Module Outcomes	Description	Duration (Hours)	Cognitive Level
CO1	**Summarize the applications of Jigs &fixtures in mass production, procedure and application of powder metallurgy and surface modification methods**		
M1.01	Appreciate the importance and selection of jigs and fixtures in mass production	4	Applying
M1.02	Describe the procedure and applications of powder metallurgy.	3	Understanding
M1.03	Illustrate the procedure and applications of surface modification methods	5	Applying
Contents: Importance of Jigs & fixtures in mass production- introduction-design considerations - applications- types- box type jig, indexing jig, Angle plate jig, channel jig -fixtures-fixtures for turning, drilling, milling, and grinding. Powder metallurgy and surface modification techniques- Powder metallurgy-applications of P/M- procedure of P/M- pros and cons- Surface modification methods – Applications- Physical vapor deposition- chemical vapor deposition- diffusion coating- Metal spraying- organic coatings- (brief explanation with line sketch)			

JIGS AND FIXTURS

Jigs and fixtures are production devices usually associated with mass production.

A *jig*: -is a work-holding device which also locates or guides the cutting tool with respect to the workpiece. It is not fastened to the machine on which it is used.

A *fixture:* - is a work-holding device but does not locate or guide the cutting tool. It is fastened to the table or base of the machine.

ELEMENTS OF JIGS AND FIXTURES

The jigs and fixtures should possess the following components to perform their basic functions.

1. Locating elements- to keep the workpiece in position with respect to the cutting tool

2. Clamping elements- to hold the workpiece against the cutting force during the machining operation

3. Tool guiding and setting elements

DIFFERENCE BETWEEN JIGS AND FIXTURES

JIG	Fixture
1.Hold the workpiece and guide the tool	1.Hold the workpiece but do not guide the tool
2. Usually movable with the machine table	2. Clamped in the fixed position of the machine table
3. Used for drilling, reaming, boring and counterboring	3. Used for welding, turning etc.
4. Lighter in construction	4. Heavy in construction

ADVANTAGES OF JIGS AND FIXTURES

- Reduces the operation time and increases productivity.
- Facilitates uniform quality and ensures interchangeability of components.
- Unskilled operators can do the job, thus saving on labour cost.
- Ensures higher accuracy and surface quality.
- Reduce the overall cost of the product.

IMPORTANT CONSIDERATIONS WHILE DESIGNING JIGS AND FIXTURES

Designing jigs and fixtures depends upon so many factors. These factors are analyzed to get design inputs for jigs and fixtures. The list of such factors is mentioned below:

(a) Study of workpiece and finished component size and geometry.

(b) Type and capacity of the machine, its extent of automation.

(c) Provision of locating devices in the machine.

(d) Available clamping arrangements in the machine.

(e) Available indexing devices, their accuracy.

(f) Evaluation of variability in the performance results of the machine.

(g) Rigidity and of the machine tool under consideration.

(h) Study of ejecting devices, safety devices, etc.

(i) Required level of the accuracy in the work and quality to be produced

TYPES OF DRILL JIGS

1. Template jig 2. Plate jig 3. Channel jig 4. Box jig 5. Leaf jig 6. Indexing jig 7. Universal jig

1. Template jig: -It is simply a plate made to the shape and size of the workpiece; with the required number of holes made it. It is placed on the workpiece and the hole will be made by the drill; which will be guided through the holes in the template plate should be hardened to avoid its frequent replacement This type of jig is suitable if only a few parts are to be made.

