Inspection is a major component of quality control, where physical product is examined visually (or the end results of service are analyzed). Product inspectors will be provided with list of descriptions of un acceptable product defects such as cracks or surface blemishes.

Need of quality control

Every operation is connected with the quality of the product it is important that quality requirements be statisfied and production schedules are met. The satisfaction of end user mainly depended on quality

Quality control is needed for

1 Encourage quality conciousness
2 Satisfaction of consumers
3 Reduction in production cost
4 Effective utilisation of resources
5 Increased good will among the consumers
6 Reducing inspection cost
7 Increase in sales
8 Best quality in available resources

SPC (Statistical process control)

If a product is to meet or exceed customer expectations, generally it should be produced by a process that is stable or repeatable. More precisely, the process must be capable of operating with little variability around the target or nominal dimensions of the product's quality characteristics. Statistical process control (SPC) is a powerful collection of problem-solving tools useful in a achieving process stability and improving capability through the reduction of variability.

SPC is one of the greatest technological developments of the twentieth century because it is based on sound underlying principles, is easy to use, has significant impact and can be applied to any process. Its seven major tools are

1 Histogram or stem-and-leaf plot
2 Check sheet
3 Pareto chart
4 Cause-and-effect diagram
5 Defect concentration diagram
6 Scatler diagram
7 Control chart

Although these tools, often called "the magnificent seven," are an important part of SPC they comprise only its technical aspects. The proper deployment of SPC helps create an environment in which all individuals in an organization seek continuous improvement in quality and productivity. This environment is best developed when management becomes involved in the process. Once this environment is established. Routine application of the magnificent seven becomes part of the usual manner of doing business, and the organization is well on its way to achieving its quality improvement objectives.

Of the seven tools, the shewhart control chart is probably the most techincally sophisticated. It was developed in the 1920s by Walter A. Shewhart of the Bell Telephone Laboratories. To understand the statistical concepts that from the basis of SPC we must first describe Shewhart's theory of variability.

Drilling jig types and uses

Objectives: At the end of this lesson you shall be to

- **what is jig**
- **list the different types of drill jig and their uses**

Introduction to jigs

A jig is a device in which a work piece/component is held and located for a specific operation in such a way that it will guide one or more cutting tools to the same zone of machining.

Types of drill jigs

Drill jigs may be divided into two types

- Open
- Closed

Open jigs are used when the operation is to be done only on one side of the piece. Closed jigs (Box jig) are used when the operations are to be done on more than one side of the piece. Jigs are identified according to the way they are built. Most commonly used jigs are:

- Template jig
- Plate jig
- Table jig
- Sandwich jig
- Angle plate jig
- Modified angle plate jig
- Box jig
- Channel jig
- Leaf jig
- Indexing jig
- Solid jig
- Post jig
- Trunnion jig

Types of drill jigs

Template jigs

This type of jigs fits over on or into the work and is not usually clamped. They are simple and cheap. They may or may not have guide bushes. When bushes are not used the whole jig plate may be (Fig 1)

The design of a particular type of jig will be based on:

- the position wherein the drilling or its allied operation/ operations are to be performed
- the shape of the piece part.

Plate jig

This jig consists of a drill plate which rests on the component to be drilled. For correct positioning/locating, pins and clips are provided. For heavier piece parts, sometimes clamps are not used. Generally a base plate will not be available for this type of jigs. (Figs 1, 2 and 3)

Fig 1

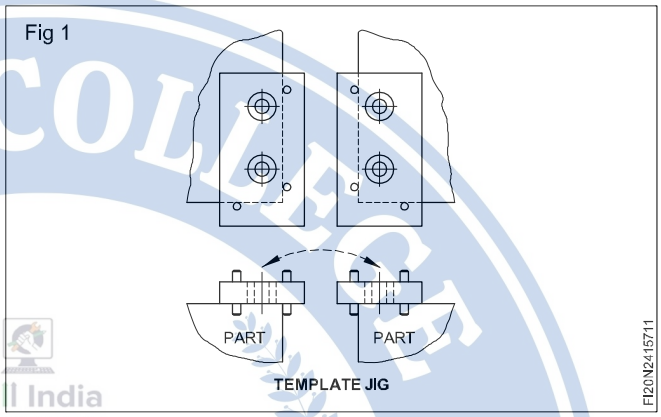

Fig 2

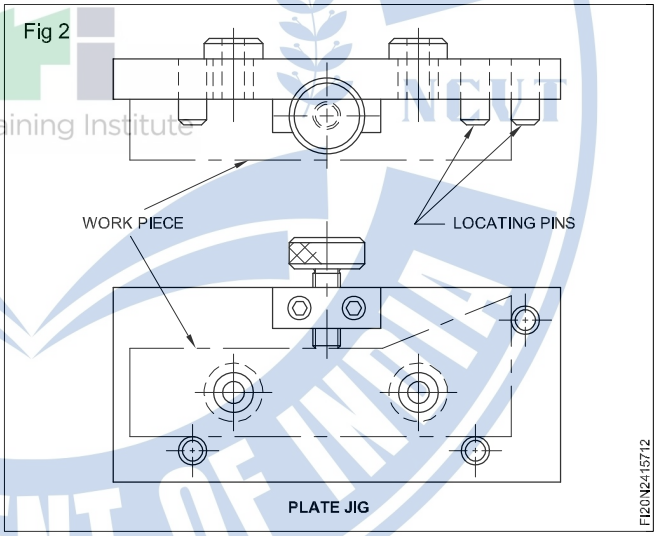

Fig 3

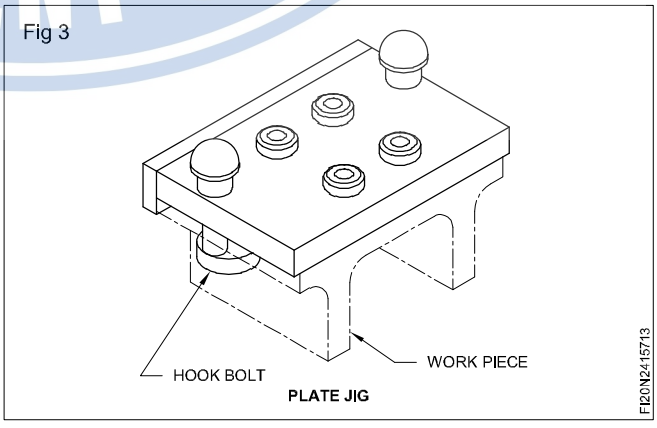

Table jig (Turnover jig)

This is used when it is necessary to locate the piece part from its face. For accurate seating of the jig on the machine table, four legs will be provided on this type of jig. (Fig 4)

