Machine Drawing

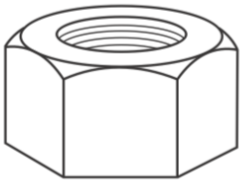
Class 2 : Machine Parts

Textbooks and References

- ***Textbook:***
  - ***N. D. Bhatt, Engineering Drawing – Plane and Solid Geometry, 51st Edition, 2012; Charotar Publishing House Private Limited, Anand, Gujarat 388 001, INDIA***

- ***References:***
  - ***N. Sidheswar, P. Kanniah and V.V.S. Sastry, Machine Drawing, Tata McGraw Hill, 2001***
  - ***SP 46: 1988 Engineering Drawing Practice for School & Colleges. Bureau of Indian Standards***

Hexagonal and Square Nut



Empirical relations :

Major or nominal diameter of bolt = D

Thickness of nut, T = D

Width of nut across flat surfaces, W = 1.5D + 3 mm

Radius of chamfer, R = 1.5D

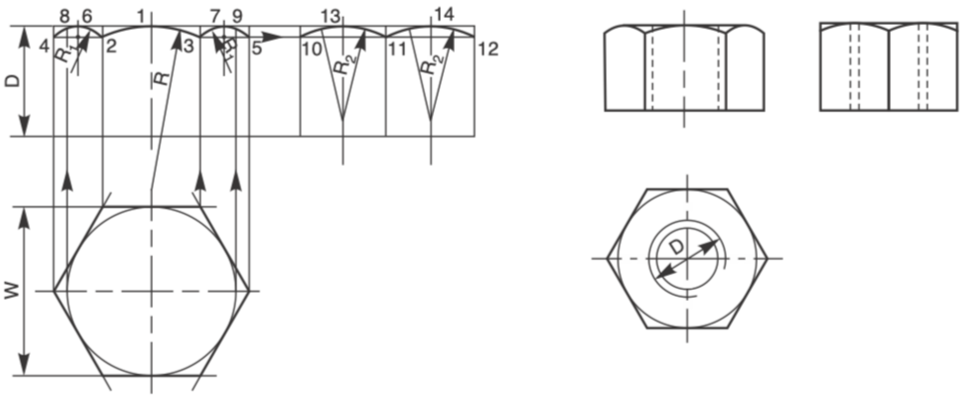
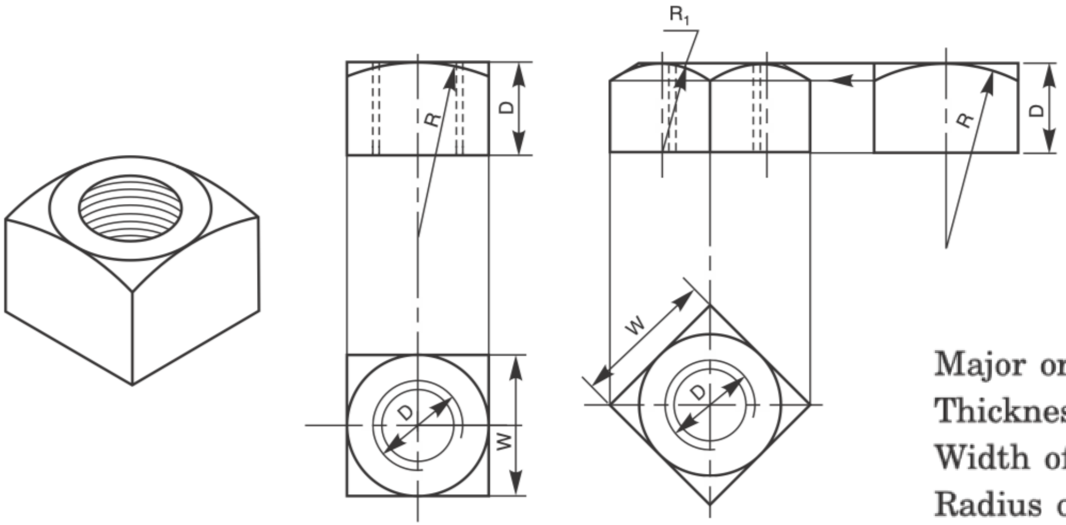