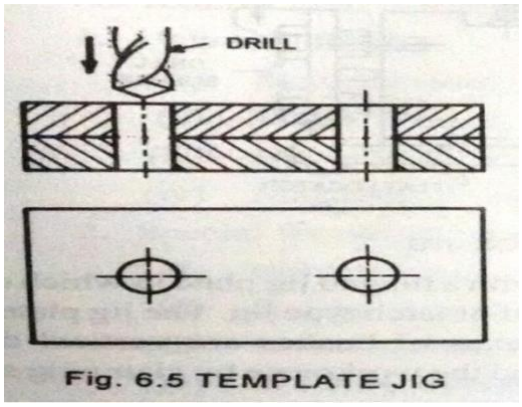

Fig. 6.5 TEMPLATE JIG

2. Plate jig:-It is a plate jig with drill bushes

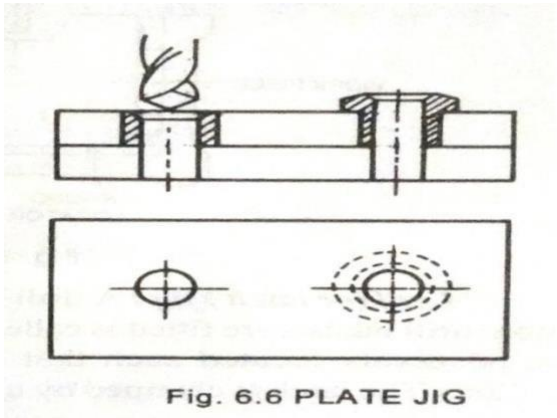
Fig. 6.6 PLATE JIG

3. Channel jig:-It is in the form of a channel. The workpiece is located in the channel and clamped by screws. Used for drilling

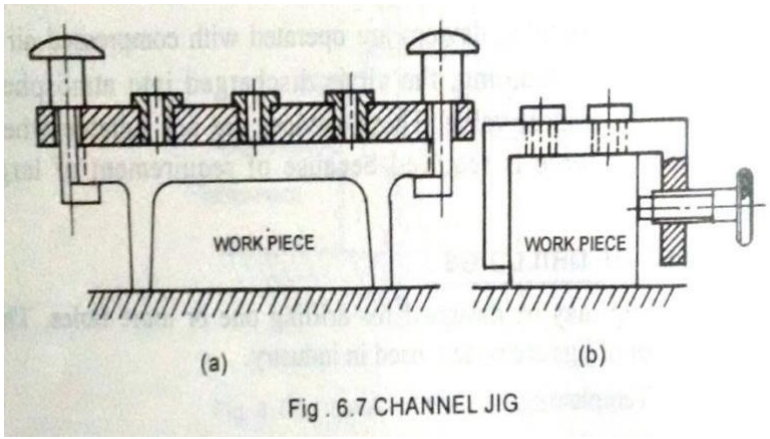

Fig . 6.7 CHANNEL JIG

4.Box jig:-Used for drilling in more than 1 plane. The jig will be in the form of a box. One side of the box is provided with a latch to place the workpiece

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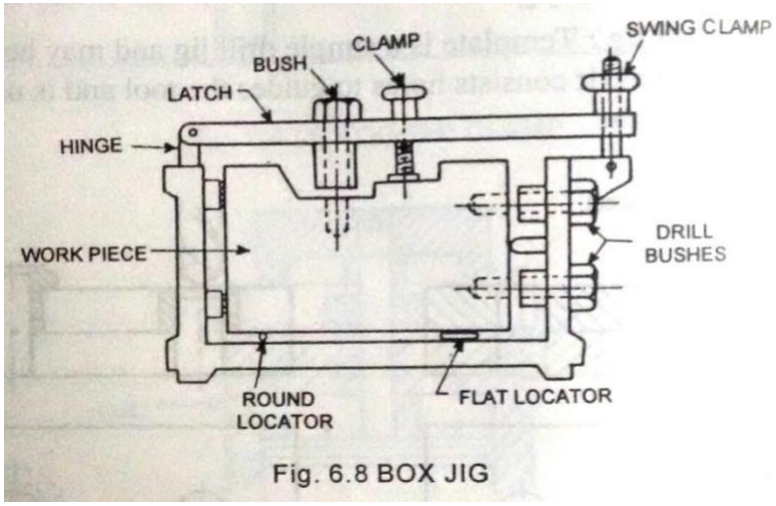
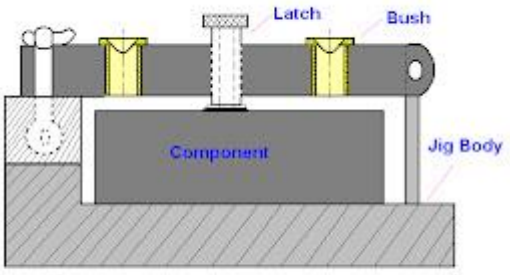


Fig. 6.8 BOX JIG

5.Leaf Jig:

It is also a sort of open type jig, in which the top plate is arranged to swing about a fulcrum point, so that it completely clears the jig for easy loading and unloading of the workpiece. The drill bushes are fitted into the plates, which is also known as leaf, latch or lid.



