calculated.
• Cutting force $F_c = 4.5Kf_db/C_s$ (N)
• Assuming feed $f=75\text{mm/min}$, $K=8.5$ for high carbon steel (from data book) and cutting speed $C_s=15\text{m/min}$,
  
  cutting force = 1721.25N

For safer design, clamping force > cutting force.
• Now, yield stress for \( w/p = 600\text{N/sq.mm.} \) for C45 steel (refer data book).

• Yield stress = cutting force/bearing area of pressure pad.

• Therefore, area = \( 1721.25/600 = 2.86\text{sq.mm.} \).

• Now, dia of pressure pad = 2mm.

• But acc to std data, min pad dia = 10mm.
d. Design of fixture body

- **Design of base plate:**
- \( L_2 = \text{number of w/p(c+d_{\max})+pressure pad height+clearance for loading and unloading.} \)
- \( L_1 = \text{height of V block(c)} \)
- \( t = \text{diameter of w/p(d_{\max})} \)
- Thickness of supporting block(\( t_s \))=1.5t
- \( L = 2L_1 + 2t_s + L_2 \)
• Height of supporting block should be equal to height of V block. $h_s = a = 50\text{mm}$.

• Assuming 5 w/ps, and assuming clearance=20mm,

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  L = 430\text{mm (approx)}
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• *Calculation of width of base and supporting plate:*

• Width of base plate ($W_b$) = 2 x breadth of V block = 2 x 40 = 80mm.

• Width of supporting block = width of base plate = 80mm.
PROBLEM 2

• A through rectangular section slot has to be cut on a rod. A fixture or jig is to be designed for cutting the slot in batch production.
• It will be a fixture, not jig, since there is no need of making holes

• A slot milling cutter of width equal to the width of the slot desired has to be used

• Since the blank is a cylindrical piece, V – block type system has been used for locating and supporting

• The axial location (and supporting) will be accomplished by the axial pin and the contact will be assured by the swing type spring loaded pusher as shown.
• Clamping will be done quickly by the cam pressing the strap as shown.

• The fixture holding the workpiece will be properly fixed on the table of the milling machine and will move along that table.

• After completion of the work, i.e. cutting of the slot, the fixture will be removed. A spring loaded ejector (cum locator) can also be used as shown.