

Drilling jig constructional features, 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 uses
- state constructional features of drill jig

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

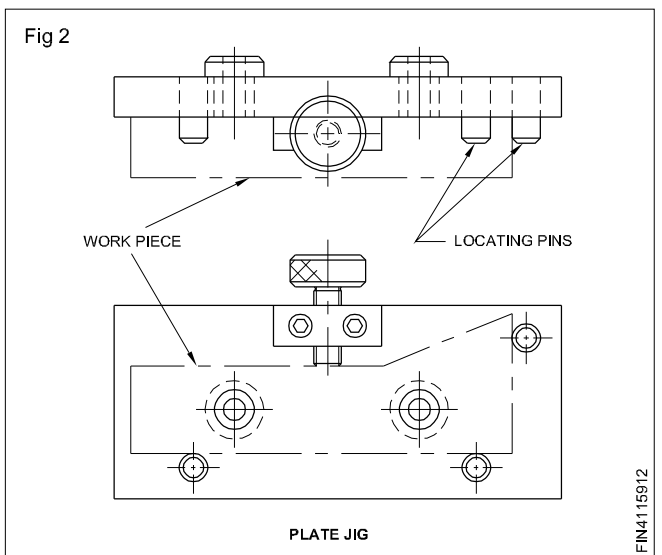
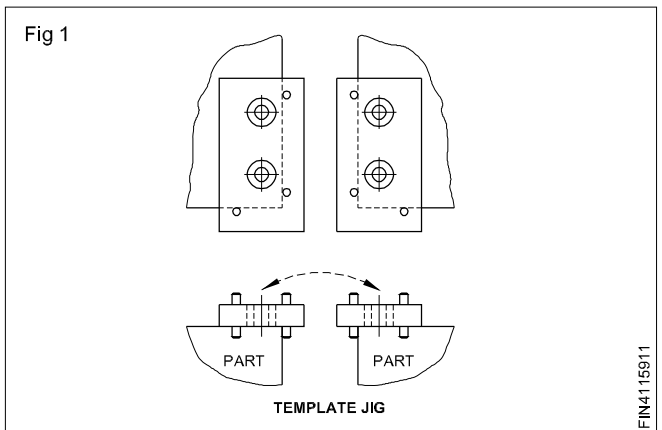
This type of jigs fits over on or into the work and is not usually clamped. They are simple and cheap. They may or may not have guide bushes. When bushes are not used the whole jig plate may be (Fig 1)

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)



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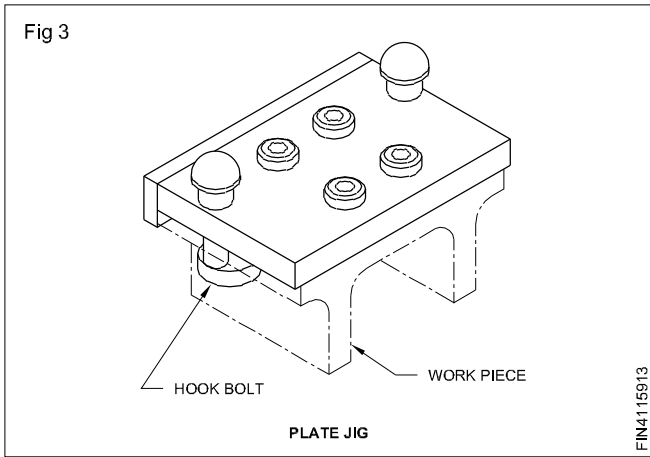
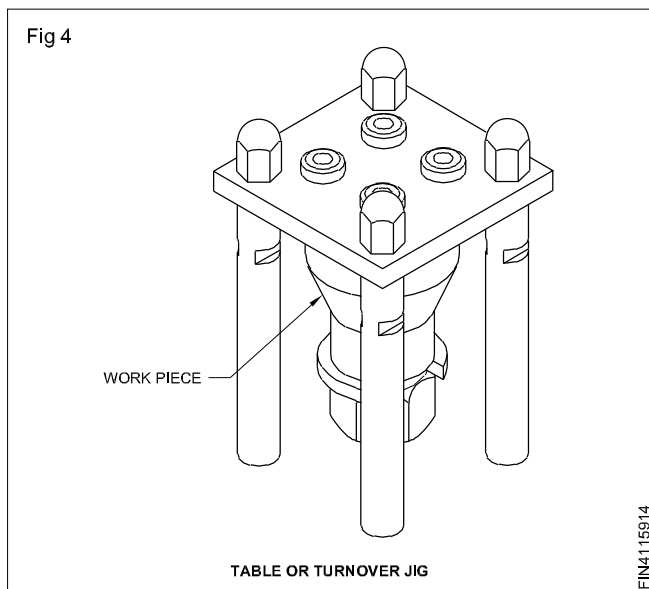


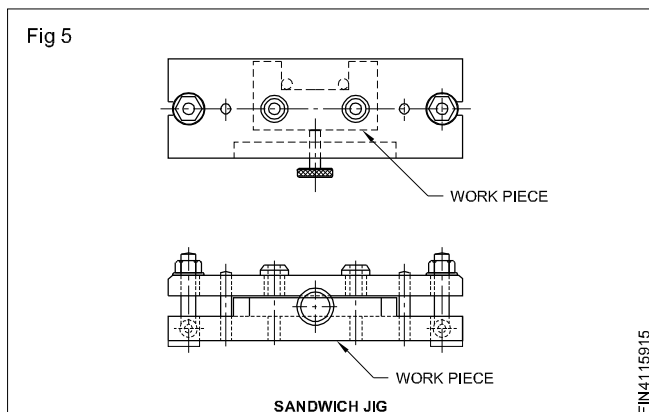
Table jig (Turnover jig)

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)



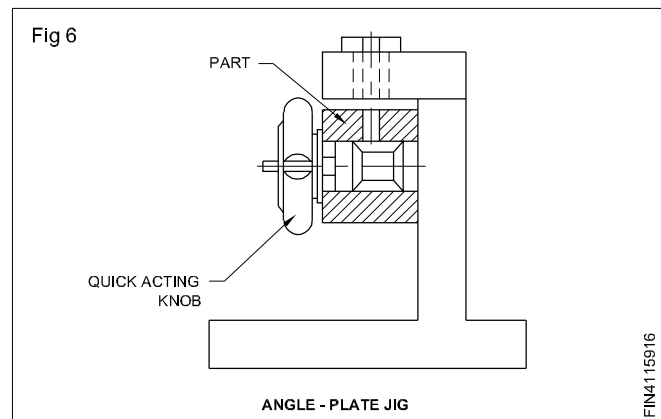
Sandwich jig

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)



