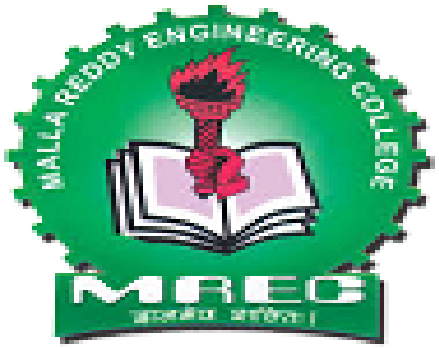
MACHINE DRAWING LABORATORY

LAB MANUAL



MALLA REDDY ENGINEERING COLLEGE
(Autonomous)
Maisammaguda, Gundlapochampally, Medchal, Hyderabad.

Department of Mechanical Engineering

MACHINE DRAWING LAB

- **Introduction to machine drawing**
- **Drafting of simple machine elements**

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2. **EXERCISE I (b)**
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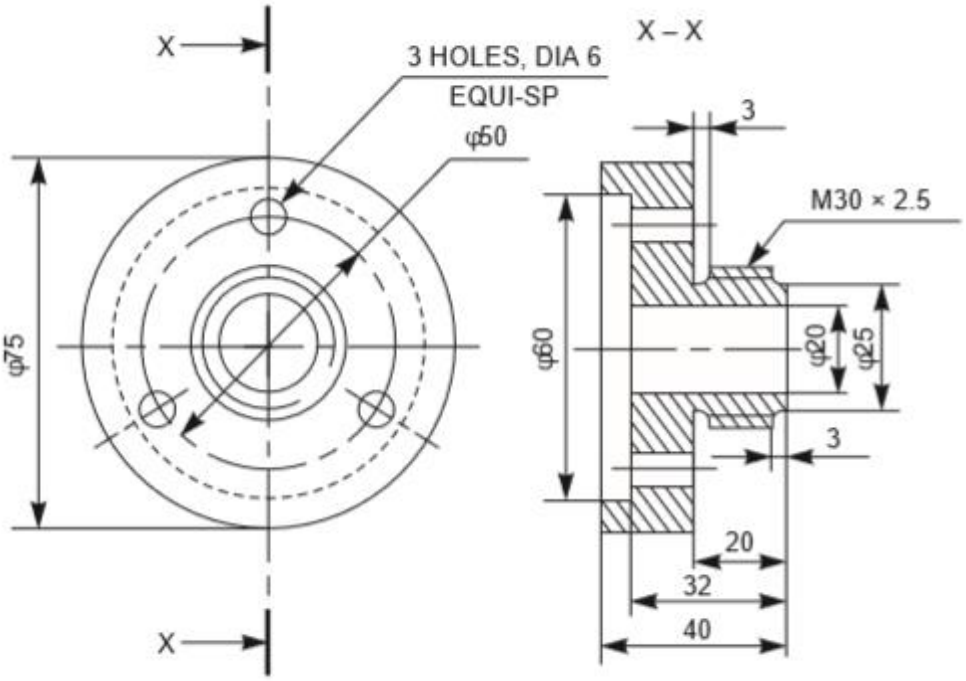
Introduction to machine drawing

It is pertaining to machine parts or components. It is presented through a number of orthographic views, so that the size and shape of the component is fully understood. Part drawings and assembly drawings belong to this classification. An example of a machine drawing is given in Fig.



Drafting of simple machine elements

Machine element refers to an elementary component of a machine. These elements in machine drawing are frame members, bearings, axles, fasteners, etc.

EXERCISE I (a)

Drafting of section elements and machine parts

In order to show the inner details of a machine component, the object is imagined to be cut by a cutting plane and the section is viewed after the removal of cut portion. Sections are made by at cutting planes and are designated by capital letters and the direction of viewing is indicated by arrow marks.

Hatching of sections:

Hatching is generally used to show areas of sections. The simplest form of hatching is generally adequate for the purpose, and may be continuous thin lines (type B) at a convenient angle, preferably 45°, to the principal outlines or lines of symmetry of the sections

Preferred hatching angle

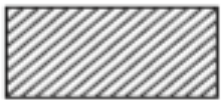
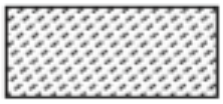
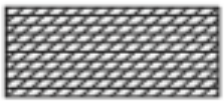
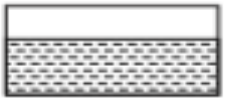
EXERCISE I (b)

Conventional representation of materials and machine components

Certain draughting conventions are used to represent materials in section and machine elements in engineering drawings.

Materials:

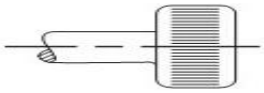
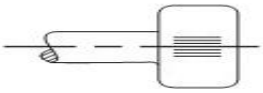
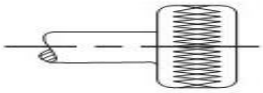
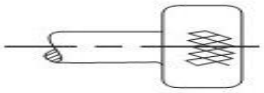
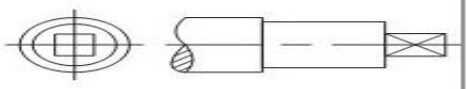
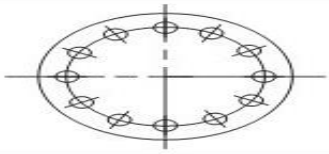
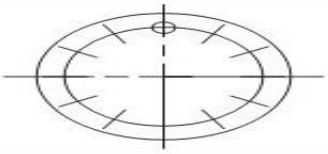
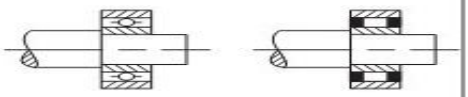
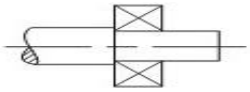
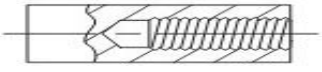
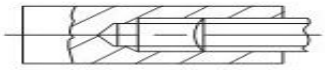
As a variety of materials are used for machine components in engineering applications, it is preferable to have different conventions of section lining to differentiate between various materials. The recommended conventions in use are shown in Fig.

Type	Convention	Material
Metals		Steel, Cast Iron, Copper and its Alloys, Aluminium and its Alloys, etc.
		Lead, Zinc, Tin, White-metal, etc.
Glass		Glass
Packing and Insulating material		Porcelain, Stoneware, Marble, Slate, etc.
		Asbestos, Fibre, Felt, Synthetic resin products, Paper, Cork, Linoleum, Rubber, Leather, Wax, Insulating and Filling materials, etc.
Liquids		Water, Oil, Petrol, Kerosene, etc.
Wood		Wood, Plywood, etc.
Concrete		A mixture of Cement, Sand and Gravel

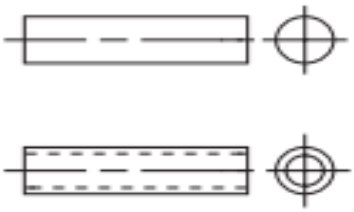
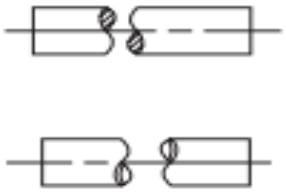
Conventional Representation of Materials

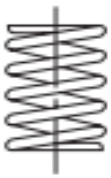
Machine Components:

When the drawing of a component in its true projection involves a lot of time, its convention may be used to represent the actual component. Figure shows typical examples of conventional representation of various machine components used in engineering drawing.

Title	Subject	Convention
Straight knurling		
Diamond knurling		
Square on shaft		
Holes on circular pitch		
Bearings		
External screw threads (Detail)		
Internal screw threads (Detail)		
Screw threads (Assembly)		

Conventional Representation of Machine Components

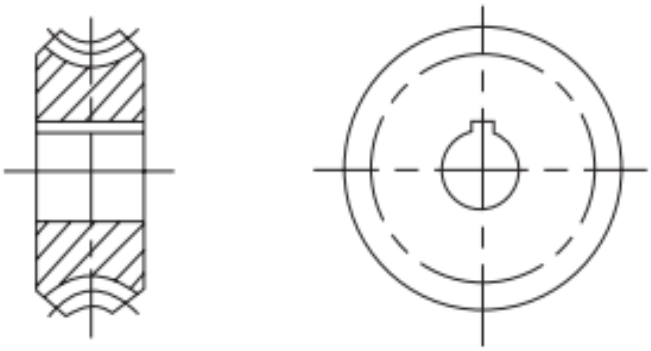
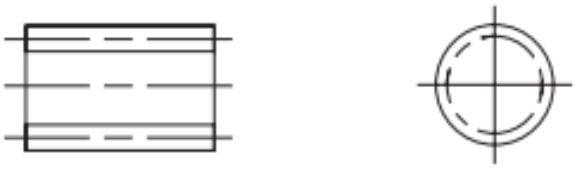
Title	Subject	Convention
Splined shafts		
Interrupted views		
Semi-elliptic leaf spring		
Semi-elliptic leaf spring with eyes		

Subject	Convention	Diagrammatic Representation
		
		

Cylindrical compression spring

Cylindrical tension spring

Conventional Representation of Machine Components

Title	Convention
Spur gear	
Bevel gear	
Worm wheel	
Worm	

Conventional Representation of Machine Components

Aim: To draw conventional machine Components and materials.

Software used: Auto cad 2016

Commands used:

Draw commands:

Line,Rectangle,Poly line,Polygon,Circle,Construction line,Arc,Spline,Ray,Hatch.

Modify commands:

Erase,Copy,Mirror,Array,Move,Rotate,Trim,Extend,Stretch,Fillet,Join,

Chamfer.