Fig. 5.12 Method of drawing views of a hexagonal nut (Method I)



Major or nominal diameter of bolt = D

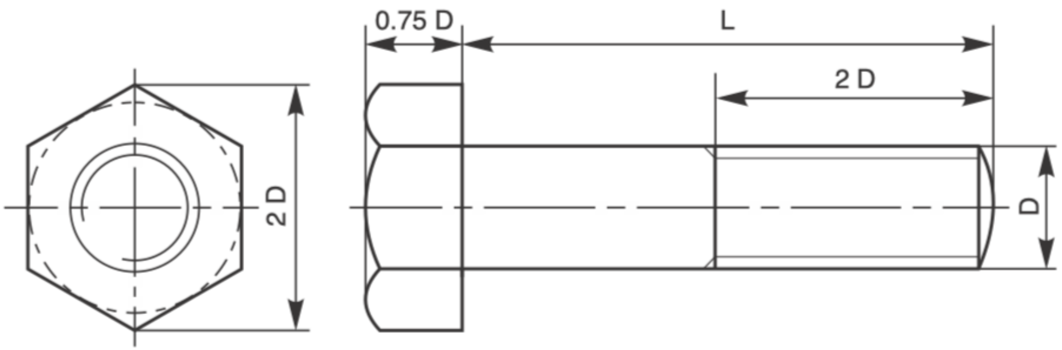
Thickness of nut, T = D

Width of the nut across flats, W = 1.5 D + 3 mm

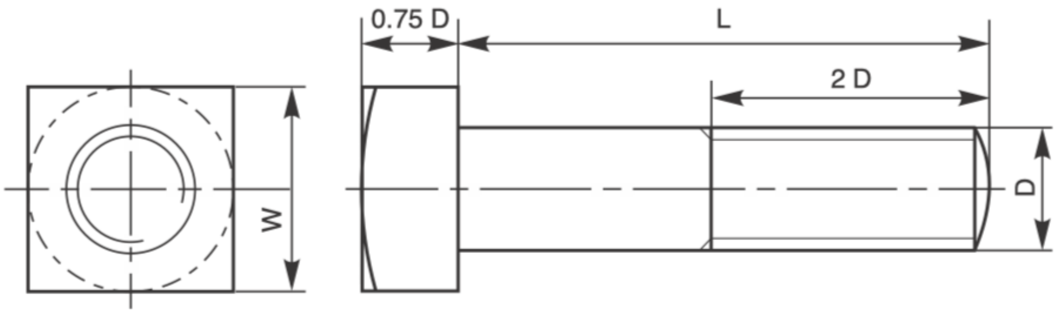
Radius of chamfer arc, R = 2 D

Fig.5.14 Method of drawing the views of a square nut

Hexagonal and Square Headed Bolt



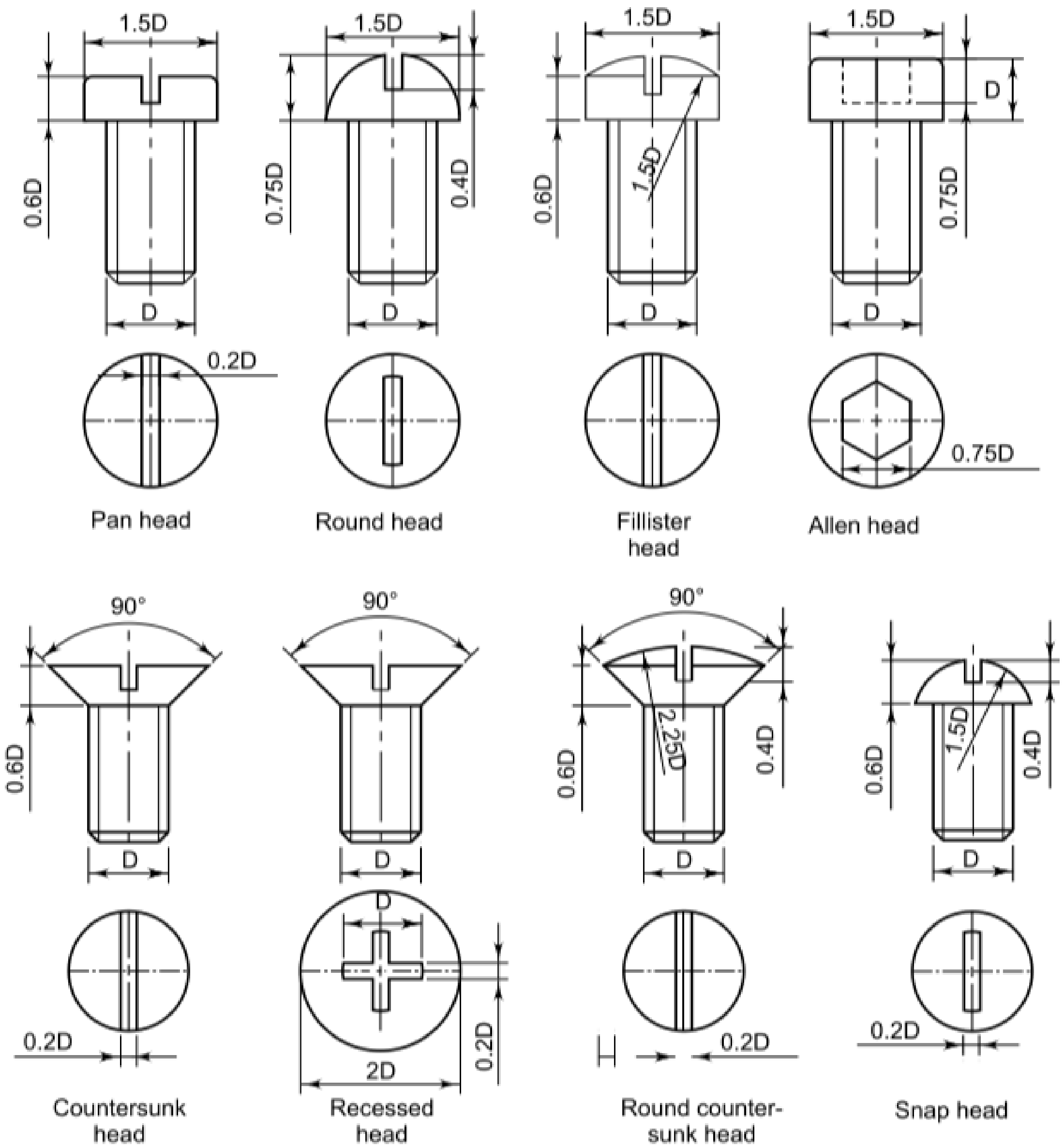