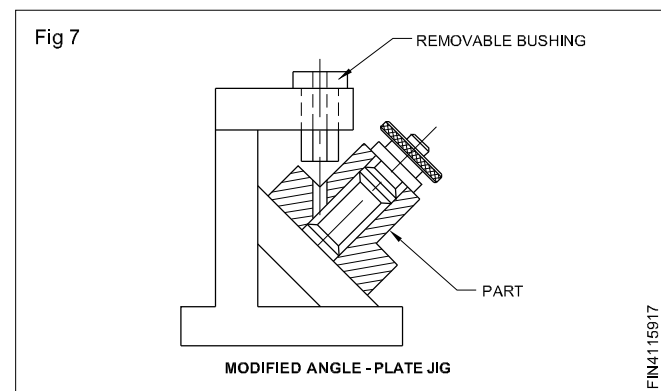
Angle plate jig

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



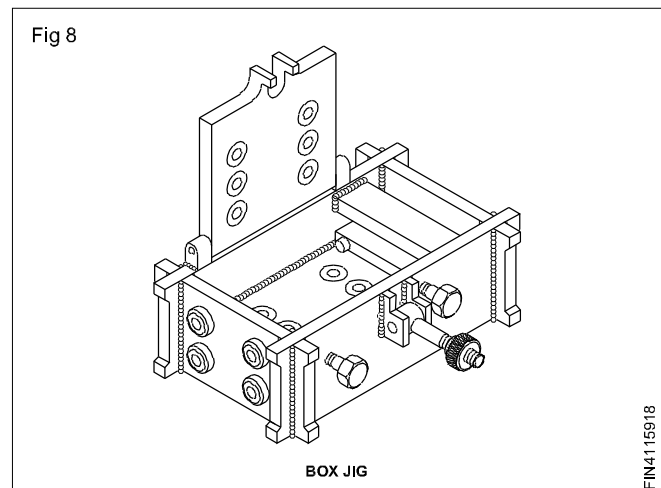
Modified angle plate jig

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



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.



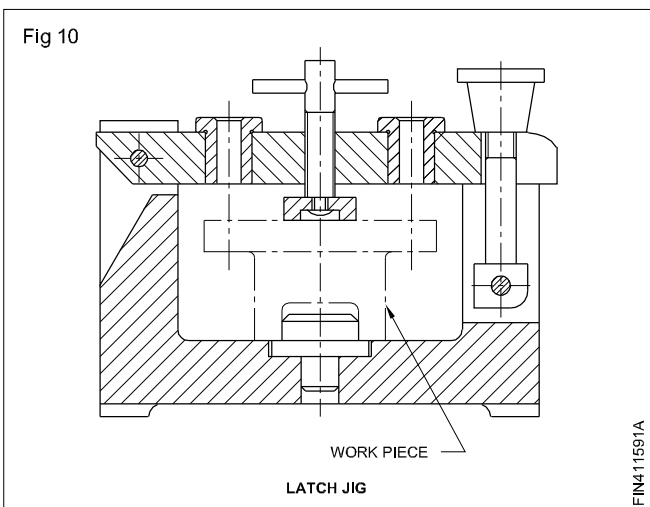
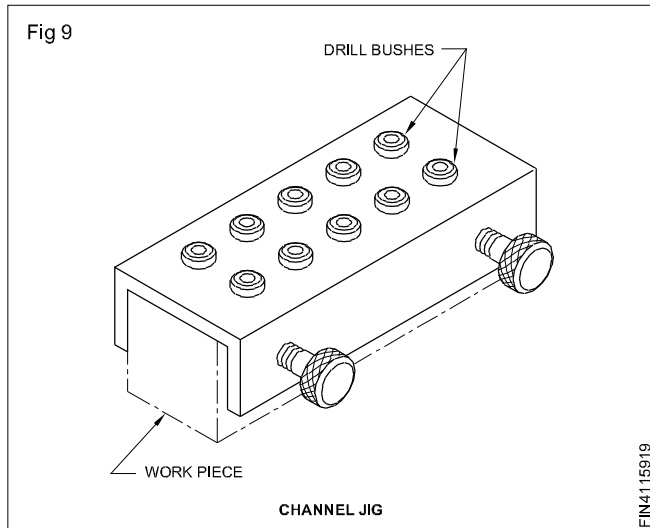
Channel jig

They are the simplest form of box jigs.

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

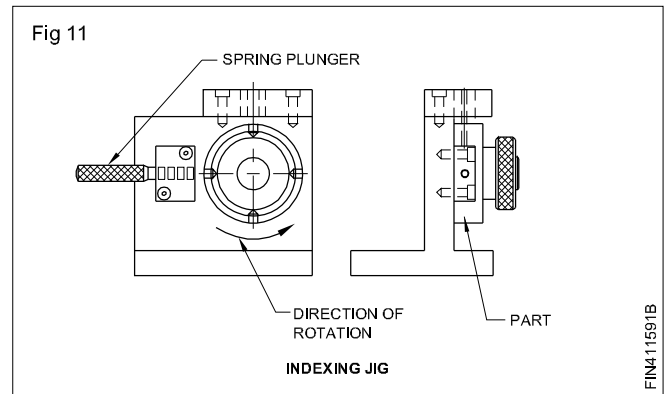
Latch or leaf jig

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)



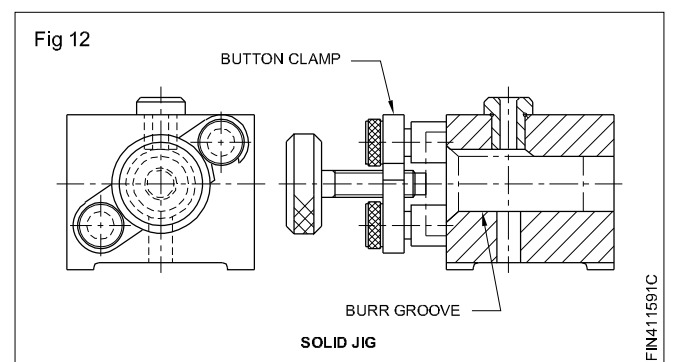
Indexing jig

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)



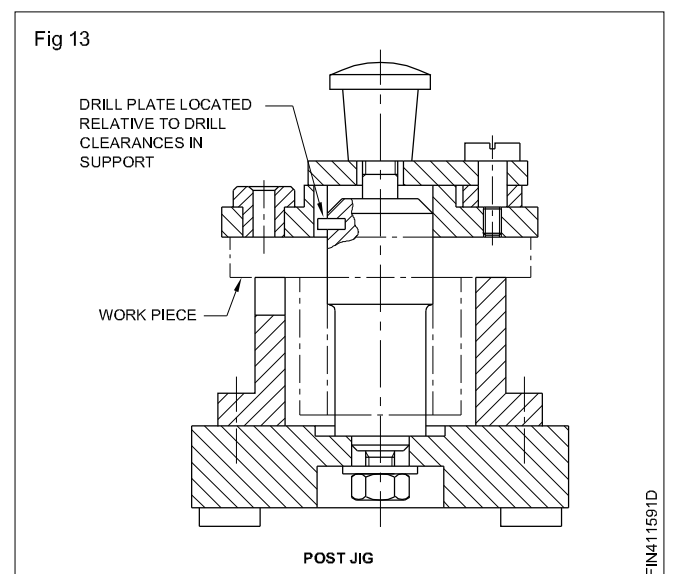
Solid jig

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)



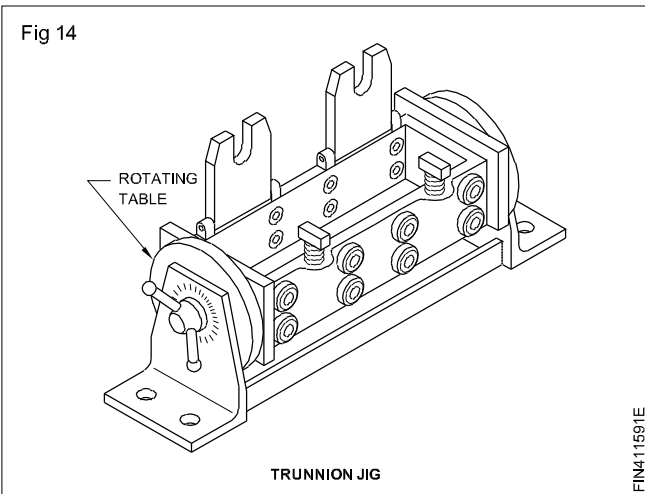
Post jig

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)