Dimension command:

Radius dimension

Linear dimension

Diameter dimension

Angular dimension

PROCEDURE:

Specify units by using units command unit change the insertsents by given and click on OK button

Now you have to specify drawing size using LI enter command

First enter 0, 0 and enter 420,297 and click enter

Reset model space limits

Specify lower left corner or [on/off] <0, 0>0, 0

Specify upper right corner <12, 9> 420,297

Refit the screen by using zoom command

Draw required convention by taking suitable dimension

Draw convention representation of metal

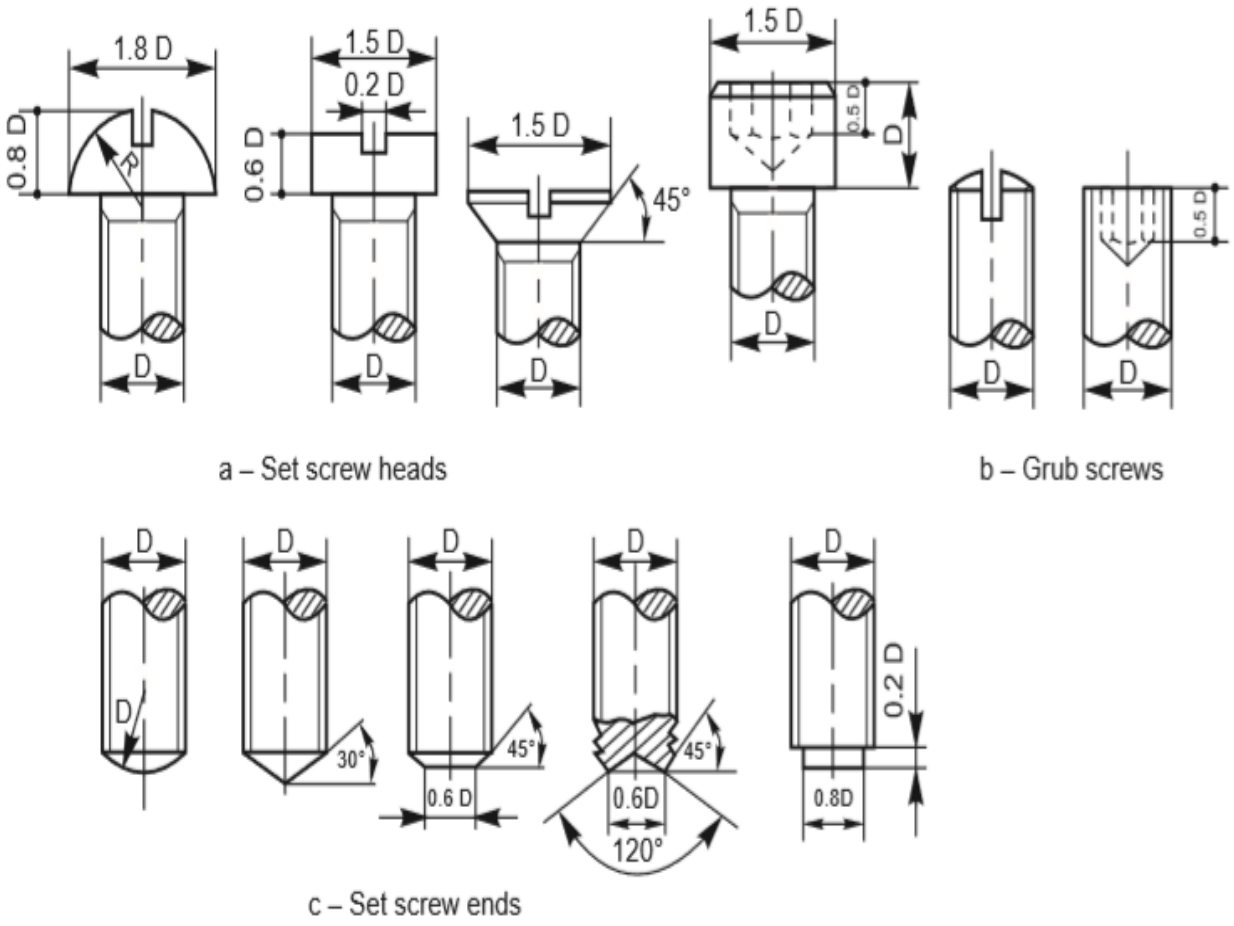
Specify convention by hatch command

Save the drawn diagram at a specified folder

Conclusion: The required conventional machine and materials is drafted in auto cad 2016 software.

EXERCISE II

Drafting of screw heads, stud bolts, tab holes and set screws



Different forms of Set Screws

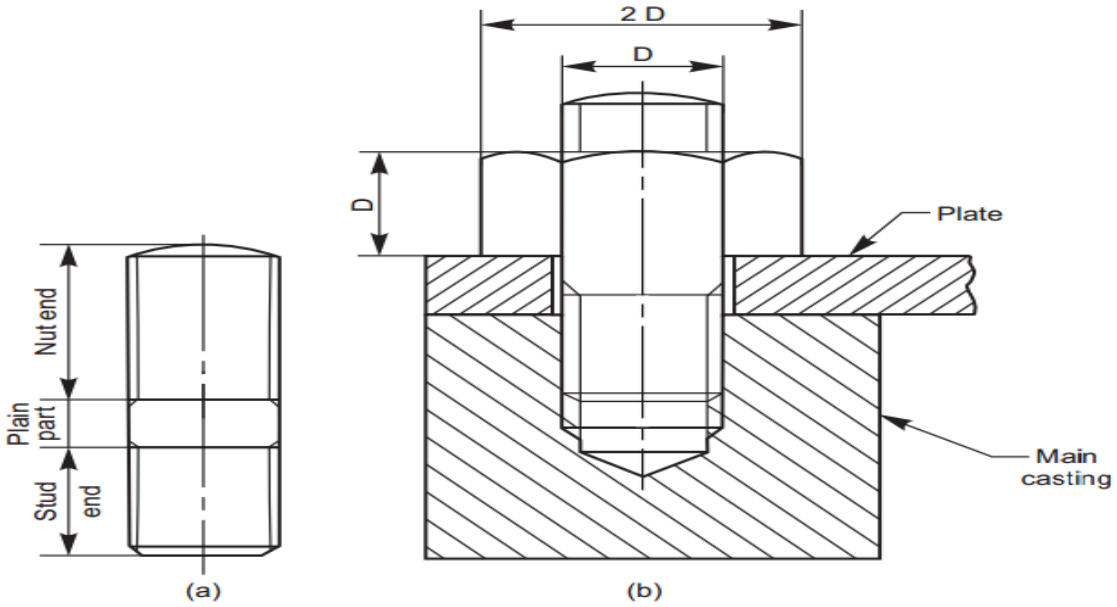


Fig. 5.22 (*a*)–Stud, (*b*)–Stud joint

Stud Bolt

Aim: To draw screw heads, stud bolts, tab holes and set screws

Software used: Auto cad 2016

Commands used:

Draw commands:

Line,Rectangle,Poly line,Polygon,Circle,Construction line,Arc,Spline,Ray,Hatch.

Modify commands:

Erase,Copy,Mirror,Array,Move,Rotate,Trim,Extend,Stretch,Fillet,Join,

Chamfer.

Dimension command:

Radius dimension

Linear dimension

Diameter dimension

Angular dimension

PROCEDURE:

Specify units by using units command unit change the insertsents by given and click on OK button

Now you have to specify drawing size using LI enter command

First enter 0, 0 and enter 420,297 and click enter

Reset model space limits

Specify lower left corner or [on/off] <0, 0>0, 0

Specify upper right corner <12, 9> 420,297

Refit the screen by using zoom command

Draw required screw heads, stud bolts, tab holes and set screws

Specify convention by hatch command

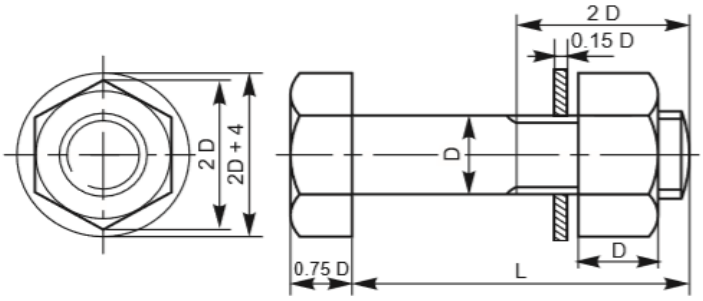
Save the drawn diagram at a specified folder

Give the dimensions to the drawn diagram by using different methods of dimensions

Conclusion: The required screw heads, stud bolts, tab holes and set screws is drafted in auto cad 2016 software.

EXERCISE III

Drafting of hexagonal nut and bolt assembly with washer



Aim: To draft a hexagonal nut and bolt with washer by using auto cad 2016 software

Software used: Auto cad 2016

Commands used:

Draw commands:

Line,Rectangle,Poly line,Polygon,Circle,Construction line,Arc,Spline,Ray,Hatch.

Modify commands:

Erase,Copy,Mirror,Array,Move,Rotate,Trim,Extend,Stretch,Fillet,Join,

Chamfer.

Dimension command:

Radius dimension

Linear dimension

Diameter dimension

Angular dimension

PROCEDURE:

Specify units by using units command unit change the insertsents by given and click on OK button

Now you have to specify drawing size using LI enter command

First enter 0, 0 and enter 420,297 and click enter

Reset model space limits

Specify lower left corner or [on/off] <0, 0>0, 0

Specify upper right corner <12, 9> 420,297

Refit the screen by using zoom command

Draw required hexagonal headed bolt with a nut and washer by taking suitable dimensions

Draw bolt by using commands and draw side view of bolt with command circle between the circles or draw hexagonal by using polygon

By using line command draw washer and hatch the section of washer by using hatch command

Give the dimensions to the drawn diagram by using different methods of dimensions

Result: The required hexagonal nut with bolt and washer is drafted in auto cad 2016 software