Fig 4

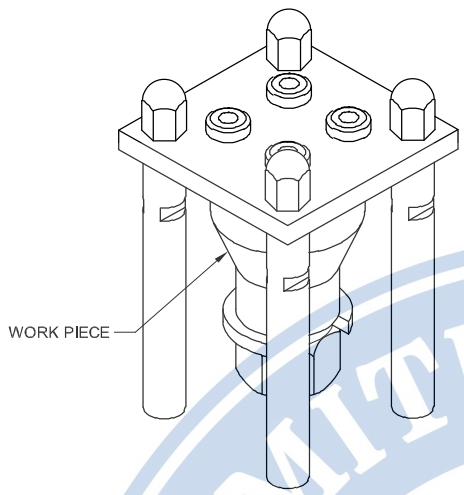

TABLE OR TURNOVER JIG

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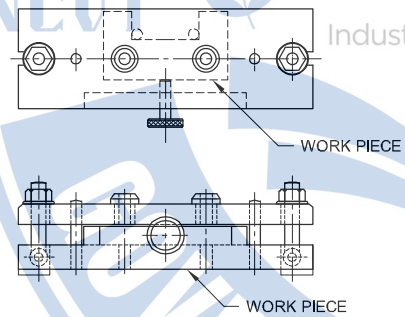
Sandwich jig

This is ideal for thin or soft workpieces which may bend or warp due to force while machining. In this type of jigs, the component will be sandwiched between the base plate and the drill plate. (Fig 5)

Fig 5



SANDWICH JIG

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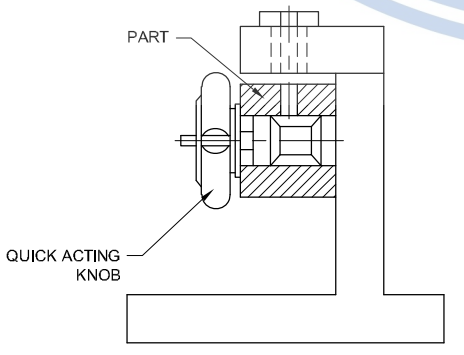
Angle plate jig

These jigs are used to hold work which are to be drilled at right angles to their mounting locators. (Fig 6)

Fig 6



ANGLE - PLATE JIG

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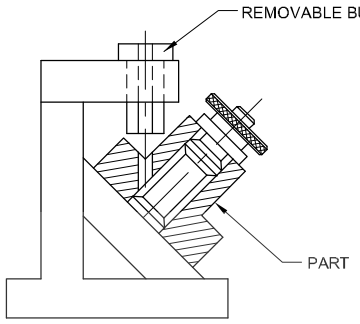
Modified angle plate jig

These jigs are used for drilling at angles other than 90°. (Fig 7)

Fig 7



MODIFIED ANGLE - PLATE JIG

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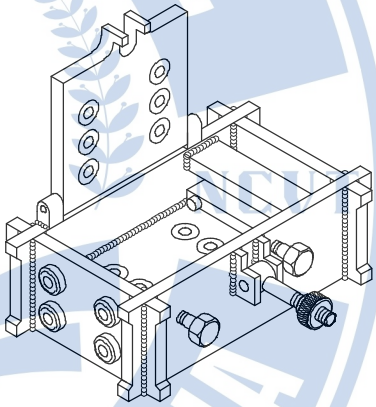
Box jig

This is made in the form of a box or a frame work. The component is located and clamped at one position but drilling can be done from different directions as required. When a box jig contains bushings on two or more sides for drilling from different directions, it is called a tumble jig. (Fig 8) This jig is meant for small components only.

Fig 8



BOX JIG

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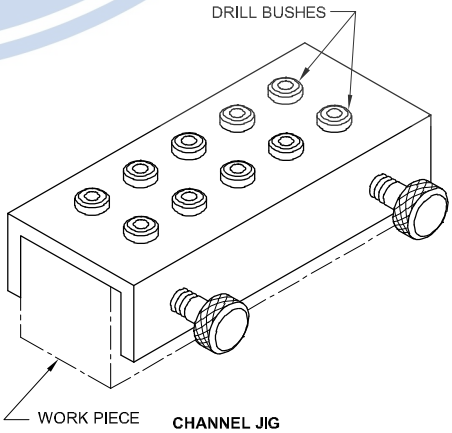
Channel jig

They are the simplest form of box jigs.

The workpiece is held between two sides and machined from the third. (Fig 9)

Fig 9



CHANNEL JIG

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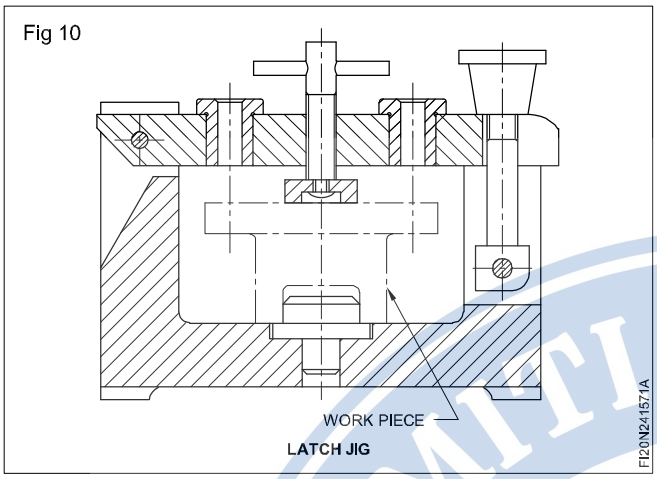
Latch or leaf jig

This type of jig will have a hinged cover with the latch clamps for easy loading and unloading of components. The cover with latch must be positively located and clamped so that the bushes are accurately located with respect to the component. (Fig 10)

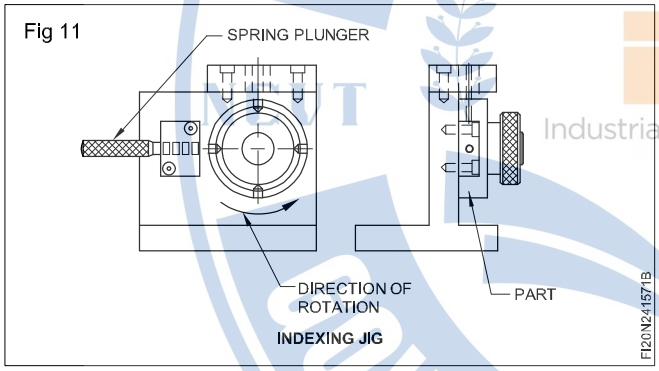
Fig 10



Indexing jig

Indexing jigs are used to accurately space holes on other machined area around a part. The jig uses the part being machined as a reference plate. A spring loaded plunger indexes the part. (Fig 11)

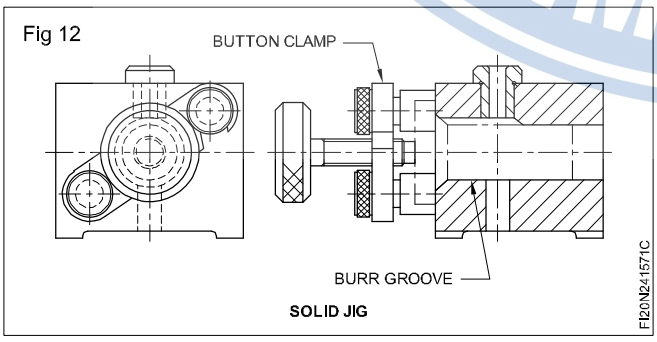
Fig 11



Solid jig

This can be used while drilling small piece parts. The body of this type of jig is machined from a solid block of steel. (Fig 12)