Leaf Jig

TYPES OF FIXTURES

All fixtures used in industry can be divided into two groups

1.Universal fixtures :-Machine vise Three jaw self-centering chuck Universal dividing head Magnetic chuck

2.Special fixtures:-Milling fixtures Boring fixtures Grinding fixtures Welding fixtures

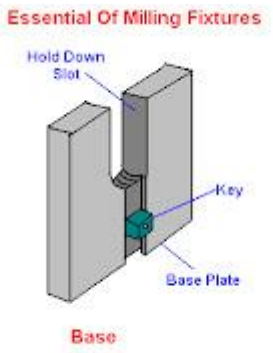
Milling Fixtures:

A Milling fixture is a work holding device which is firmly clamped to the table of the milling machine. It holds the workpiece in the correct position as the table movement carries it past the cutter or cutters.

Essentials of Milling Fixtures:

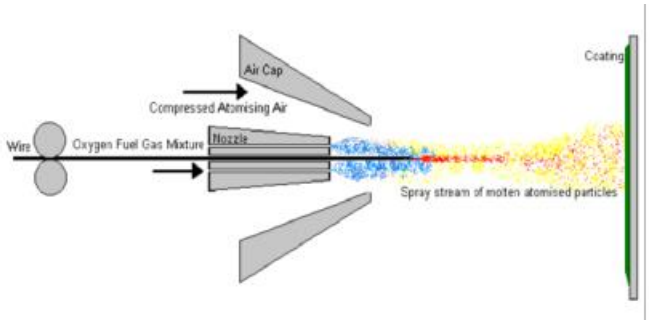
1: Base:

A heavy base is the most important element of a milling fixture. It is a plate with a flat and smooth under face. The complete fixture is built up from this plate. Keys are provided on the plate's under face, which are used for easy and accurate aligning of the fixture on the milling machine table. By inserting them into one the T slot in the table. These keys are usually set in keyways on the under face of the plate and are held in place by a socket head cap screw for end key. The fixture is fastened to the machine table with the help of two T bolts engaging in T slots of the work table.



Surface Modification methods

Metal spraying



Metal spraying is a process of applying a metallic coating to a substrate by projecting molten metal

particles onto the surface. The molten metal particles are atomized and sprayed onto the surface using a variety of methods, including arc spraying, flame spraying, and plasma spraying.

The metal spraying process can be summarized in the following steps:

1. The substrate is cleaned and prepared to ensure good adhesion of the coating.

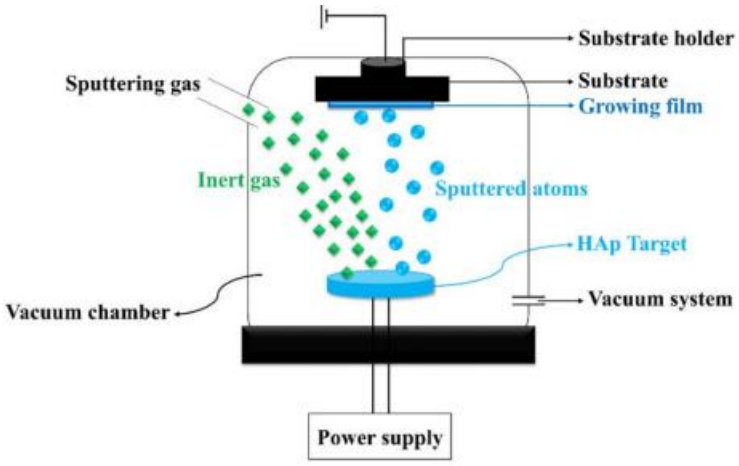
2. The metal spraying gun is positioned at the desired distance from the substrate.

3. The metal is melted in the spray gun.

4. The molten metal is atomized and sprayed onto the substrate.

5. The molten metal particles solidify on the substrate to form a coating.

Physical vapour deposition (PVD) is fundamentally a vaporisation coating technique, involving transfer of material on an atomic level.



PVD processes are carried out under vacuum conditions. The process involved four steps:

• Evaporation

• Transportation

• Reaction

• Deposition

Evaporation

During this stage, a target, consisting of the material to be deposited is bombarded by a high energy source such as a beam of electrons or ions. This dislodges atoms from the surface of the target, 'vaporising' them.

Transport

This process simply consists of the movement of 'vaporised' atoms from the target to the substrate to be coated and will generally be a straight-line affair.

Reaction

In some cases, coatings will consist of metal oxides, nitrides, carbides and other such materials. In these cases, the target will consist of the metal. The atoms of metal will then react with the appropriate gas during the transport stage.

Deposition

This is the process of coating build up on the substrate surface.