EXERCISE IV

Drafting of cotter joint with sleeve

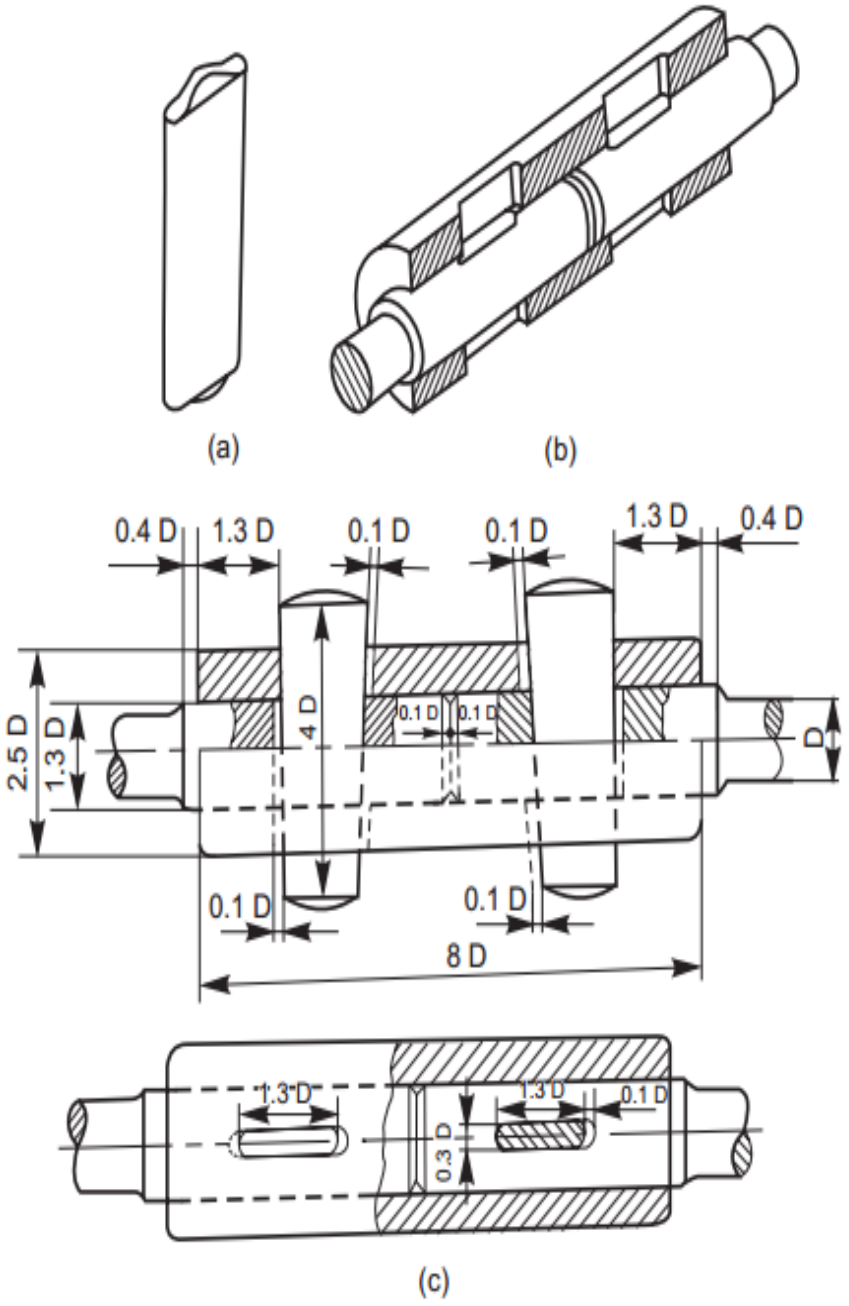


Fig. 6.12 Cotter joint with sleeve

Aim: To draft a cotter joint with sleeve by using software auto cad 2016

Software used: auto cad 2016

Commands used:

Draw commands:

Line,Rectangle,Poly line,Polygon,Circle,Construction line,Arc,Spline,Ray,Hatch.

Modify commands:

Erase,Copy,Mirror,Array,Move,Rotate,Trim,Extend,Stretch,Fillet,Join,

Chamfer.

Dimension command:

Radius dimension

Linear dimension

Diameter dimension

Angular dimension

PROCEDURE:

Specify units by using units command unit change the insertsents by given and click on OK button

Now you have to specify drawing size using LI enter command

First enter 0, 0 and enter 420,297 and click enter

Reset model space limits

Specify lower left corner or [on/off] <0, 0>0, 0

Specify upper right corner <12, 9> 420,297

Refit the screen by using zoom command

Draw the required cotter joint with sleeve by taking suitable dimensions

Draw the required left hand side of cotter joint draw the cotter portion by using rectangle command

Remove the sharp edges bu chamfer command

Draw the shaft by using rectangle command and draw the sleeve by using rectangle command

Draw arc for the sleeve by using arc command

Click hatch command angle 45 degrees line to line distance 2mm

Select the left hand portion of the cotter joint and click mirror command and select the axis point which we want and click enter

Give dimensions to cotter joint and change required dimension style

Result: The required cotter joint is drafted in software AutoCAD 2016

EXERCISE V

Drafting of knuckle joint

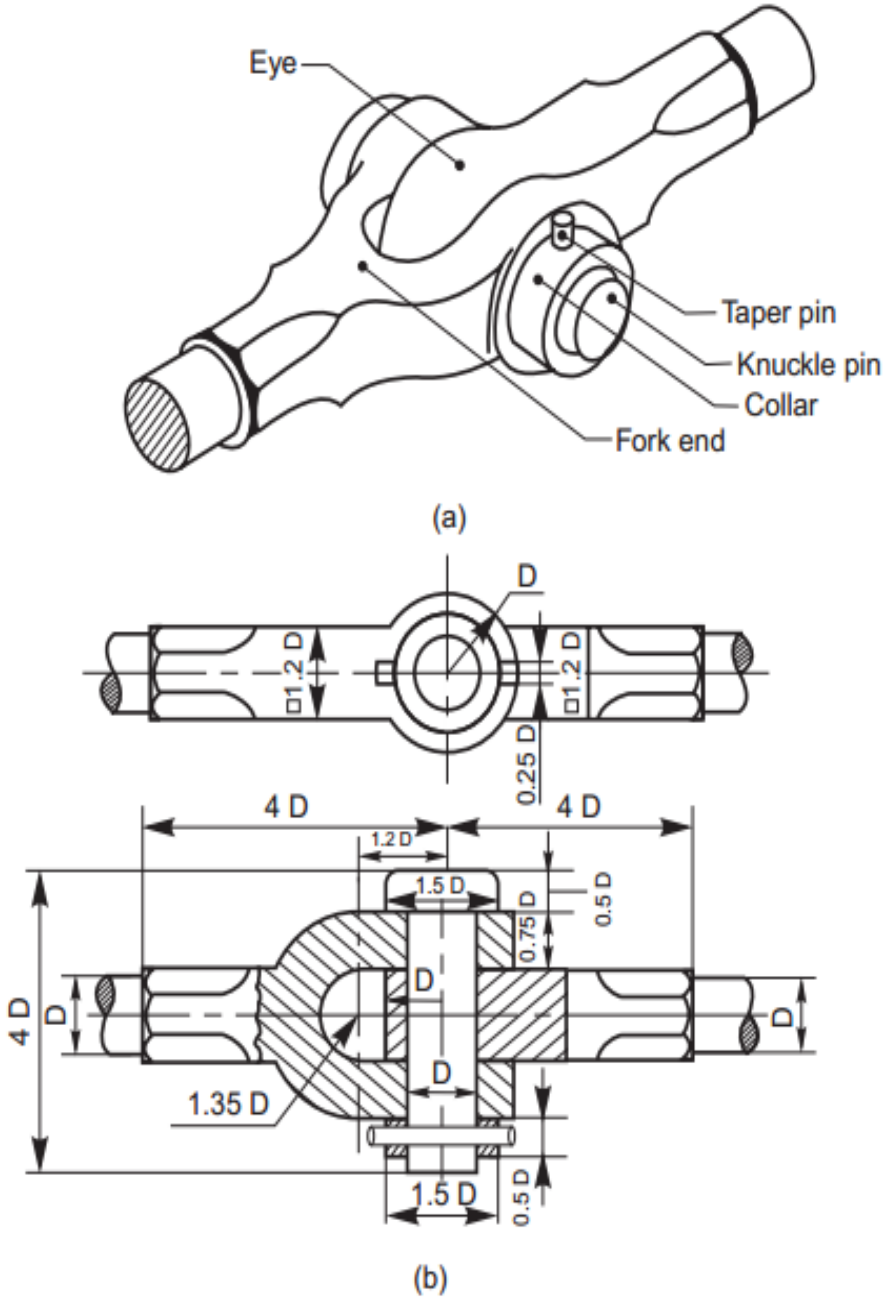


Fig. 6.15 Knuckle joint

Aim: To draft a knuckle joint using auto cad 2016

Software used: auto cad 2016

Commands used:

Draw commands:

Line,Rectangle,Poly line,Polygon,Circle,Construction line,Arc,Spline,Ray,Hatch.

Modify commands:

Erase,Copy,Mirror,Array,Move,Rotate,Trim,Extend,Stretch,Fillet,Join,

Chamfer.

Dimension command:

Radius dimension

Linear dimension

Diameter dimension

Angular dimension

PROCEDURE:

Specify units by using units command unit change the insertsents by given and click on OK button