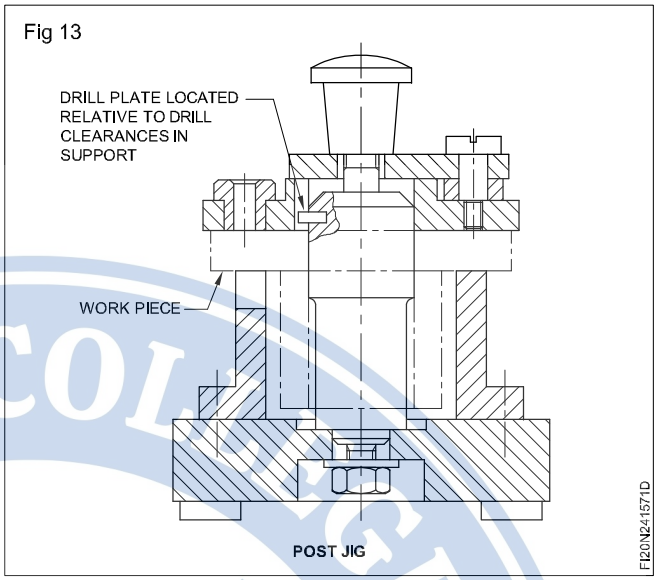
Fig 12



Post jig

This is used for location from a bore. The post should be as short as possible to facilitate loading and at the same time it must be long enough to support the workpiece. (Fig 13)

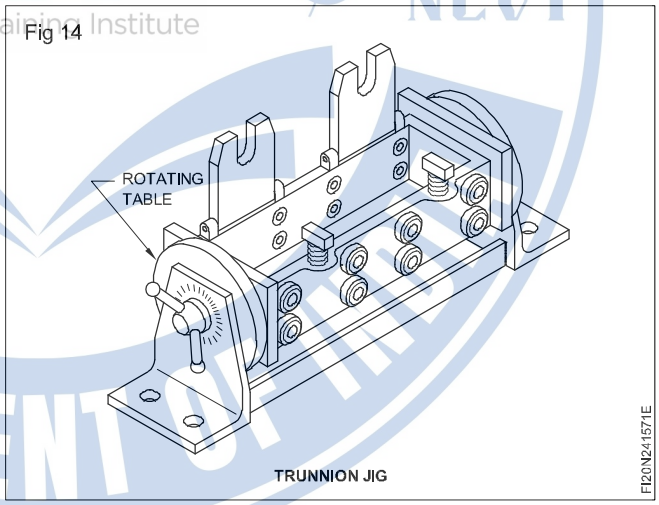
Fig 13



Trunnion jig

This can be used when large or awkwardly shaped workpieces are to be drilled from different directions. This is a further modification of the box jig which is carried on trunnions and rotated from station to station and positioned, using an indexing device. (Fig 14)

Fig 14

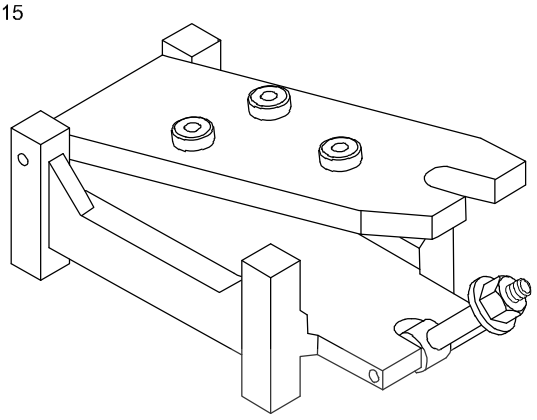


A jig is a special device which holds, supports, locates and also guides the cutting tool during operation. Jigs are designed to accommodate on or more components at a time.

Jigs are available for drilling or boring.

Drilling jigs are used to drill , ream, tap and to perform other allied operations. (Figs 15 & 16)

Fig 15



DRILL JIG

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Boring jigs are used to bore holes which are either too large to drill or of odd size. (Fig 17)

Fig 17

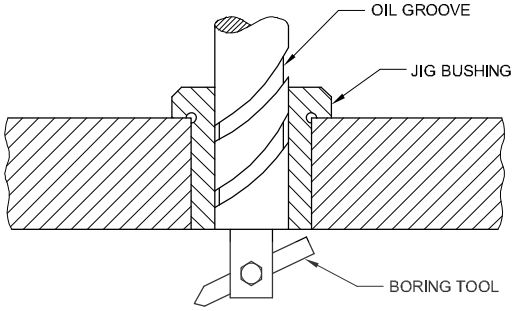

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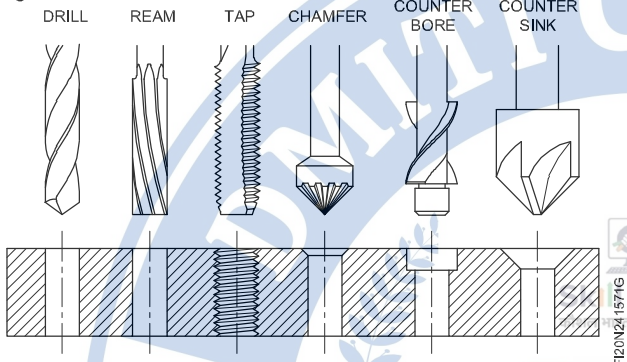
Fig 16



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Constructional features of drill jig

Objectives: At the end of this lesson you shall be to

- **list the different parts of a drill jig and also their uses**
- **state the different types of drill bushes and their uses**
- **state the different types of locators and clamps used in jigs.**

The basic features of a drill jig are (Fig 1)

- base plate or jig body
- drill plate or jig plate
- drill bushes locating pins
- clamps.

Base plate

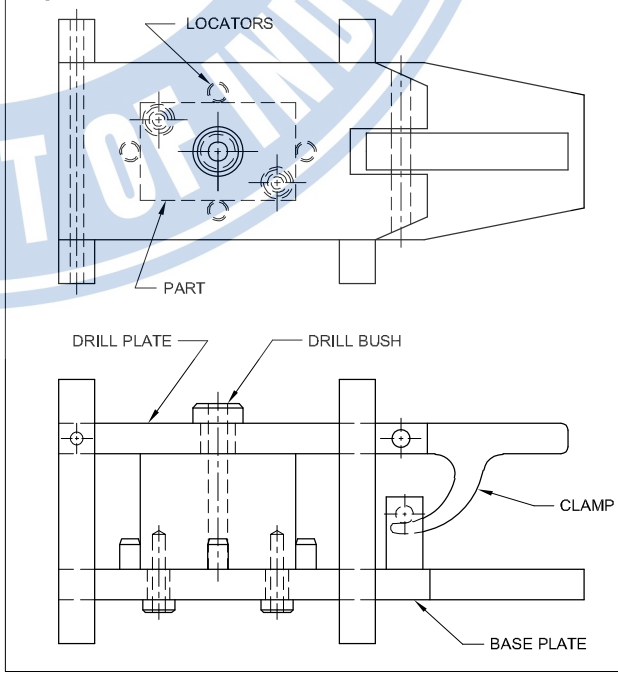
This provides a rigid support for mounting piece parts, locating pins etc.