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)

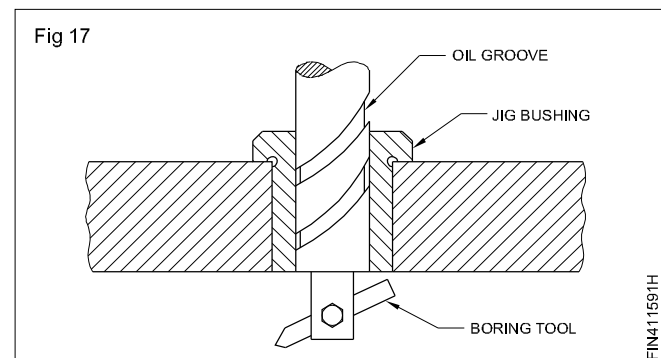
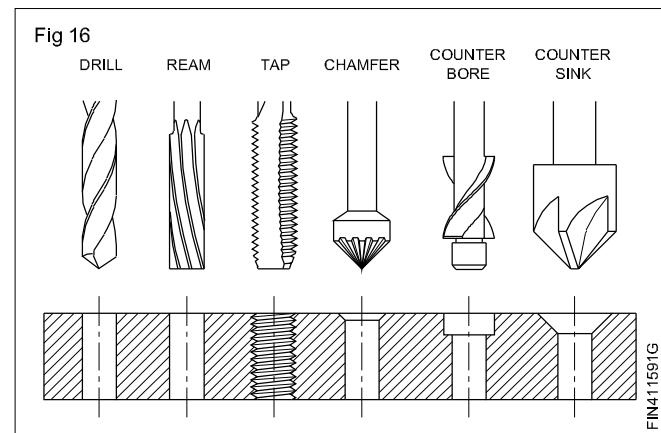
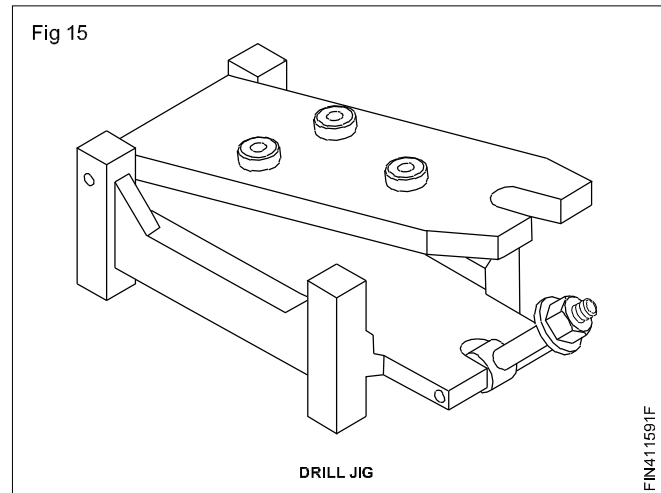


A jig is a special device which holds, supports, locates and also guides the cutting tool during operation. Jigs are designed to accommodate one or more components at a time.

Jigs are available for drilling or boring.

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

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



Constructional features of drill jig

Objectives: This shall help you 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

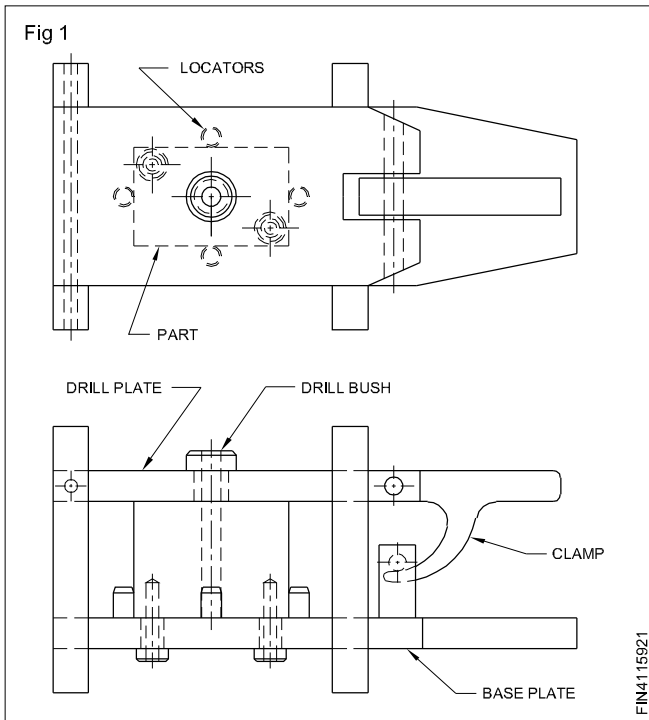
This provides a rigid support for mounting piece parts, locating pins etc.

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

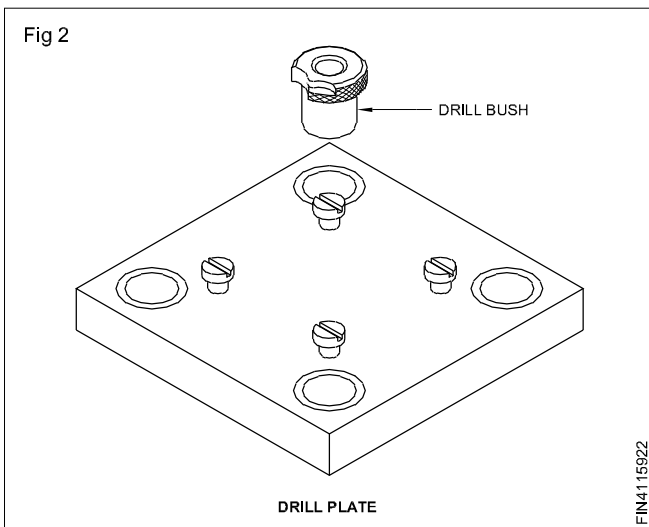
Drill plate

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.

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)



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

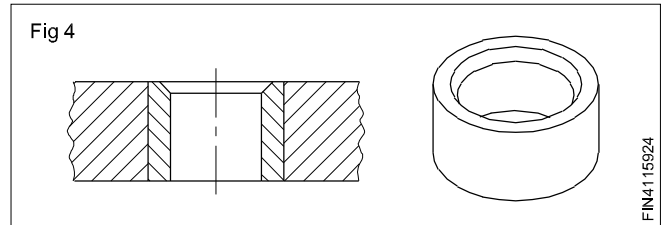
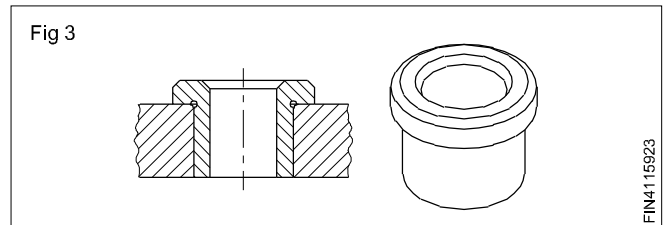
Types of drill bushes

- Press fit bushes
- Renewable bushes
- Liner bushes

Press fit bushes are made in two forms.