Now you have to specify drawing size using LI enter command

First enter 0, 0 and enter 420,297 and click enter

Reset model space limits

Specify lower left corner or [on/off] <0, 0>0, 0

Specify upper right corner <12, 9> 420,297

Refit the screen by using zoom command

Draw the required knuckle joint by taking suitable dimensions

Select part 1 fork end and draw 2D object and use CAD feature on it

Select part 2 eye and draw 2D object and dimensions and use CAD feature on it

Select part 4 cotter draw 2D object and use CAD feature on it

Select the parts tapper pin it should be in tapered position

Assemble all parts by using command join

Give the dimensions on knuckle joint and change the require dimensions style

Result: The required knuckle joint is drafted by using auto cad 2016

EXERCISE VI

Drafting of Oldham coupling

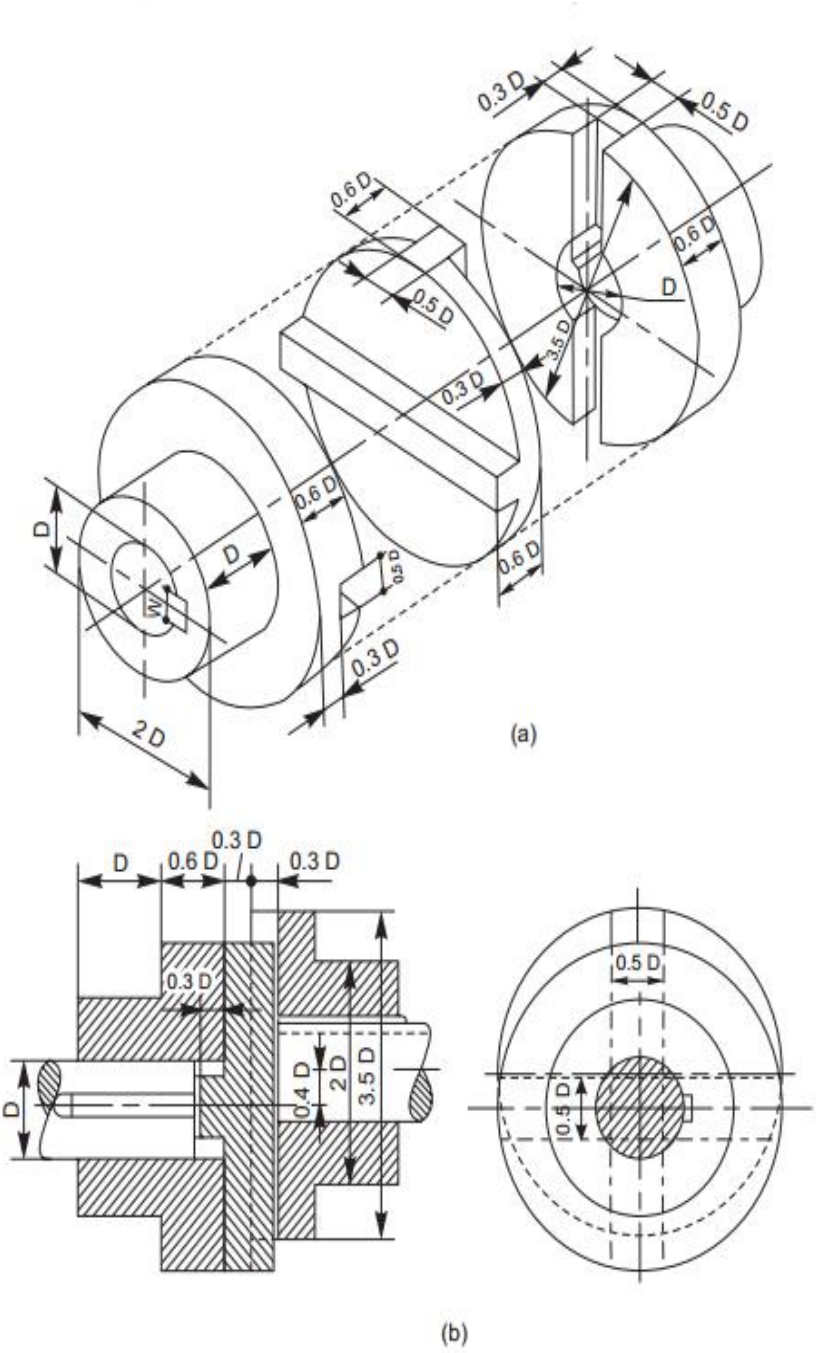


Fig. 7.12 Oldham coupling

Aim: To draft an Oldham Coupling by using software auto cad 2016

Software used: Auto cad 2016

Commands used:

Draw commands:

Line,Rectangle,Poly line,Polygon,Circle,Construction line,Arc,Spline,Ray,Hatch.

Modify commands:

Erase,Copy,Mirror,Array,Move,Rotate,Trim,Extend,Stretch,Fillet,Join,

Chamfer.

Dimension command:

Radius dimension

Linear dimension

Diameter dimension

Angular dimension

PROCEDURE:

Specify units by using units command unit change the insertsents by given and click on OK button

Now you have to specify drawing size using LI enter command

First enter 0, 0 and enter 420,297 and click enter

Reset model space limits

Specify lower left corner or [on/off] <0, 0>0, 0

Specify upper right corner <12, 9> 420,297

Refit the screen by using zoom command

Select the circle command and draw the Oldham with circle command

Draw the shaft circle by using the circle command and draw the key by using rectangle command on the shaft

Project all lines from the side view

Draw the Oldham by using auto cad feature

Draw the shaft and place the key on the shaft by given dimensions

Hatch the Oldham by sing hatch command angle 45 degrees and distance between lines of hatch is 2mm.

Give the dimensions so that Oldham Coupling and change the required dimensions style

Result: The required Oldham Coupling is drafted in software AutoCAD 2016

EXERCISE VII

Drafting of flanged coupling (butt muff coupling)

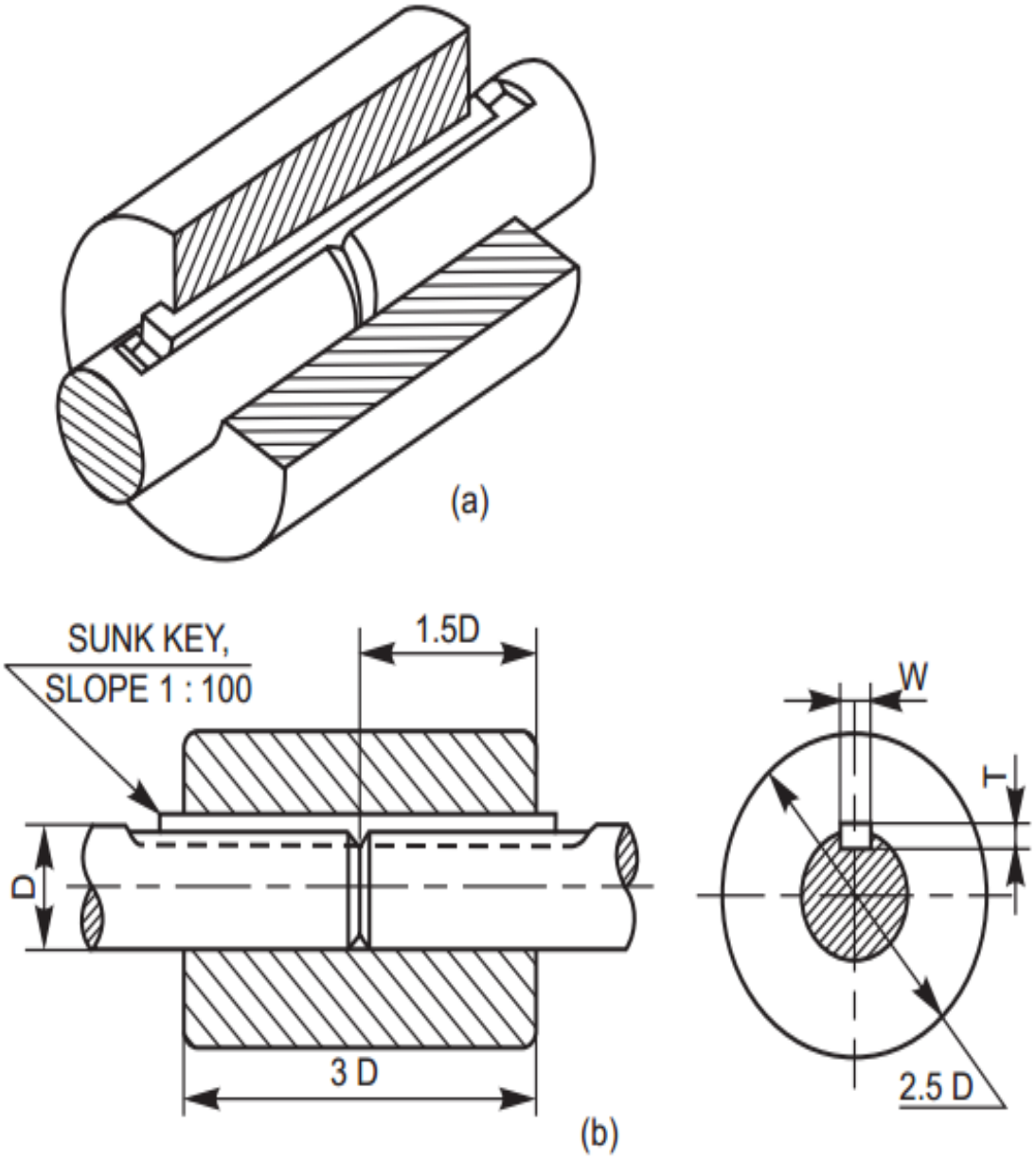


Fig. 7.1 Butt-muff coupling

Aim: To draft a butt muff coupling by using auto CAD 2016 software

Software used: Auto cad 2016

Commands used:

Draw commands:

Line,Rectangle,Poly line,Polygon,Circle,Construction line,Arc,Spline,Ray,Hatch.

Modify commands:

Erase,Copy,Mirror,Array,Move,Rotate,Trim,Extend,Stretch,Fillet,Join,

Chamfer.

Dimension command:

Radius dimension

Linear dimension

Diameter dimension

Angular dimension

PROCEDURE:

Specify units by using units command unit change the insertsents by given and click on OK button

Now you have to specify drawing size using LI enter command

First enter 0, 0 and enter 420,297 and click enter

Reset model space limits

Specify lower left corner or [on/off] <0, 0>0, 0

Specify upper right corner <12, 9> 420,297

Refit the screen by using zoom command

Select the circle command and draw the muff with circle command

Draw the shaft circle by using the circle command and draw the key by using rectangle command on the shaft

Project all lines from the side view

Draw the muff by using auto cad feature

Draw the shaft and place the key on the shaft by given dimensions

Hatch the muff by sing hatch command angle 45 degrees and distance between lines of hatch is 2mm

Give the dimensions so that muff coupling and change the required dimensions style

Result: The required muff coupling is drafted in auto cad 2016 software.