In some drill jigs like plate and clamp jigs there will be no base plate.

Drill plate

It holds the drill bushes. Cutting tools are guided by means of the drill bushes. Unbushed holes made on the drill plate are sometimes used for small runs.

Fig 1



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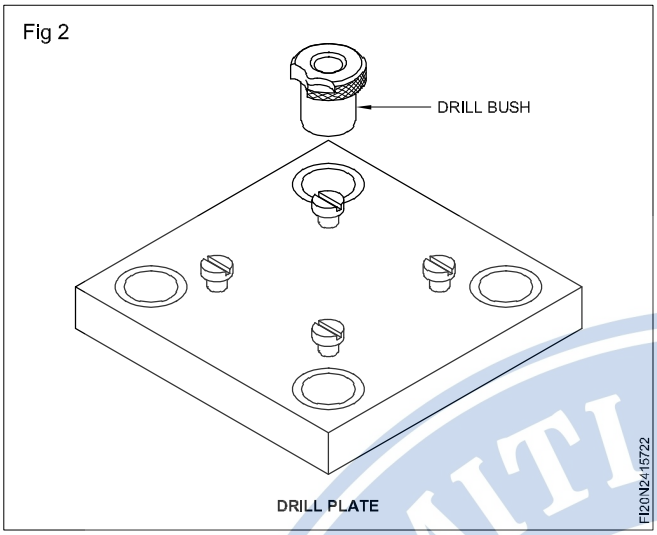
Drill bushes

They are used to locate and guide drills, reamers, taps and any other revolving tools commonly used to make or modify holes. (Fig 2)

Fig 2



These are hardened and ground to exact sizes to ensure the needed repeatability in the jig. Standard size bushes are also available.

Types of drill bushes

- Press fit bushes
- Renewable bushes
- Liner bushes

Press fit bushes are made in two forms.

- Head
- Headless

These bushes are used where frequent change of bushes is not anticipated. (Figs 3 and 4)

Fig 3

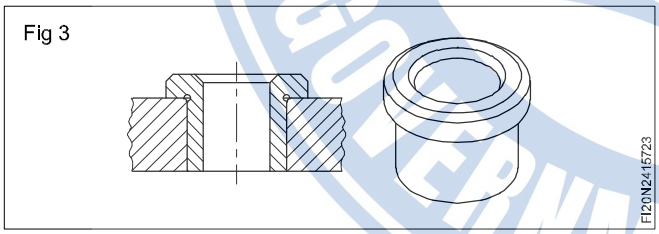
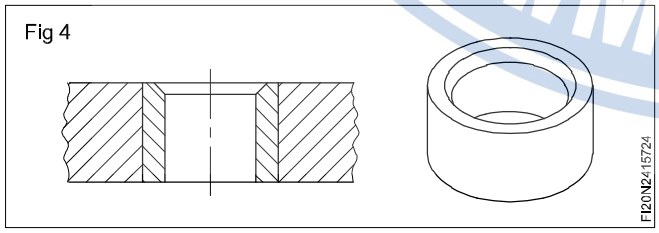


Fig 4

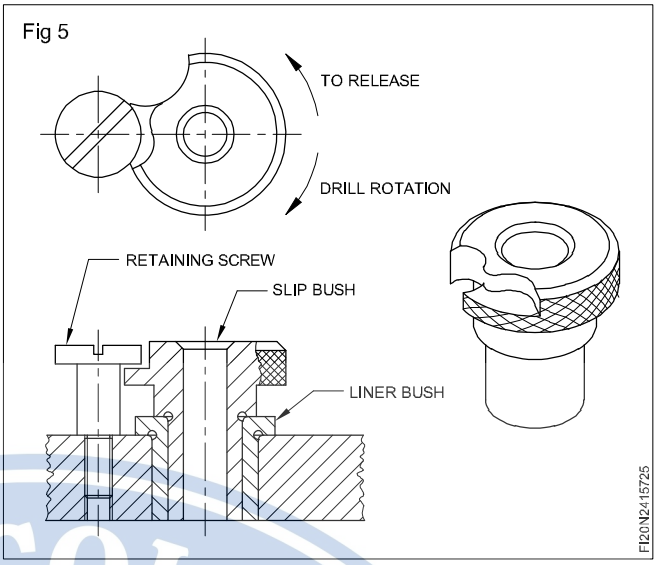


Renewable bushes are divided into two groups.

Slip renewable bushes (slip bushes)

These bushes are used when more than one operation is performed in the same location. (Eg:drilling and reaming) These bushes are used with press-fitted liner bushes and a lock clamp. (Fig 5)

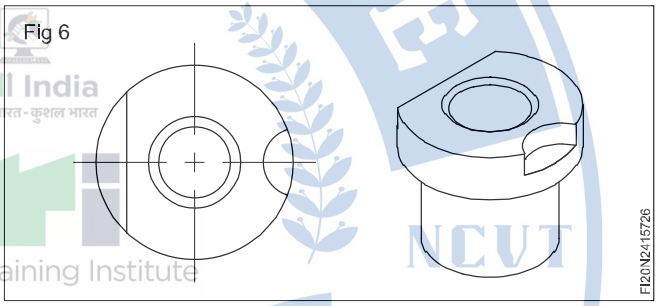
Fig 5



Fixed renewable bushes

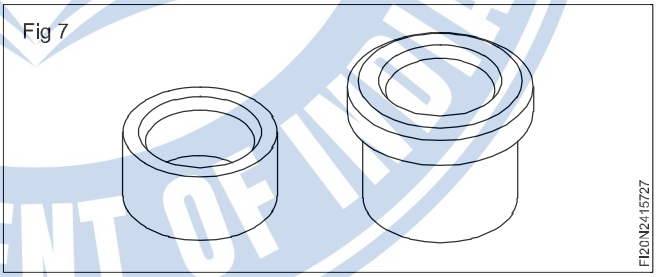
These bushes are used where only one operation is to be performed with each bush, whereas several bushes may be used during the life of the jig. These are also held in a liner and retained by a screw. (Fig 6)

Fig 6



Liner bushes are used to provide a hardened hole where renewable bushes are located. Liner bushes are press-fitted to the jig plate.(Fig 7)

Fig 7



Locating pins or locaters are used

- to restrict the movement of the component
- to position the piece part with respect to the tool
- to facilitate easy loading and unloading of component piece parts
- to assist the operator for correct loading (fool proofing).

Different types of locating pins are used according to the shape of the component and also according to the hole locators. A few types of locating pins are shown in Figs 8 to 16.