- Head
- Headless

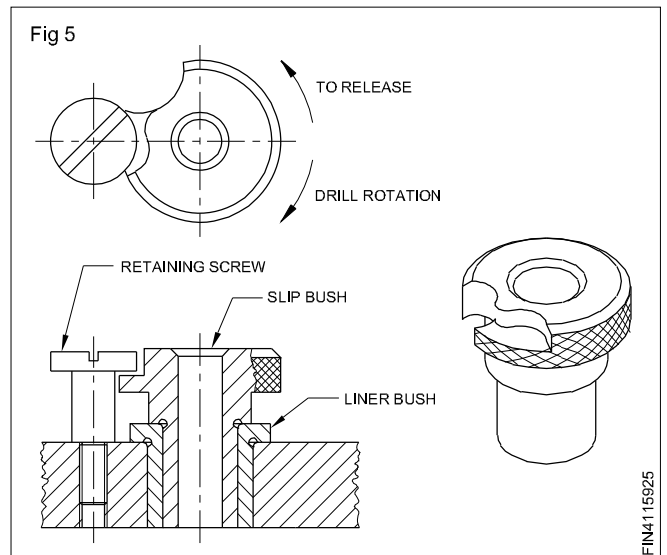
These bushes are used where frequent change of bushes is not anticipated. (Figs 3 and 4)



Renewable bushes are divided into two groups.

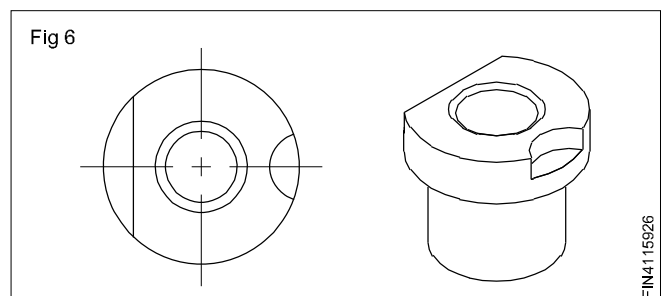
Slip renewable bushes (slip bushes)

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)

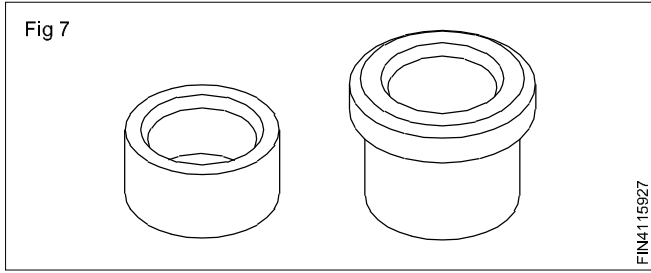


Fixed renewable bushes

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)



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)

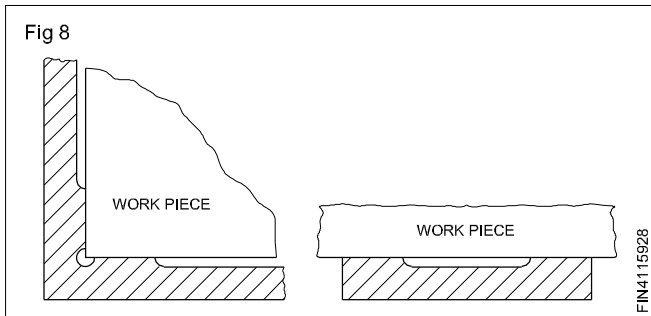


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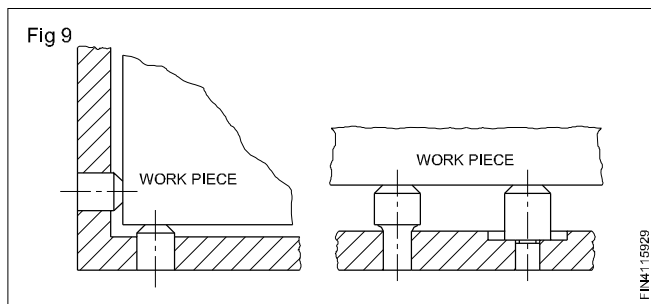
Locating pins or locaters are used

- 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).

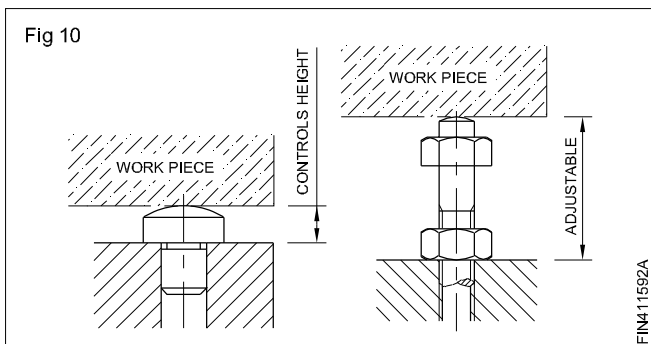
Different types of locating pins are used according to the shape of the component and also according to the hole locaters. A few types of locating pins are shown in Figs 8 to 16.