EXERCISE VIII

Drafting of universal coupling

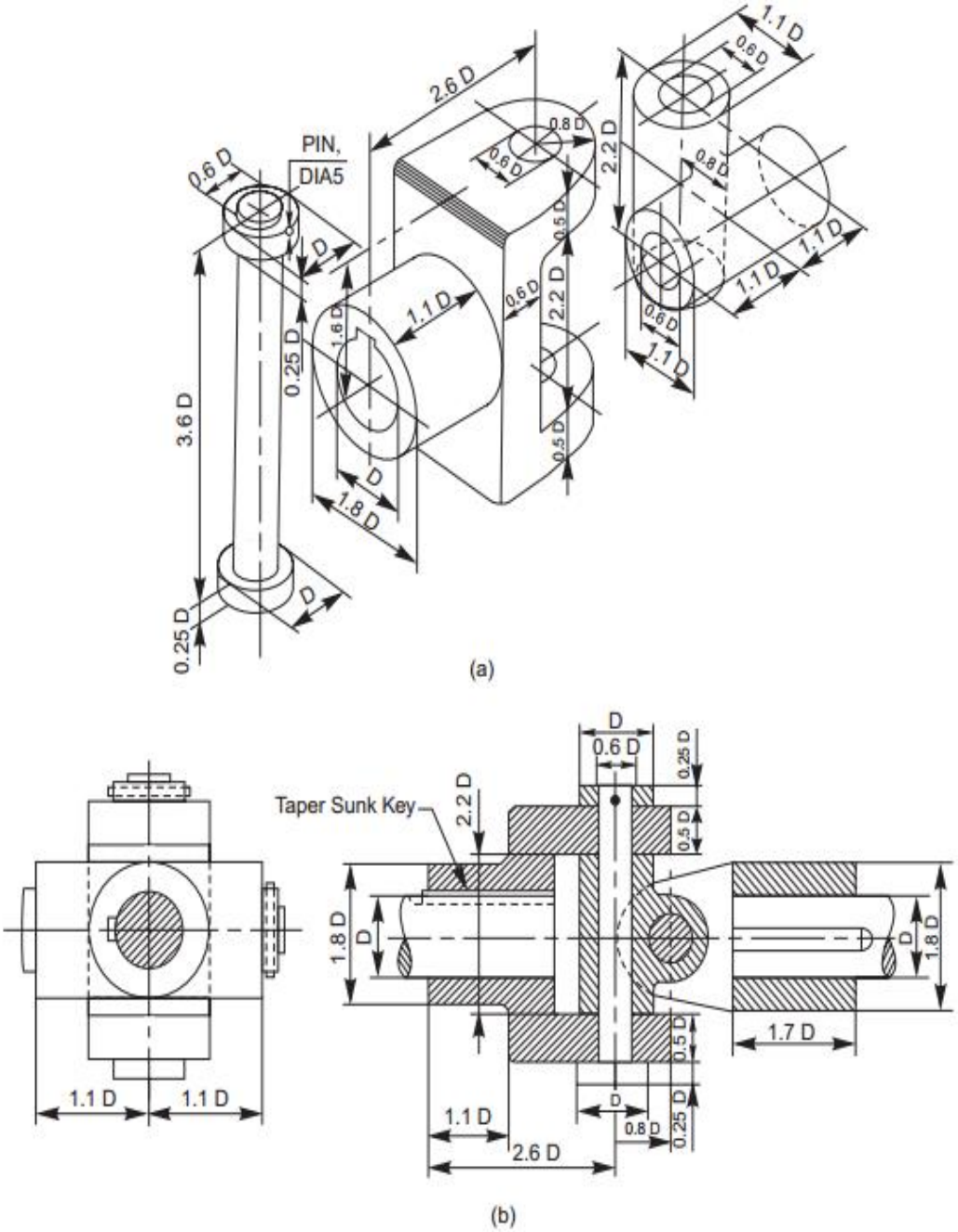


Fig. 7.11 Universal coupling

Aim: To draft universal coupling using Auto CAD 2016

Software used: Auto cad 2016

Commands used:

Draw commands:

Line,Rectangle,Poly line,Polygon,Circle,Construction line,Arc,Spline,Ray,Hatch.

Modify commands:

Erase,Copy,Mirror,Array,Move,Rotate,Trim,Extend,Stretch,Fillet,Join,

Chamfer.

Dimension command:

Radius dimension

Linear dimension

Diameter dimension

Angular dimension

PROCEDURE:

Specify units by using units command unit change the insertsents by given and click on OK button

Now you have to specify drawing size using LI enter command

First enter 0, 0 and enter 420,297 and click enter

Reset model space limits

Specify lower left corner or [on/off] <0, 0>0, 0

Specify upper right corner <12, 9> 420,297

Refit the screen by using zoom command

Draw a shafts and forks.

Draw taper shunk key.

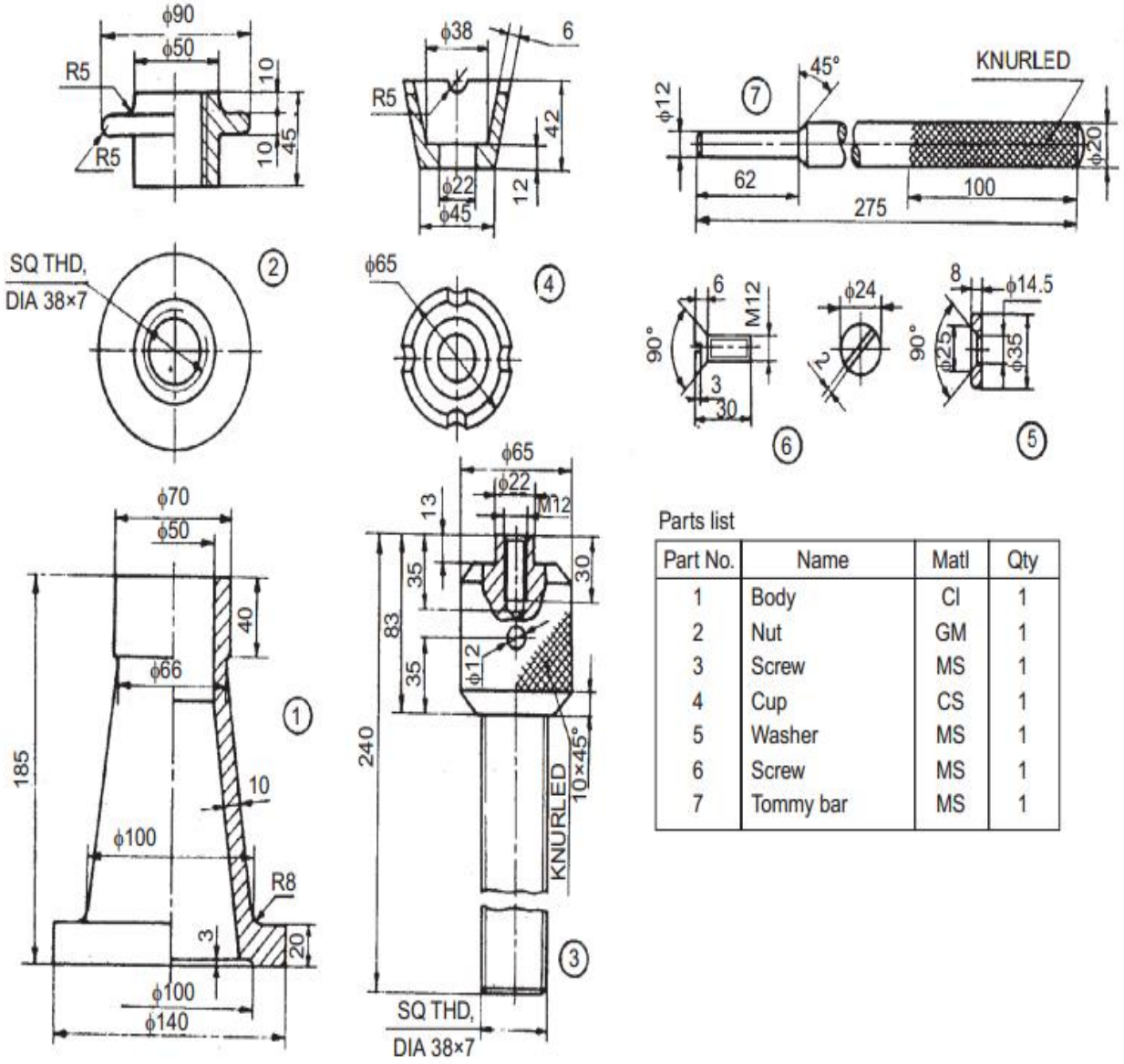
Use hatching command where ever required

Give dimensions by using suitable dimensioning method.

Result: The required universal coupling drafted using Auto CAD 2016.

EXERCISE IX (a)

Drafting of screw jack



Parts list

Part No.	Name	Matl	Qty
1	Body	CI	1
2	Nut	GM	1
3	Screw	MS	1
4	Cup	CS	1
5	Washer	MS	1
6	Screw	MS	1
7	Tommy bar	MS	1

Fig. 18.51 Screw jack

Aim: To draft Screw Jack using Auto CAD 2016

Software used: Auto cad 2016

Commands used:

Draw commands:

Line,Rectangle,Poly line,Polygon,Circle,Construction line,Arc,Spline,Ray,Hatch.

Modify commands:

Erase,Copy,Mirror,Array,Move,Rotate,Trim,Extend,Stretch,Fillet,Join,

Chamfer.

Dimension command:

Radius dimension

Linear dimension

Diameter dimension

Angular dimension

PROCEDURE:

Specify units by using units command unit change the insertsents by given and click on OK button

Now you have to specify drawing size using LI enter command

First enter 0, 0 and enter 420,297 and click enter

Reset model space limits

Specify lower left corner or [on/off] <0, 0>0, 0

Specify upper right corner <12, 9> 420,297

Refit the screen by using zoom command

Use hatching command where ever required

Draw the screw jack main body and its parts nut, screw, washer.