Fig 8

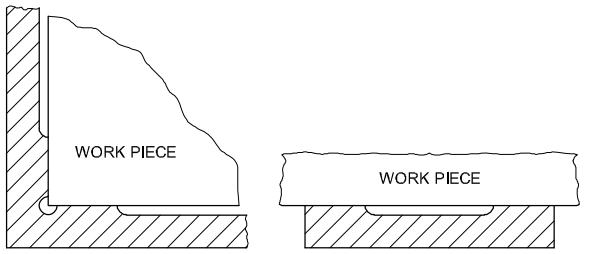


Fig 9

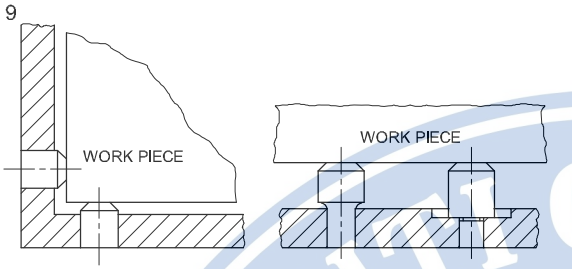


Fig 10

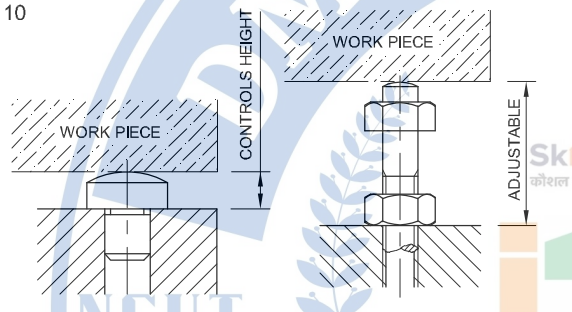


Fig 11

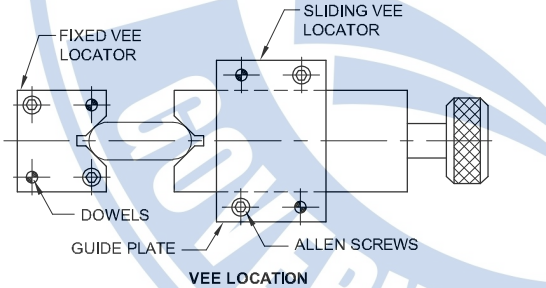


Fig 12

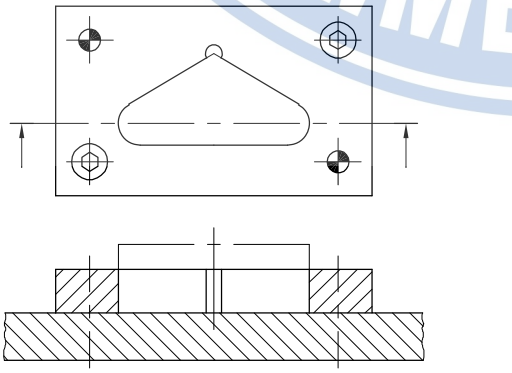


Fig 13

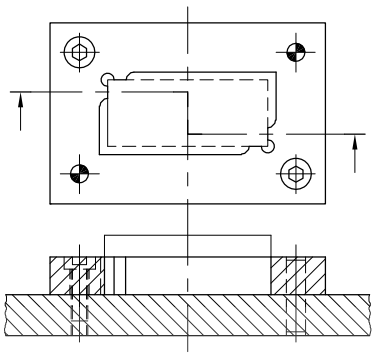


Fig 14

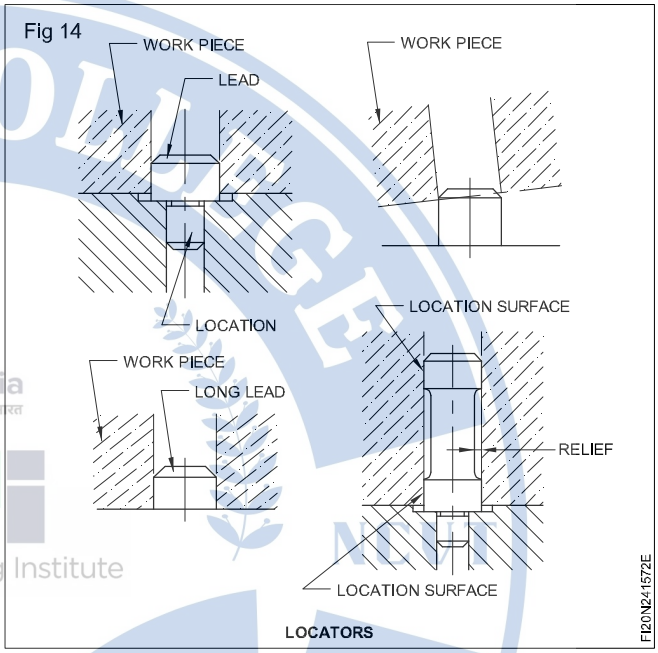


Fig 15

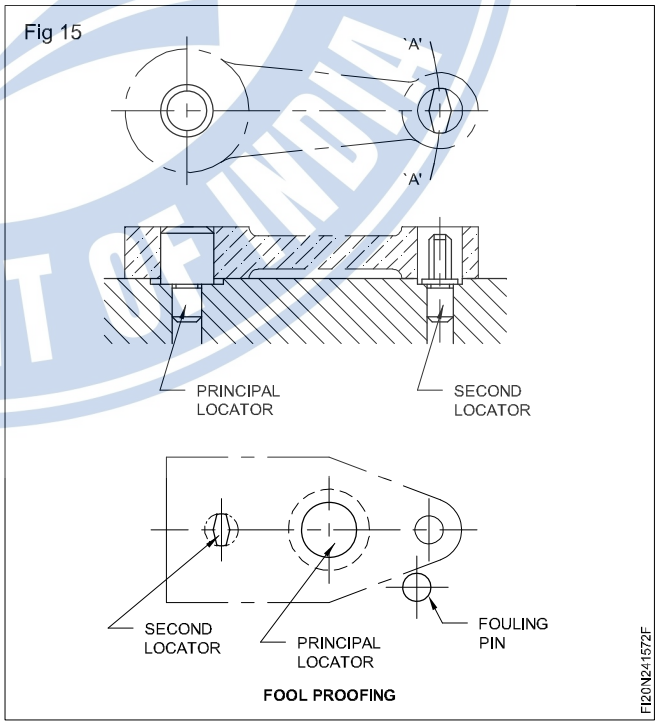
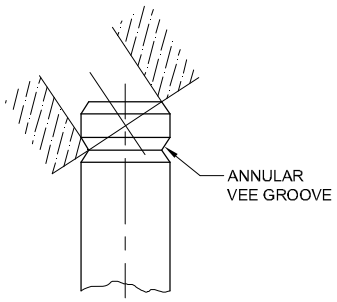


Fig 16



SPECIAL LEAD TO PREVENT JAMMING

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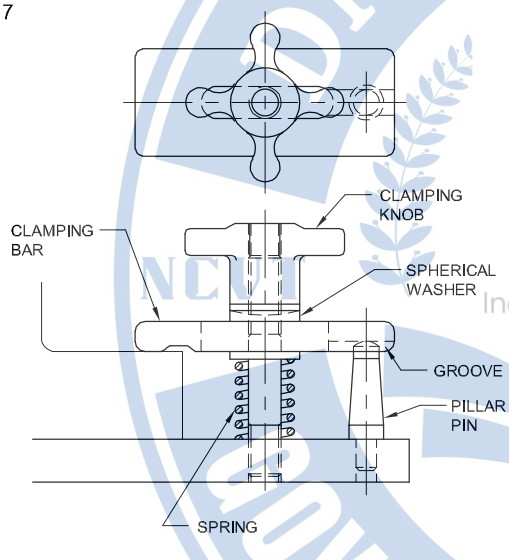
Clamps

Clamps in jigs are meant for holding the component in position against the cutting force. They also help in rapid loading and unloading of the components. Clamps are fitted in such a way that they do not interfere with the cutting operation.