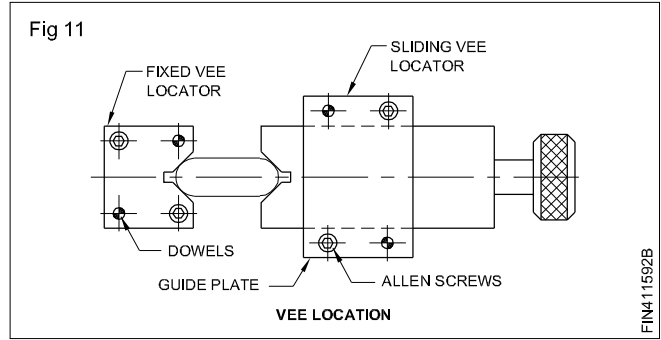
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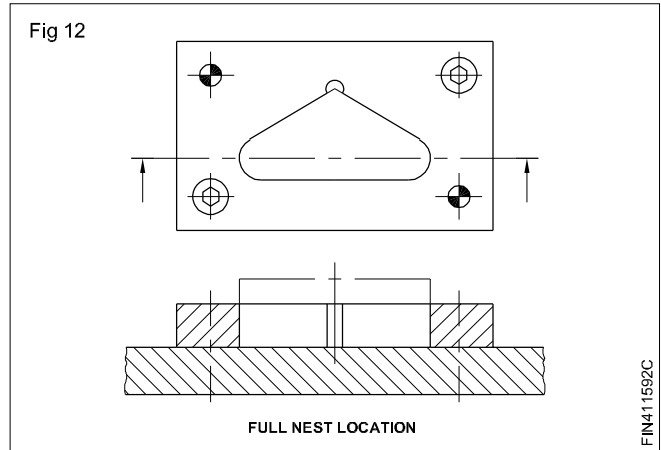
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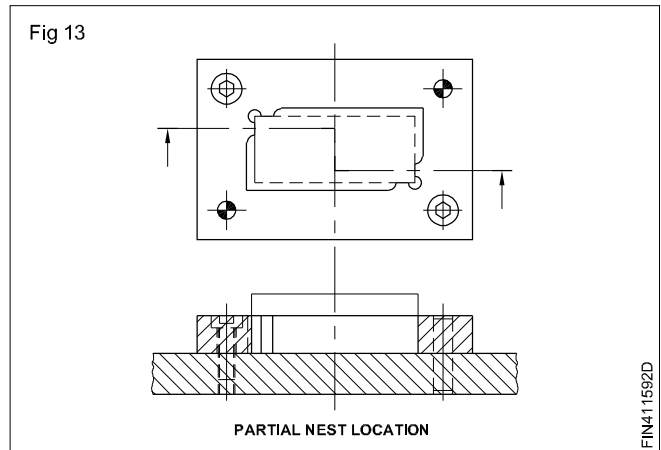
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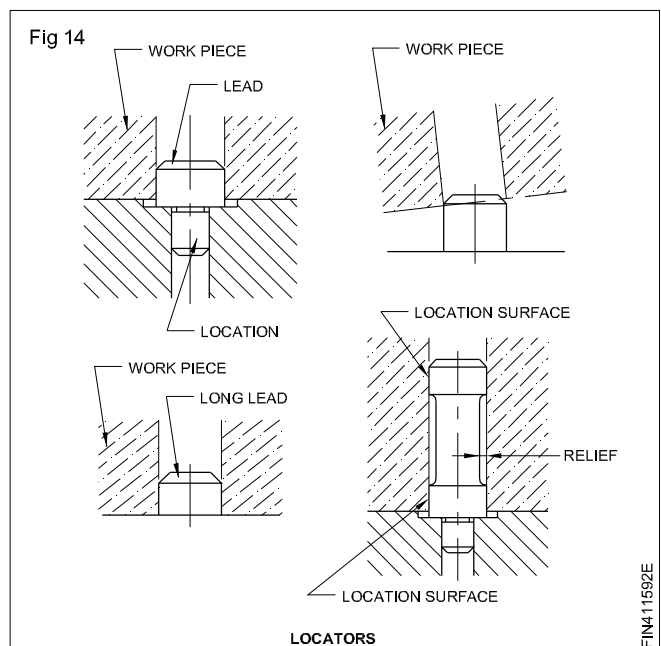
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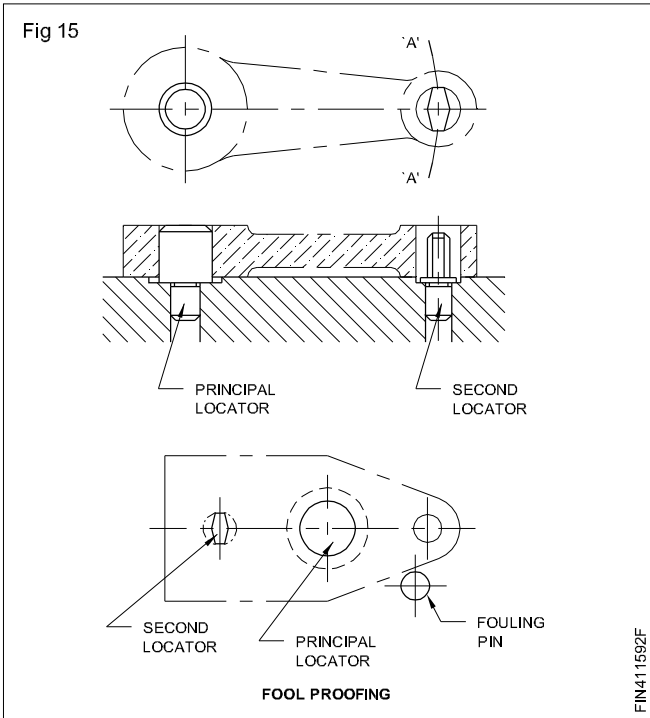
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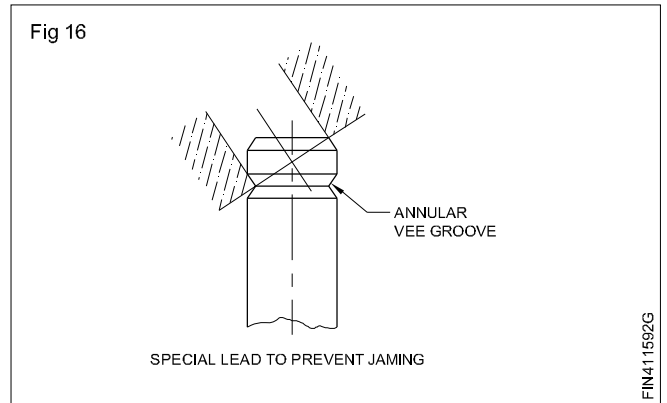
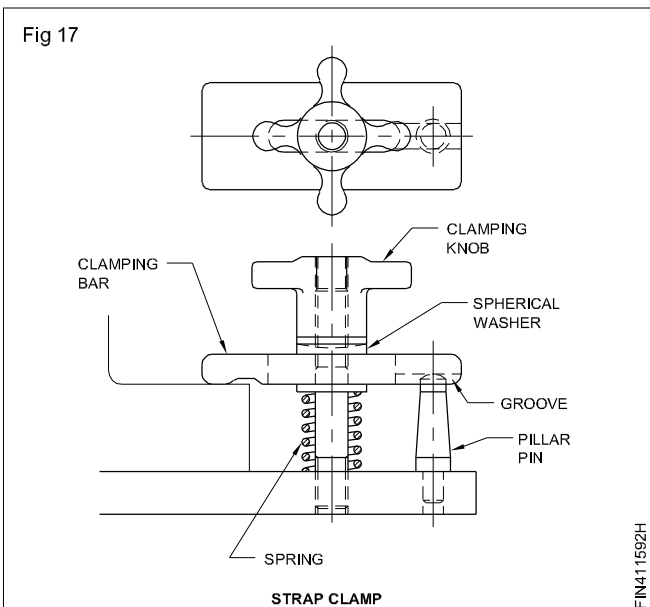
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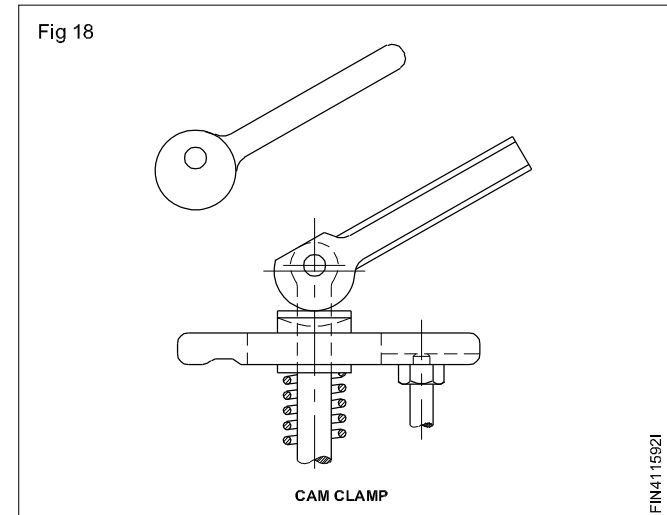
Clamps

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.