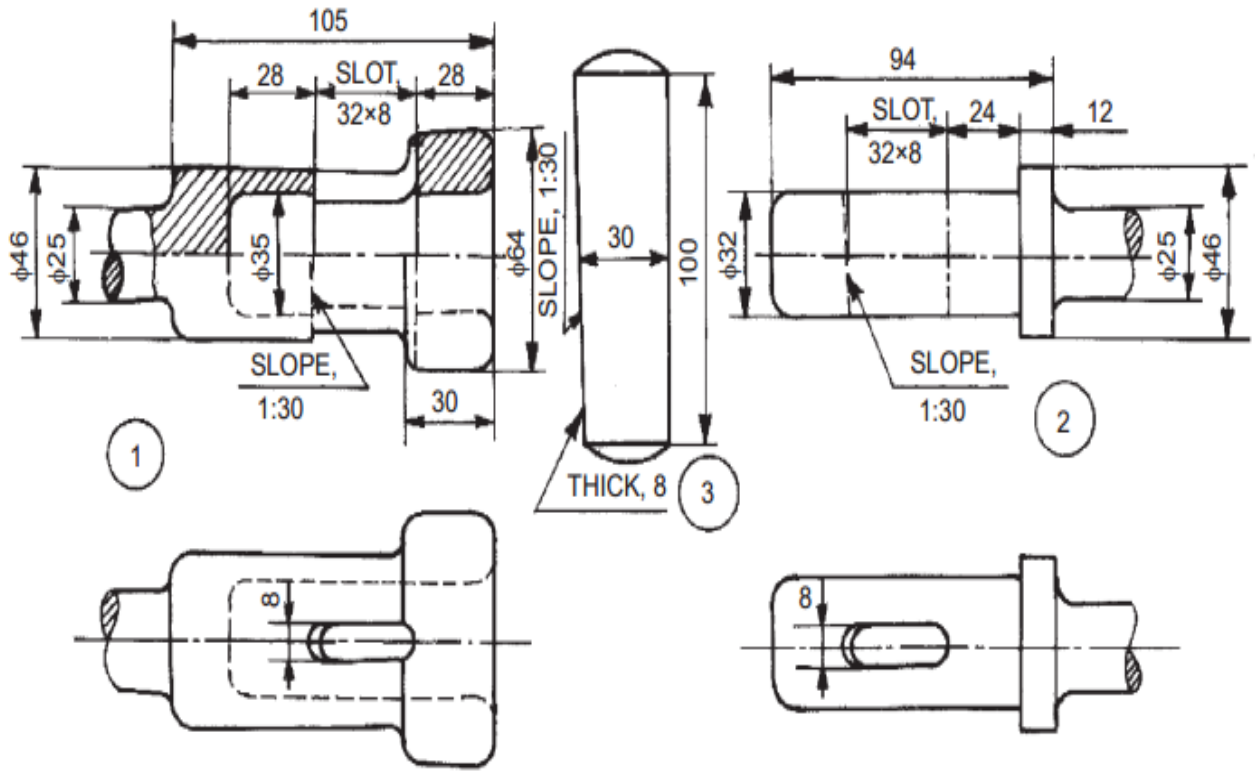
Draw the Screw of main jack and Tommy bar.

Give dimensions to Screw Jack by using suitable dimensioning method.

Result: The required Screw Jack drafted using Auto CAD 2016.

EXERCISE IX (b)

Drafting of Socket and Spigot joint



Parts list

Sl. No.	Name	Matl.	Qty.
1	Socket end	MS	1
2	Spigot end	MS	1
3	Cotter	HCS	1

Fig. 18.39 Socket and spigot joint

Aim: To draft Socket and Spigot joint using Auto CAD 2016

Software used: Auto cad 2016

Commands used:

Draw commands:

Line,Rectangle,Poly line,Polygon,Circle,Construction line,Arc,Spline,Ray,Hatch.

Modify commands:

Erase,Copy,Mirror,Array,Move,Rotate,Trim,Extend,Stretch,Fillet,Join,

Chamfer.

Dimension command:

Radius dimension

Linear dimension

Diameter dimension

Angular dimension

PROCEDURE:

Specify units by using units command unit change the insertsents by given and click on OK button

Now you have to specify drawing size using LI enter command

First enter 0, 0 and enter 420,297 and click enter

Reset model space limits

Specify lower left corner or [on/off] <0, 0>0, 0

Specify upper right corner <12, 9> 420,297

Refit the screen by using zoom command

Use hatching command where ever required

Draw the socket end and spigot end.

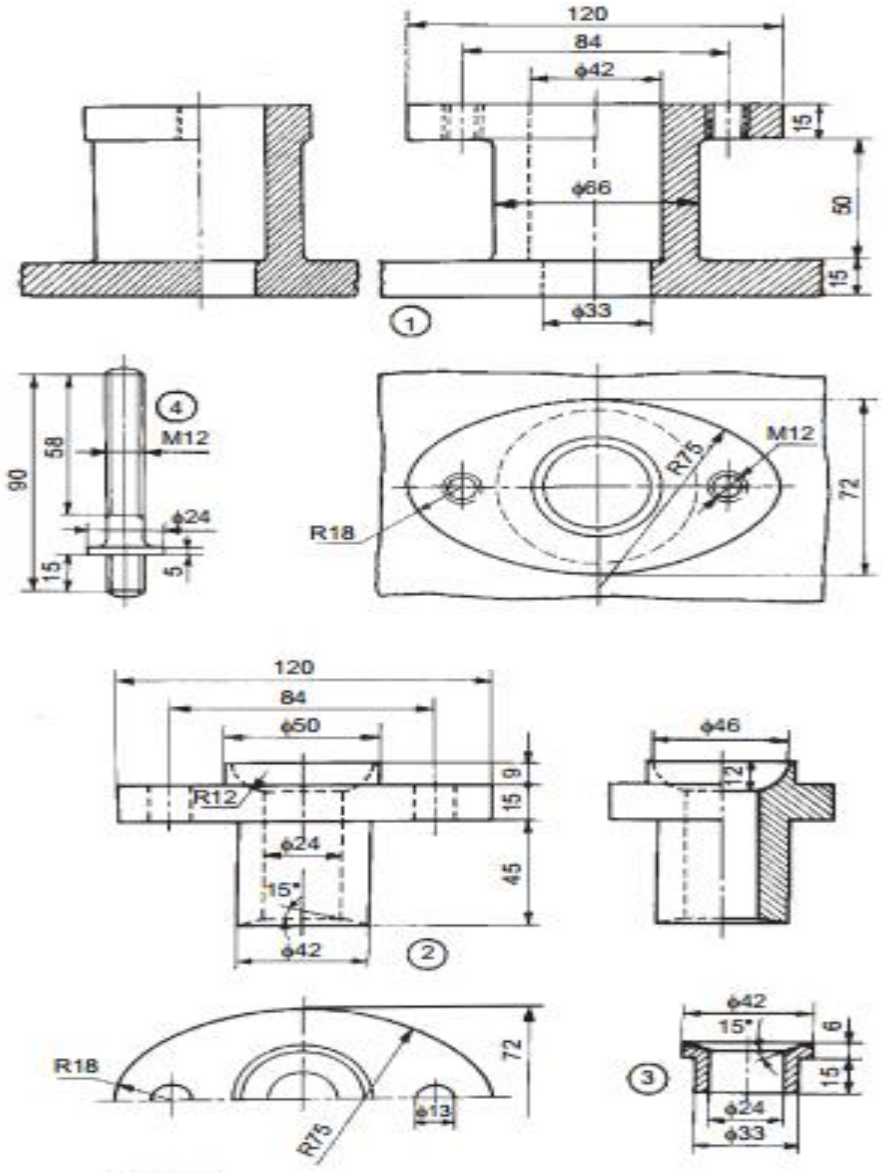
Draw the cotter.

Give dimensions to Socket and Spigot joint by using suitable dimensioning method.

Result: The required Socket and Spigot joint drafted using Auto CAD 2016.

EXERCISE X

Assembling of stuffing box



Parts list

Part No.	Name	Matl	Qty
1	Body	CI	1
2	Gland	Brass	1
3	Bush	Brass	1
4	Stud	MS	2
5	Nut, M12	MS	2

Fig. 18.1 Stuffing box

Aim: To draft Stuffing Box using Auto CAD 2016

Software used: Auto cad 2016

Commands used:

Draw commands:

Line,Rectangle,Poly line,Polygon,Circle,Construction line,Arc,Spline,Ray,Hatch.

Modify commands:

Erase,Copy,Mirror,Array,Move,Rotate,Trim,Extend,Stretch,Fillet,Join,

Chamfer.

Dimension command:

Radius dimension

Linear dimension

Diameter dimension

Angular dimension

PROCEDURE:

Specify units by using units command unit change the insertsents by given and click on OK button

Now you have to specify drawing size using LI enter command

First enter 0, 0 and enter 420,297 and click enter

Reset model space limits

Specify lower left corner or [on/off] <0, 0>0, 0

Specify upper right corner <12, 9> 420,297

Refit the screen by using zoom command

Use hatching command where ever required

Draw the body gland and bush.