The commonly used types of clamps are:

strap clamp (Fig 17)

Fig 17



STRAP CLAMP

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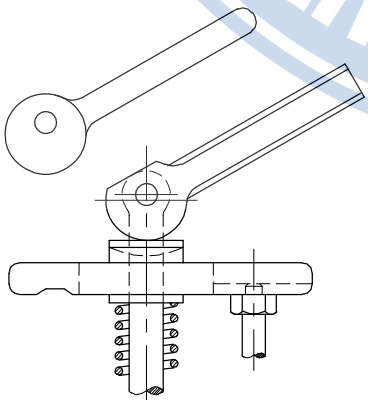
- cam clamp (Fig 18)

Fig 18



CAM CLAMP

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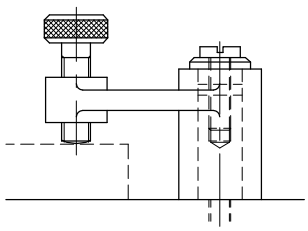
- screw clamp (Fig 19)

Fig 19



SCREW CLAMP

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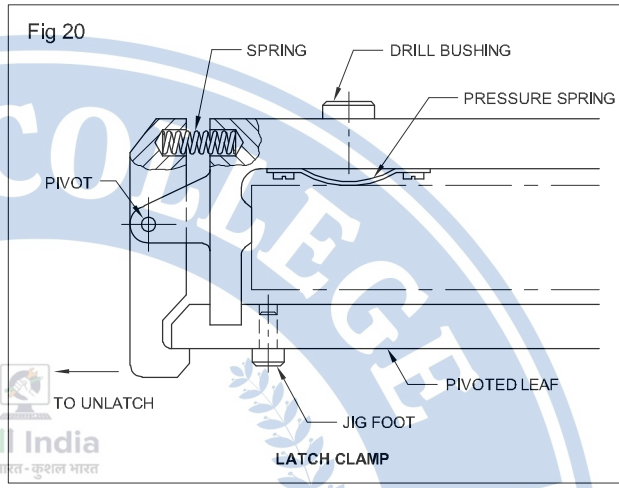
- latch clamp (Fig 20)

Fig 20



LATCH CLAMP

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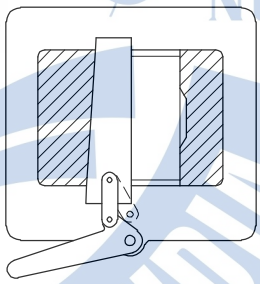
- wedge clamp (Fig 21)

Fig 21



WEDGE CLAMP

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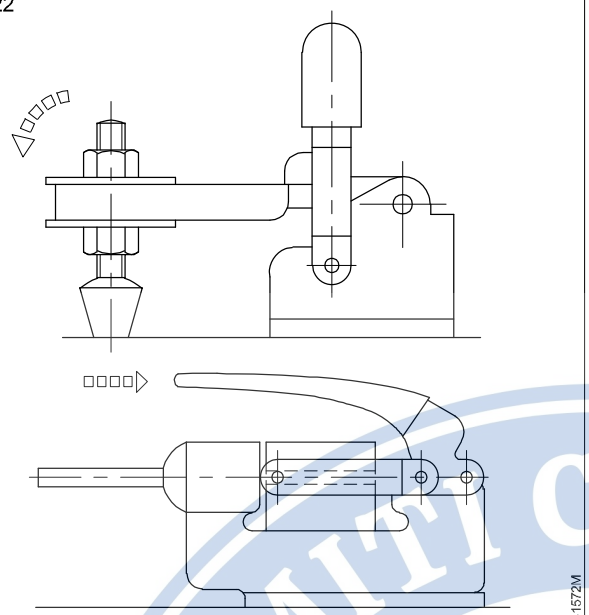
- toogle clamp (Fig 22)

Fig 22

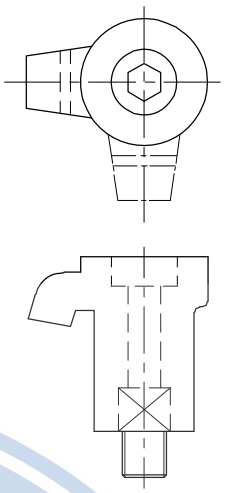


TOGGLE CLAMP

FI20N241572M

- hook clamp (Fig 23)

Fig 23



HOOK CLAMP

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Fixtures - Types and uses

Objectives: At the end of this lesson you shall be to
- **what is fixture**
- **list the different type of fixture and their uses**

Introduction to fixture

A fixture is a production tool used to locate accurately and to hold securely one or more work- pieces so that the required machining operations can be performed. A fixture should be securely fastened to the table of the machine upon which the work is done. The main purpose of a fixture is to locate the work quickly and accurately,support it properly ,and hold it securely.

Classification of fixtures

Fixtures are classified by the type of machine on which they are used. If a fixture is made for a milling machine it is called a milling fixture. Some of the most commonly used fixtures are turning fixture, milling fixture, welding fixture, boring fixture, assembly fixture, inspection fixtures etc.

The elements of jigs and fixtures are

- location
- clamping
- tool guiding or setting
- body base or frame

Types of fixtures

Types of fixtures are determined mainly by how the tool is used. Because of the increased tool forces, fixtures are built stronger and heavier than jigs. The most common type of fixtures are

Plate fixture

These are the simplest form of fixtures. It is made from a flat plate which has locater and clamps to locate and hold the part (Fig 1).