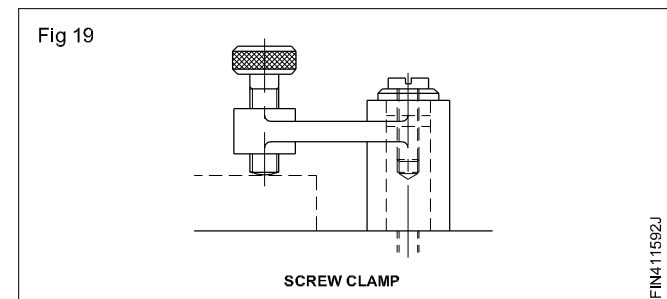
The commonly used types of clamps are:
strap clamp (Fig 17)



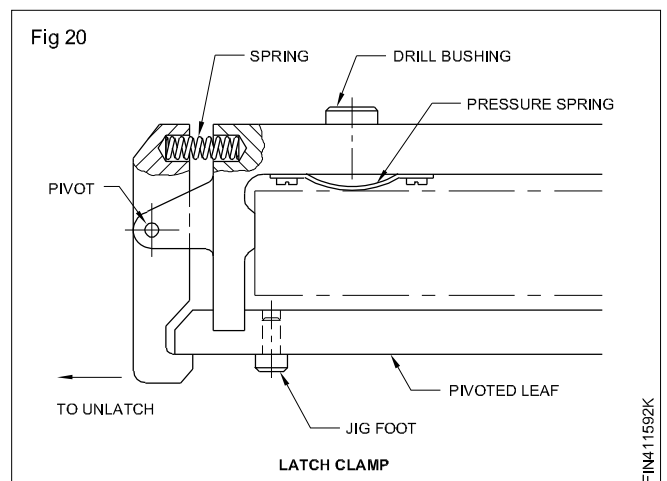
- cam clamp (Fig 18)



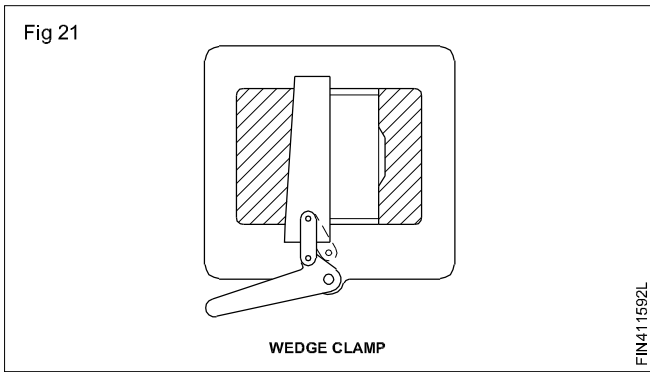
- screw clamp (Fig 19)



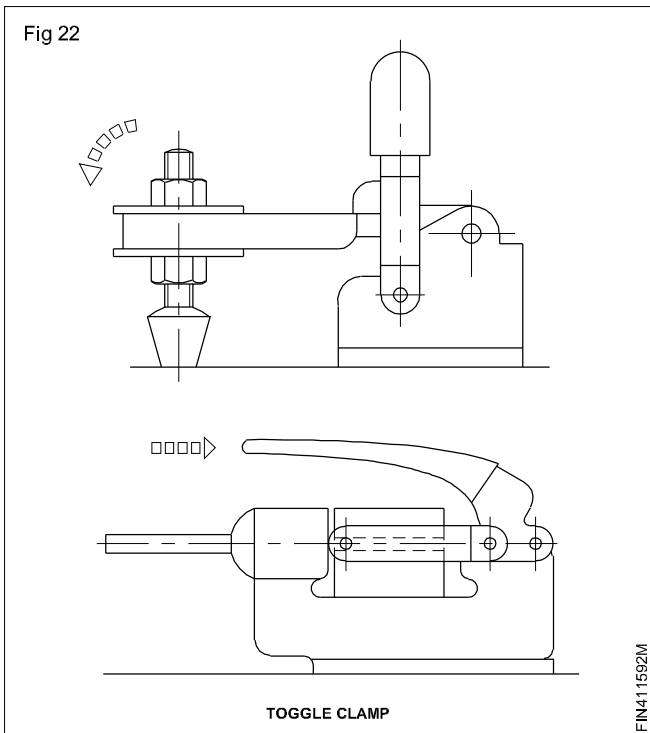
- latch clamp (Fig 20)



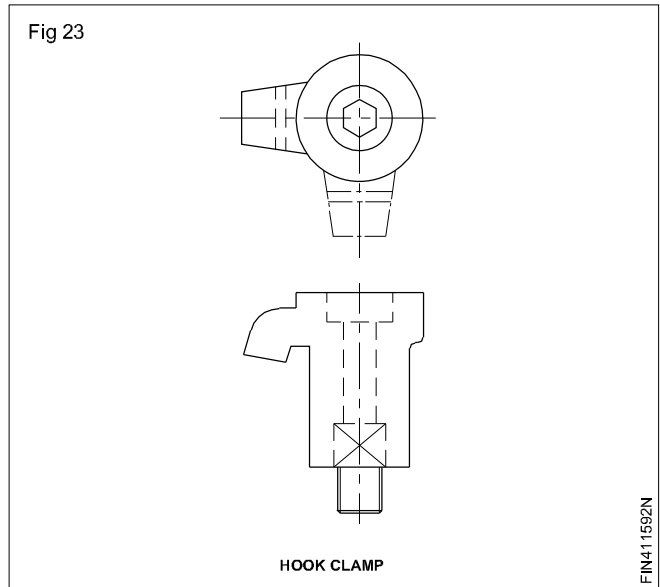
- wedge clamp (Fig 21)



- toggle clamp (Fig 22)



- hook clamp (Fig 23)



Fixtures - constructional features, types and uses

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

- what is fixture
- list the different type of fixture and uses
- state the constructional features of fixtures
- state the functions of setting blocks and blancing weight in fixture.

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

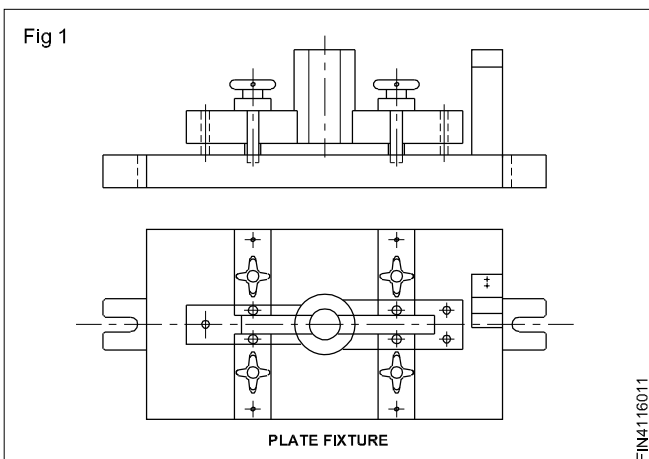
- location
- clamping
- tool guiding or setting
- body base or frame