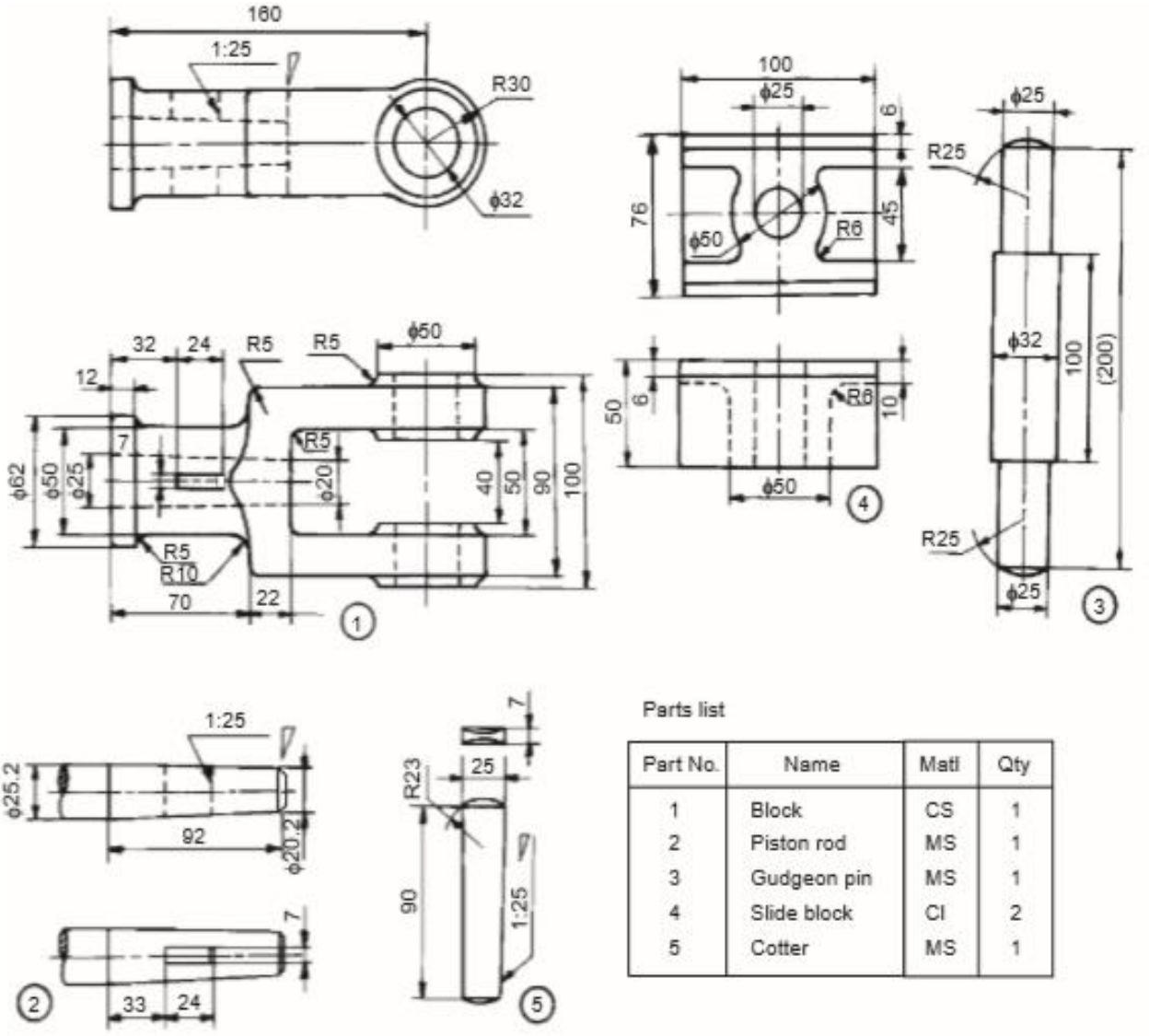
Draw the stud and nut.

Give dimensions to Stuffing Box by using suitable dimensioning method.

Result: The required Stuffing Box drafted using Auto CAD 2016.

EXERCISE XI

Assembling of cross head



Parts list

Part No.	Name	Matl	Qty
1	Block	CS	1
2	Piston rod	MS	1
3	Gudgeon pin	MS	1
4	Slide block	CI	2
5	Cotter	MS	1

Aim: To draft Cross Head using Auto CAD 2016

Software used: Auto cad 2016

Commands used:

Draw commands:

Line,Rectangle,Poly line,Polygon,Circle,Construction line,Arc,Spline,Ray,Hatch.

Modify commands:

Erase,Copy,Mirror,Array,Move,Rotate,Trim,Extend,Stretch,Fillet,Join,

Chamfer.

Dimension command:

Radius dimension

Linear dimension

Diameter dimension

Angular dimension

PROCEDURE:

Specify units by using units command unit change the insertsents by given and click on OK button

Now you have to specify drawing size using LI enter command

First enter 0, 0 and enter 420,297 and click enter

Reset model space limits

Specify lower left corner or [on/off] <0, 0>0, 0

Specify upper right corner <12, 9> 420,297

Refit the screen by using zoom command

Use hatching command where ever required

Draw the block, piston rod and gudgeon rod.

Draw the slide block and cotter.

Give dimensions to Cross Head by using suitable dimensioning method.

Result: The required Cross Head drafted using Auto CAD 2016.

EXERCISE XII

Modeling and assembly of eccentric joint

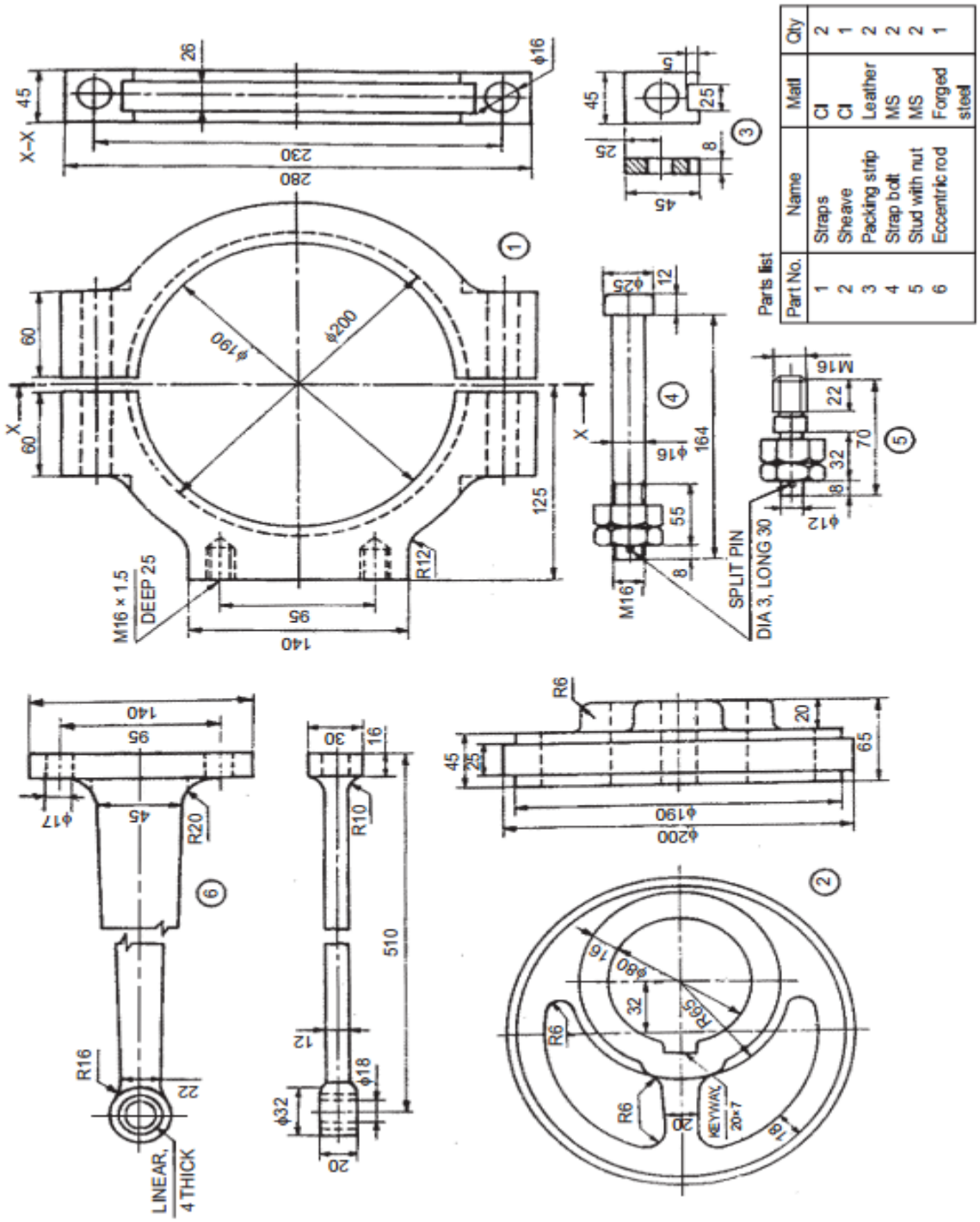


Fig. 18.8b Details of an eccentric

Aim: To draft Eccentric Joint using Auto CAD 2016

Software used: Auto cad 2016

Commands used:

Draw commands:

Line,Rectangle,Poly line,Polygon,Circle,Construction line,Arc,Spline,Ray,Hatch.

Modify commands:

Erase,Copy,Mirror,Array,Move,Rotate,Trim,Extend,Stretch,Fillet,Join,

Chamfer.

Dimension command:

Radius dimension

Linear dimension

Diameter dimension

Angular dimension

PROCEDURE:

Specify units by using units command unit change the insertsents by given and click on OK button

Now you have to specify drawing size using LI enter command

First enter 0, 0 and enter 420,297 and click enter

Reset model space limits

Specify lower left corner or [on/off] <0, 0>0, 0

Specify upper right corner <12, 9> 420,297

Refit the screen by using zoom command

Use hatching command where ever required

Draw the straps, sheave and packing strip.