Fig 1

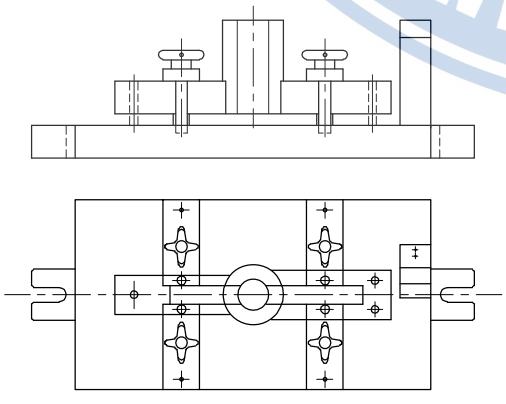


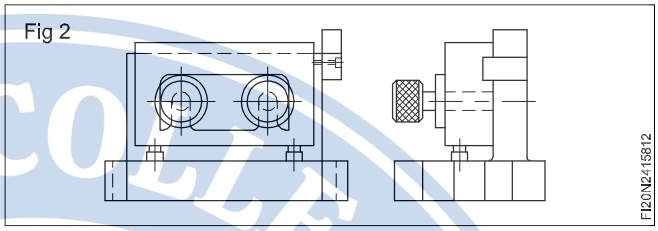
PLATE FIXTURE

FI20N2415811

Angle plate fixture

This fixture is used for machining the part at right angle to the locator. (Fig 2)

Fig 2

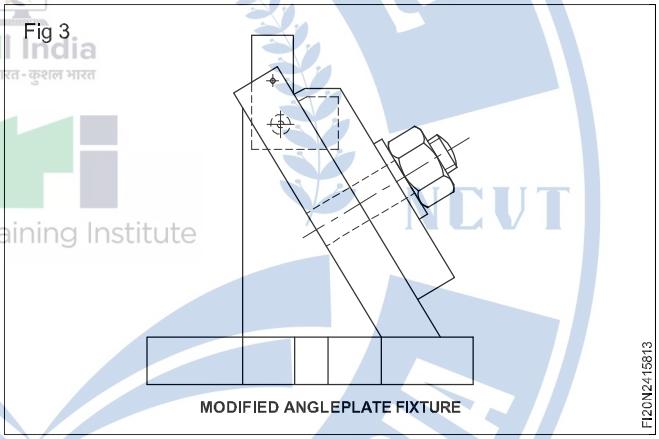


FI20N2415812

Modified angle plate fixture

This fixture is used for machining the part at angles other than 90°. (Fig 3)

Fig 3



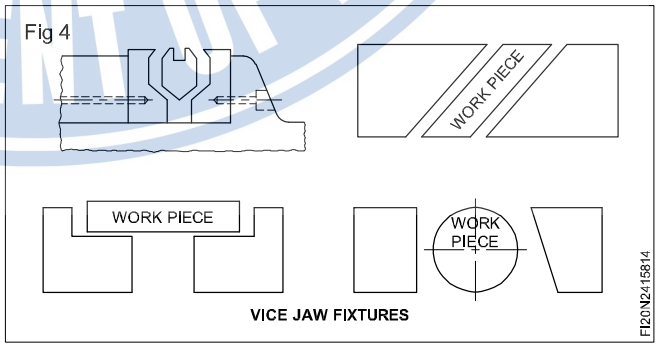
MODIFIED ANGLEPLATE FIXTURE

FI20N2415813

Vice jaw fixture

This fixture is used for machining small parts. The standard vice jaws are replaced with jaws that are made to suit the work. (Fig 4)

Fig 4



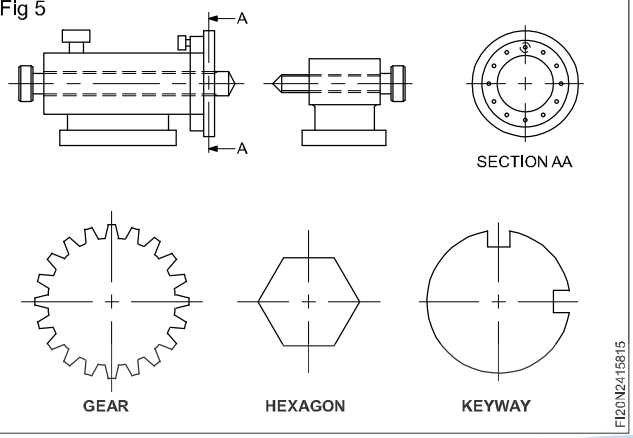
VICE JAW FIXTURES

FI20N2415814

Indexing fixtures

These fixtures are used for parts that require machining on evenly spaced surfaces. (Fig 5)

Fig 5



Use of fixtures

A great deal of importance is placed today on improving productivity in manufacturing processes. Application of jigs and fixtures has contributed a lot towards this direction.

Jigs and fixtures (Figs 6 and 7) are devices used in manufacturing or assembling. They also facilitate in carrying out special operations accurately.

Fig 6

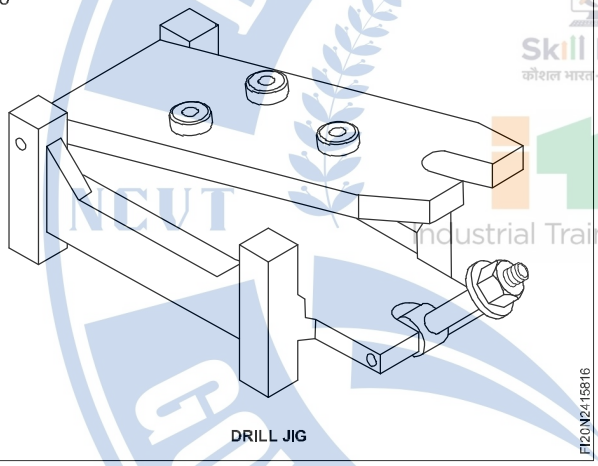
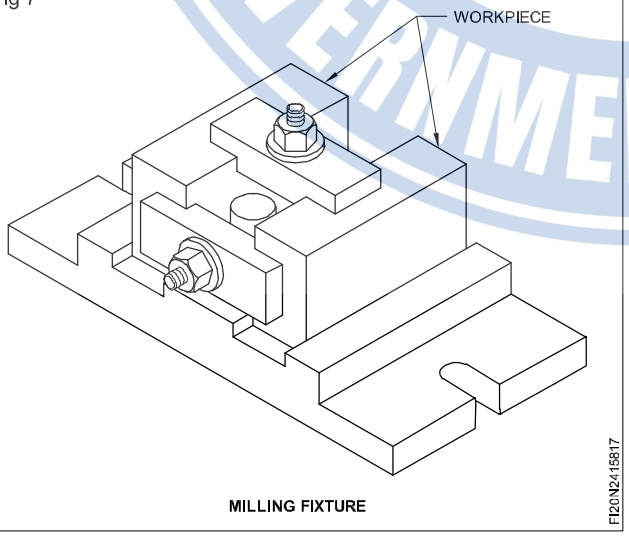
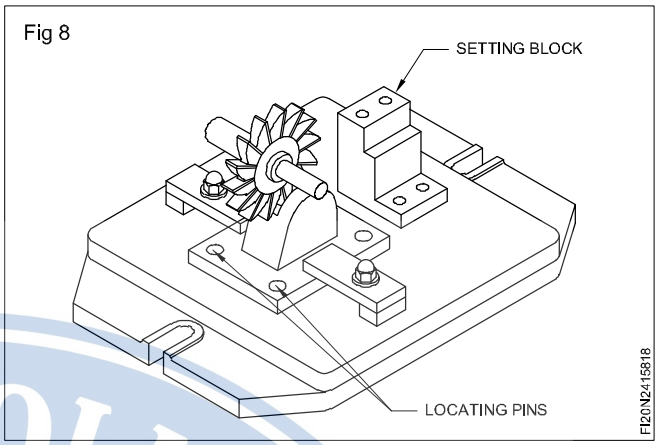


Fig 7



Fixture is a production tool that locates and holds the work-piece. It does not guide the cutting tools, but the tools can be positioned before cutting with the help of setting blocks and feeler gauges etc. (Fig 8)