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

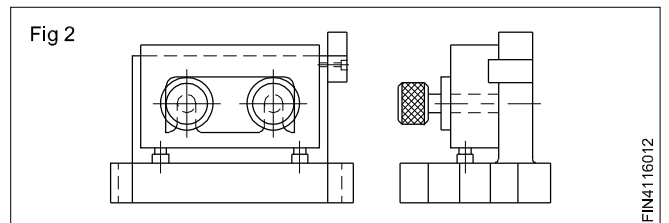
Plate fixture

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



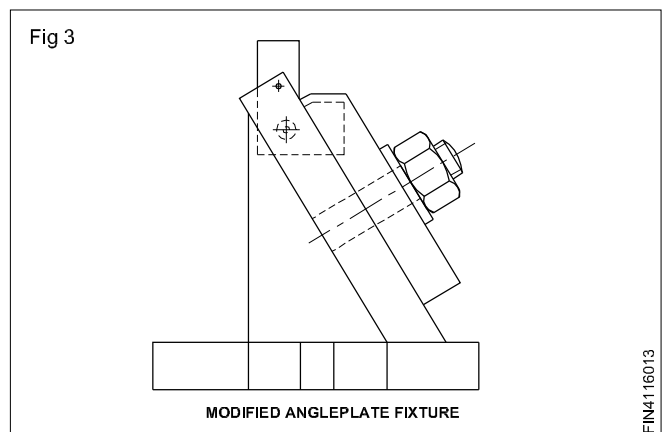
Angle plate fixture

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



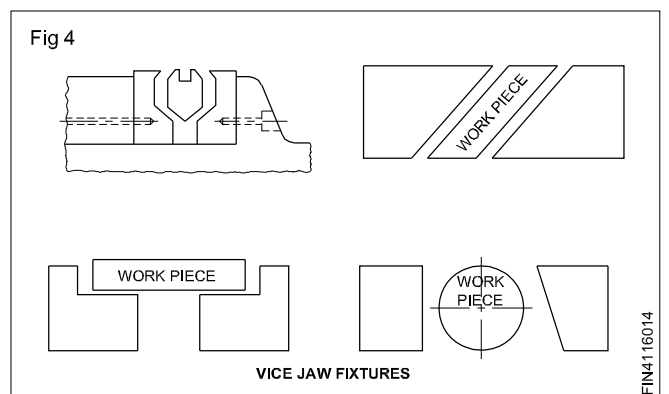
Modified angle plate fixture

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



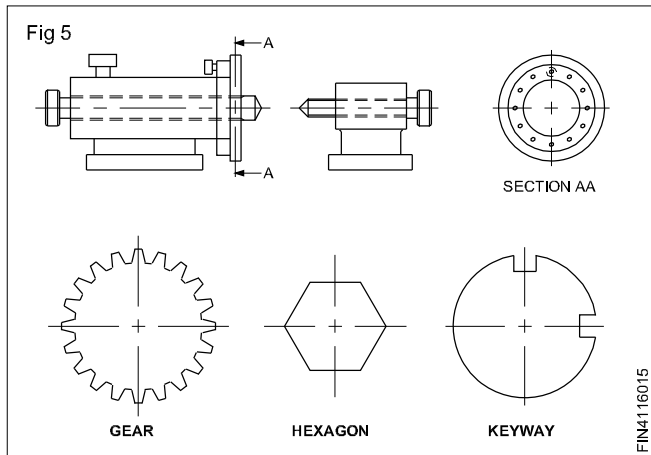
Vice jaw fixture

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)



Indexing fixtures

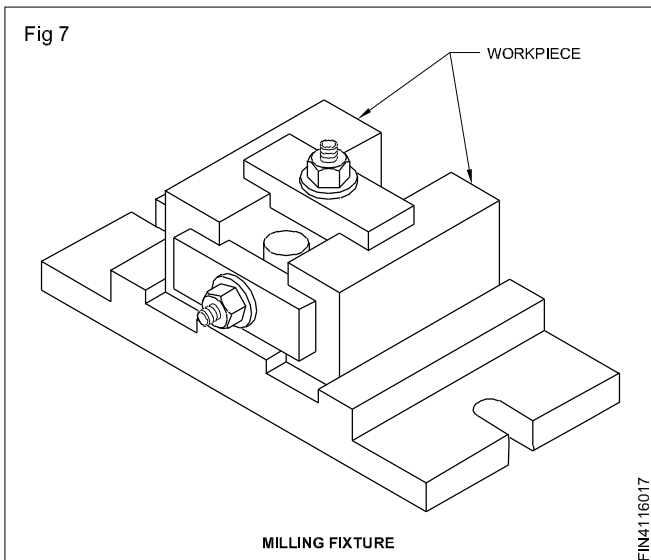
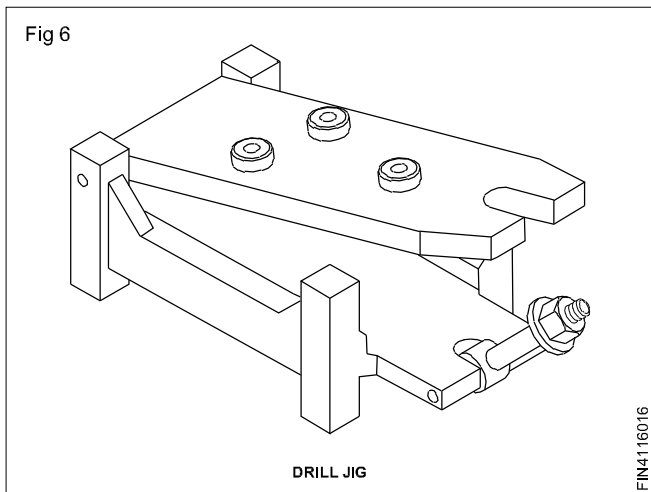
These fixtures are used for parts that require machining on evenly spaced surfaces. (Fig 5)



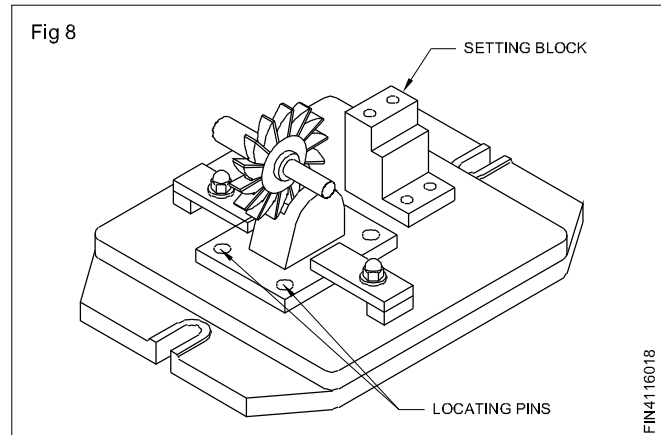
Use of fixtures

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.

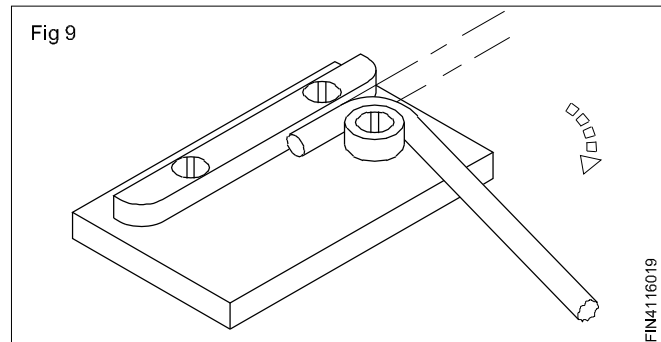


fixture is a production tool that locates and holds the work-piece. It does not guide the cutting tools, but the tools can be positioned before cutting with the help of setting blocks and feeler gauges etc. (Fig 8)



Fixtures of different types are made for:

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



Constructional features of a fixture

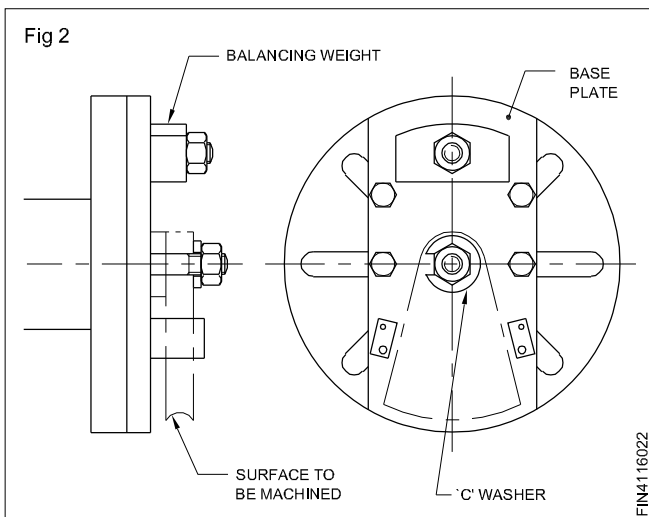
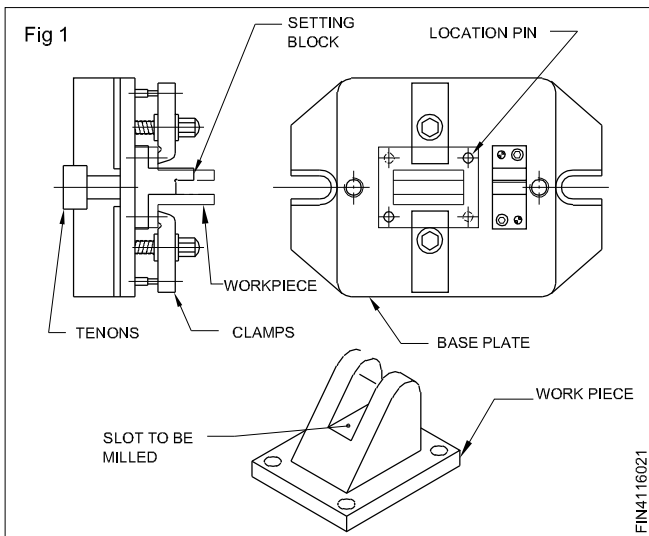
Objective: This shall help you to

- define various constructional features of a 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.

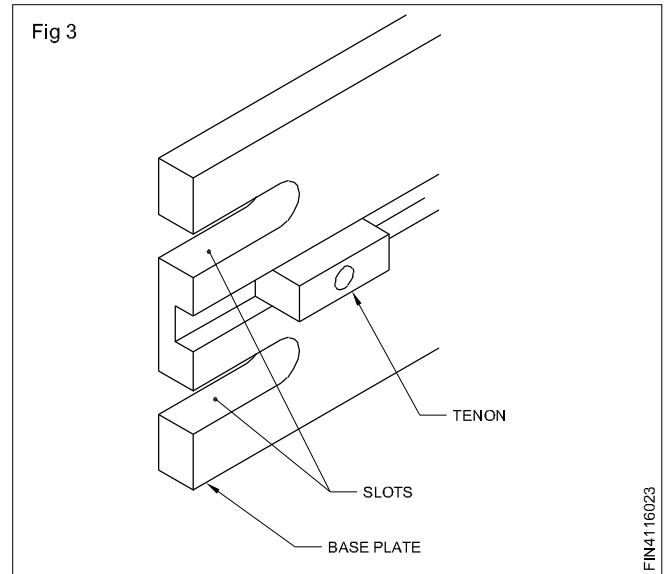


Base plate

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

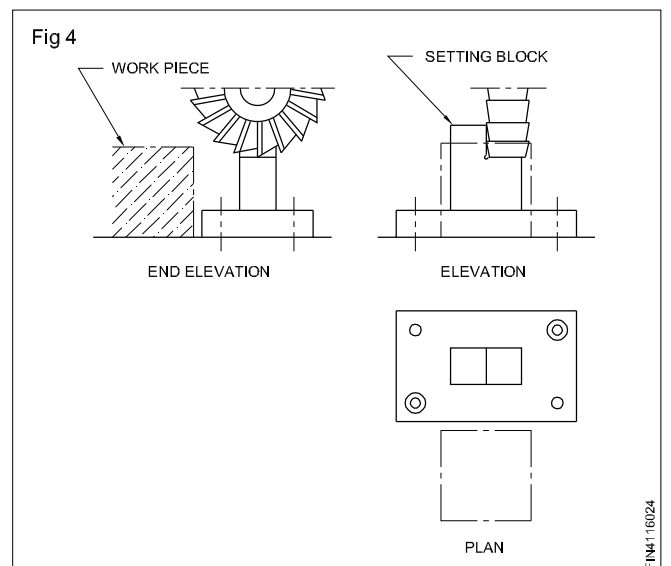


workpieces with the fixture as in the case of drill jigs. The clamps used in the fixtures are very rigid and sturdy.

The setting blocks

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

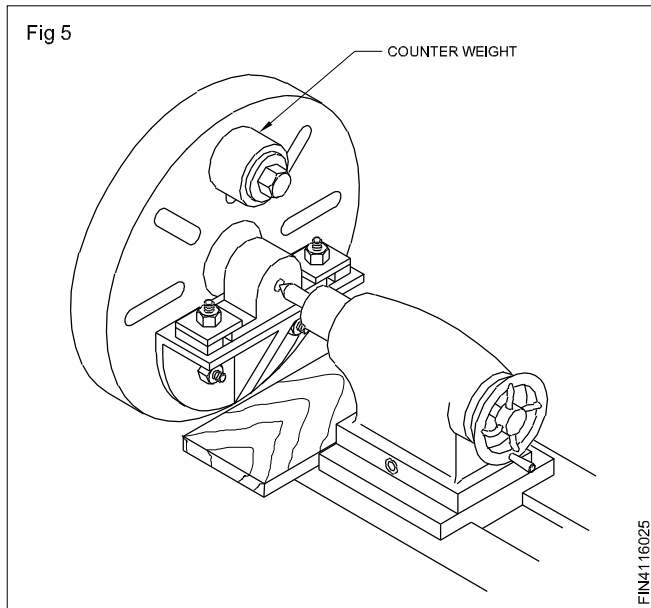
A feeler is introduced between the cutter and the setting faces of the block for correct positioning of the cutter with the fixture. (Fig 4)



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)

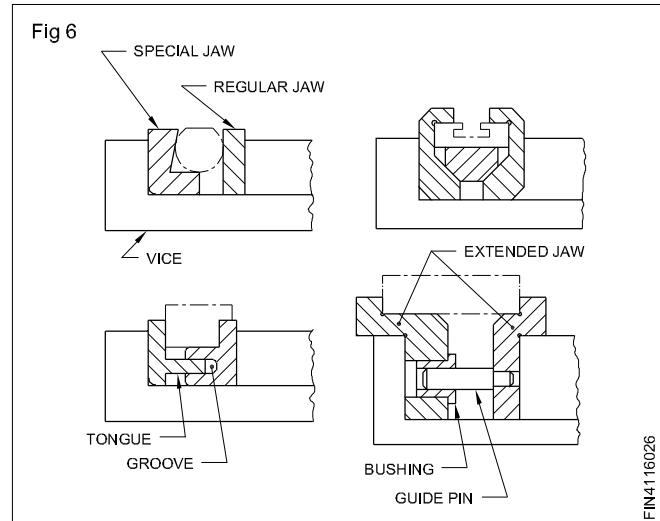


Vice fixture

Standard machine vices, attached with special jaws, provide an easy method of holding parts for machining. (Fig 6)

Other types of tooling used for positioning parts relative to each other for fabricating purposes are also commonly referred to as fixtures. Bending fixtures, assembly fixtures and welding fixtures are examples of this type.

The construction of a fixture depends upon the machining and fabricating methods employed.



Difference between jigs and fixtures

Jigs	Fixtures
<p>jig holds and positions the work piece, guides the cutting tool</p> <p>Jig is not fixed to the machine table</p> <p>Jigs are used in drilling machine for drilling, tapping, counter boring, and countersinking etc.</p>	<p>Fixture only hold and position the work piece, does not guide the cutting tool</p> <p>Fixture is usually fixed to the machine table</p> <p>Fixtures are used in grinding, milling, turning, bending and assembling.</p>