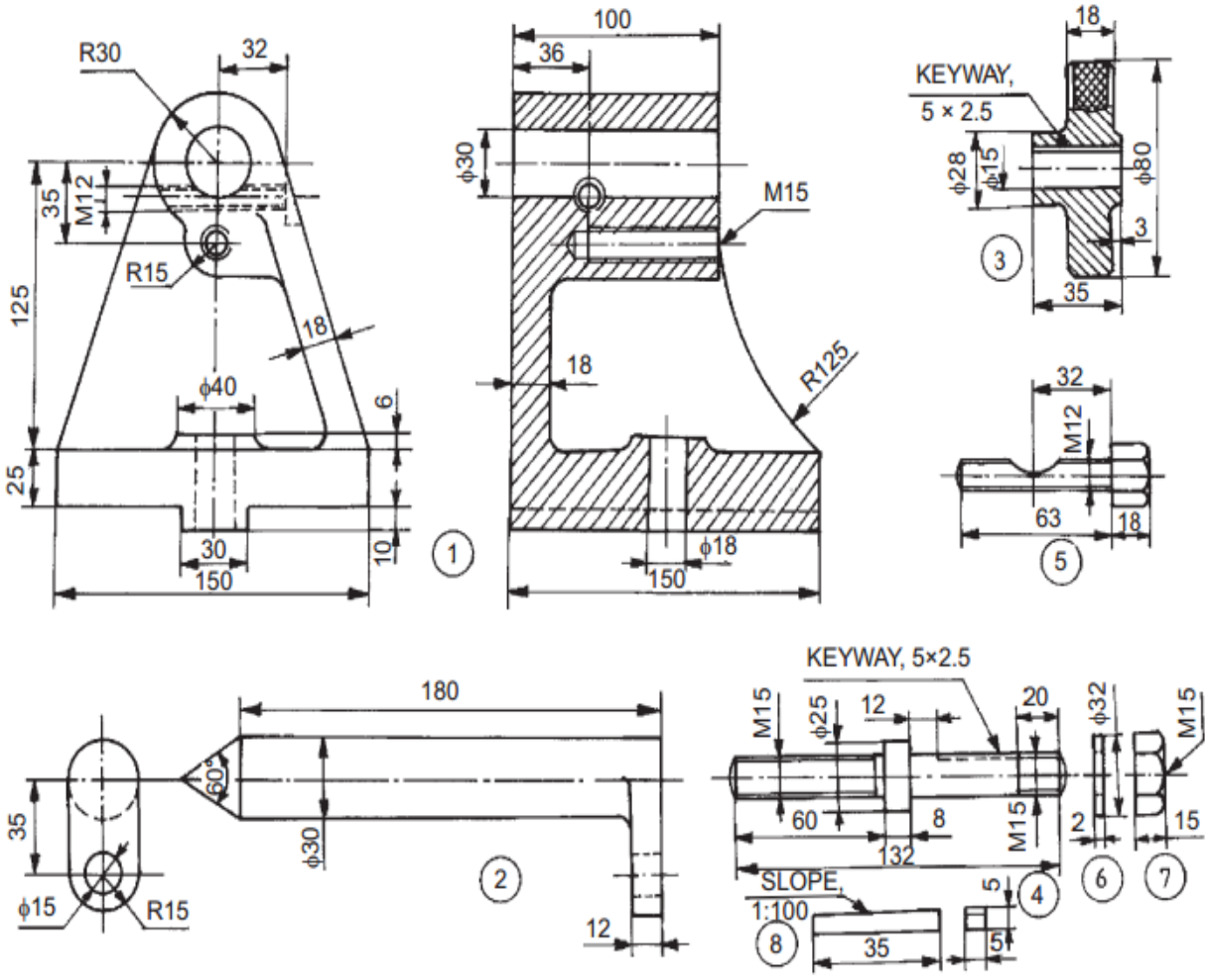
Draw the strap bolt, stud with nut and eccentric rod

Give dimensions to Eccentric Joint by using suitable dimensioning method.

Result: The required Eccentric Joint drafted using Auto CAD 2016.

EXERCISE XIII

Modeling and assembly of milling machine tail stock



Parts list

Sl. No.	Name	Matl.	Qty.
1	Body	CI	1
2	Centre	Case hardened alloy steel	1
3	Hand wheel	Cast steel	1
4	Screw	MS	1
5	Screw	MS	1
6	Washer	MS	1
7	Nut	MS	1
8	Key	MS	

Fig. 18.19 Milling machine tail-stock

Aim: To draft Milling Machine Tail - Stock using Auto CAD 2016

Software used: Auto cad 2016

Commands used:

Draw commands:

Line,Rectangle,Poly line,Polygon,Circle,Construction line,Arc,Spline,Ray,Hatch.

Modify commands:

Erase,Copy,Mirror,Array,Move,Rotate,Trim,Extend,Stretch,Fillet,Join,

Chamfer.

Dimension command:

Radius dimension

Linear dimension

Diameter dimension

Angular dimension

PROCEDURE:

Specify units by using units command unit change the insertsents by given and click on OK button

Now you have to specify drawing size using LI enter command

First enter 0, 0 and enter 420,297 and click enter

Reset model space limits

Specify lower left corner or [on/off] <0, 0>0, 0

Specify upper right corner <12, 9> 420,297

Refit the screen by using zoom command

Use hatching command where ever required

Draw the body hand wheel and centre.

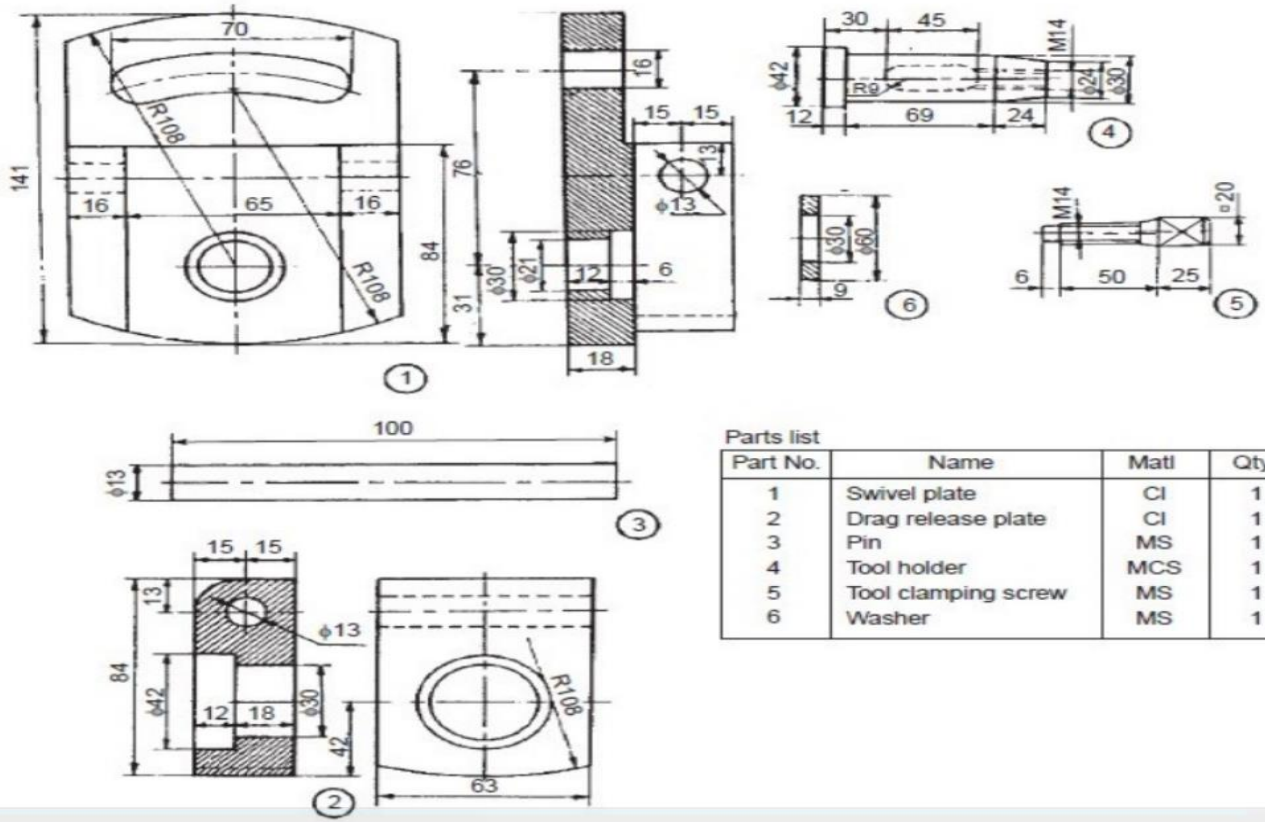
Draw the screws, washer, key and nut.

Give dimensions to Milling machine Tail – Stock by using suitable dimensioning method.

Result: The required Milling machine Tail – Stock drafted using Auto CAD 2016.

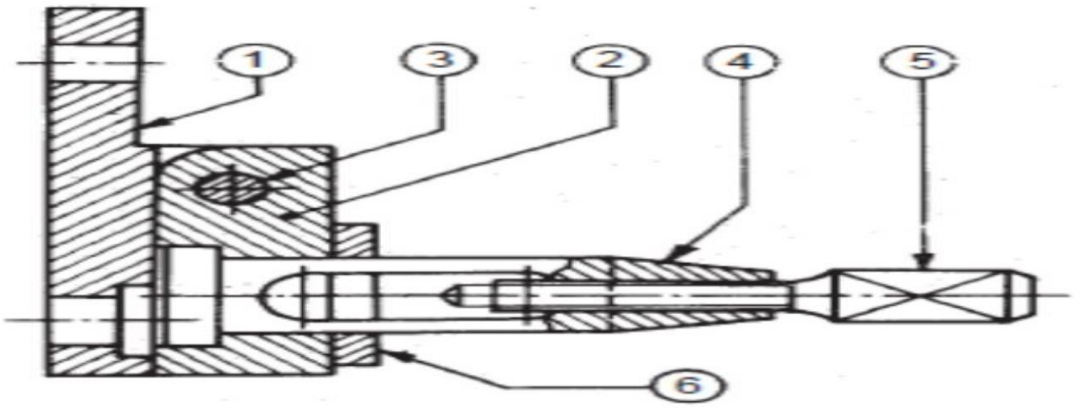
EXERCISE XIV

Modeling and assembly of milling machine clapper block



Parts list

Part No.	Name	Matl	Qty
1	Swivel plate	CI	1
2	Drag release plate	CI	1
3	Pin	MS	1
4	Tool holder	MCS	1
5	Tool clamping screw	MS	1
6	Washer	MS	1



Aim: To draft Milling Machine Clapper Block using Auto CAD 2016

Software used: Auto cad 2016

Commands used:

Draw commands:

Line,Rectangle,Poly line,Polygon,Circle,Construction line,Arc,Spline,Ray,Hatch.

Modify commands:

Erase,Copy,Mirror,Array,Move,Rotate,Trim,Extend,Stretch,Fillet,Join,

Chamfer.

Dimension command:

Radius dimension

Linear dimension

Diameter dimension

Angular dimension

PROCEDURE:

Specify units by using units command unit change the insertsents by given and click on OK button

Now you have to specify drawing size using LI enter command

First enter 0, 0 and enter 420,297 and click enter

Reset model space limits

Specify lower left corner or [on/off] <0, 0>0, 0

Specify upper right corner <12, 9> 420,297

Refit the screen by using zoom command

Use hatching command where ever required

Draw the Swivel Plate, Drag Release Plate, Pin and Tool Holder.

Draw the Tool Clamping Screw and Washer.

Give dimensions to Milling Machine Clapping Block by using suitable dimensioning method.

Result: The required Milling Machine Clapping Block drafted using Auto CAD 2016.