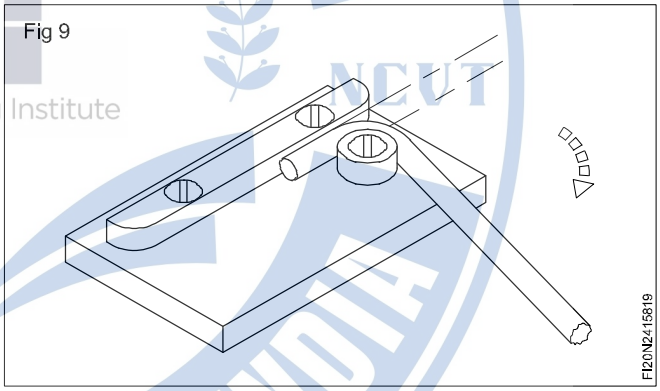
Fig 8



Fixtures of different types are made for:

- milling
- turning
- grinding
- welding
- assembly
- bending etc. (Fig 9)

Fig 9



Constructional features of a fixture

Objective: At the end of this lesson you shall be to

- **brief various constructional features of a fixture**
- **state the functions of setting block and balancing weight in fixture**

common types of fixtures used for the machining operations are:

- milling fixture (Fig 1)
- turning fixture (Fig 2)
- grinding fixture etc.

These fixtures consist of a base plate, standard clamps and locators, setting blocks and balancing weights.

Fig 1

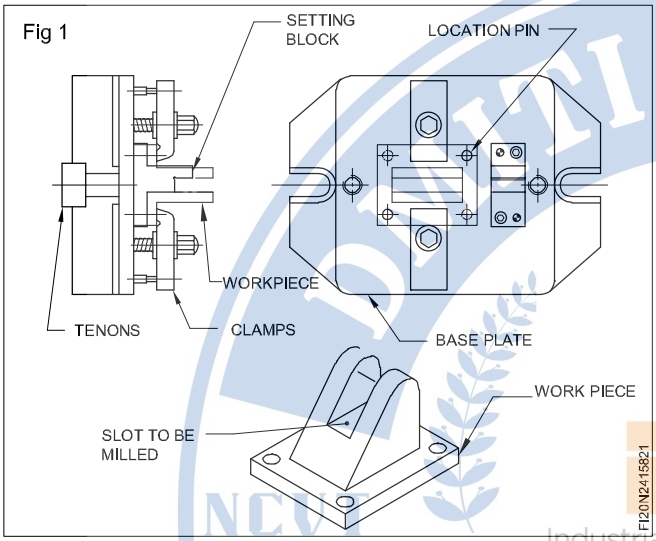
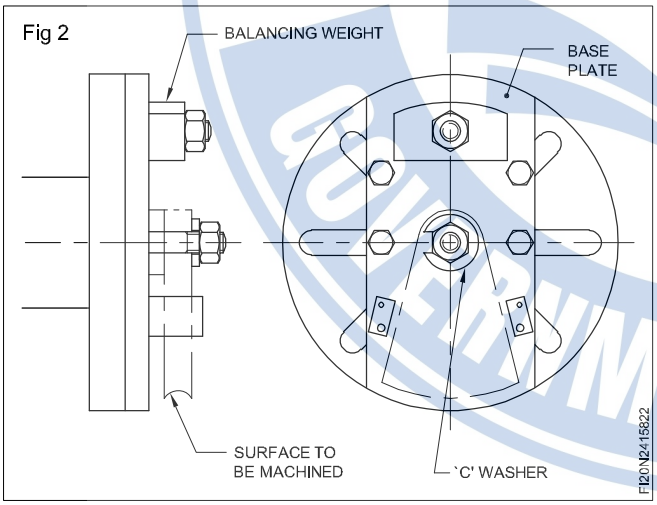


Fig 2



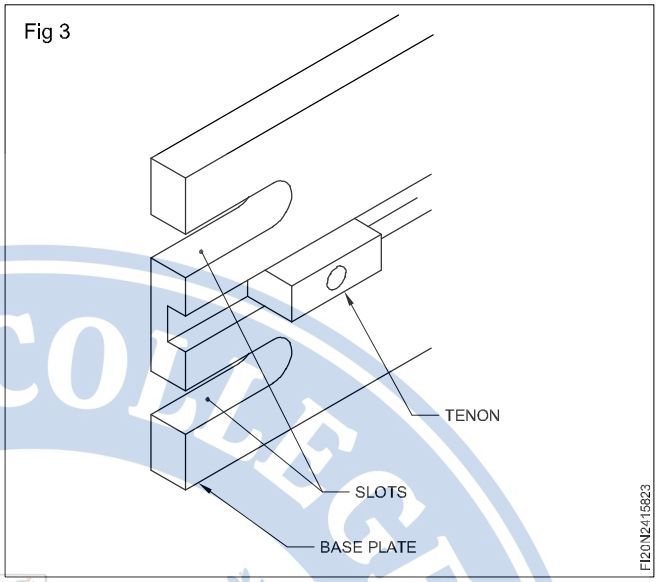
Base plate

The base plate for a milling fixture is provided with tenons at its bottom for proper location of the fixture with the machine table through Tee slots. (Fig 3) Two or four hold-down slots are provided in the base plate for rigid clamping of the fixture with the machine table.

Standard clamps and locators

These are provided for clamping and locating the workpieces with the fixture as in the case of drill jigs.

Fig 3



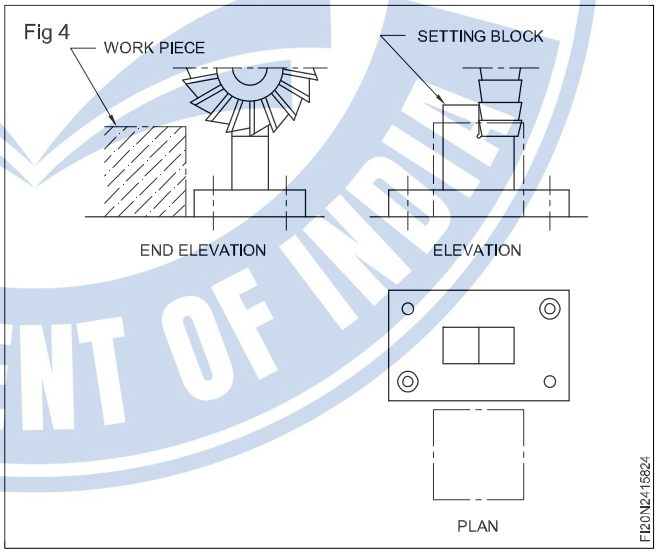
The clamps used in the fixtures are very rigid and sturdy.

The setting blocks

These are used to position the fixture and work relative to the cutter before machining.

A feeler is introduced between the cutter and the setting faces of the block for correct positioning of the cutter with the fixture. (Fig 4)

Fig 4



Balancing weight

This is used dynamically balancing the irregular workpiece fixed to the turning or cylindrical grinding fixture.

In the case of a turning fixture, normally the base plate of the fixture is clamped to the face plate. (Fig 5)