(a) Hexagonal headed bolt



(b) Square headed bolt

Fig. 5.15

Screw Heads


1.5D
0.6D
D
0.2D
Pan head
1.5D
0.75D
0.4D
D
Round head
1.5D
0.6D
1.5D
D
Fillister head
1.5D
D
0.75D
D
0.75D
Allen head
90°
0.6D
D
0.2D
Countersunk head
90°
D
D
2D
0.2D
Recessed head
90°
0.6D
2.25D
0.4D
D
0.2D
Round counter-sunk head
0.6D
1.5D
0.4D
D
0.2D
Snap head

Washers

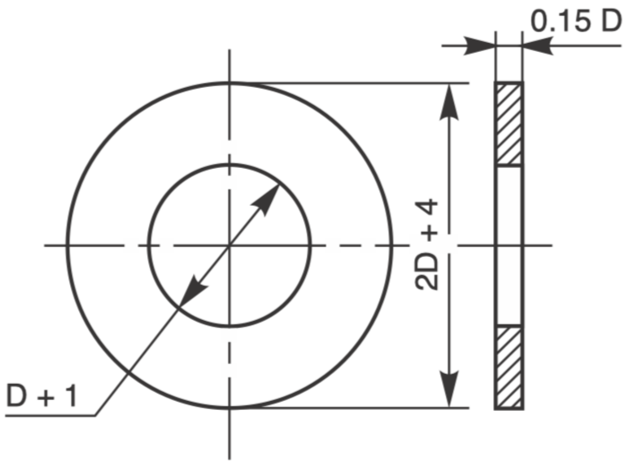


Fig. 5.16 Washer

Nut, Bolt and Washer Together

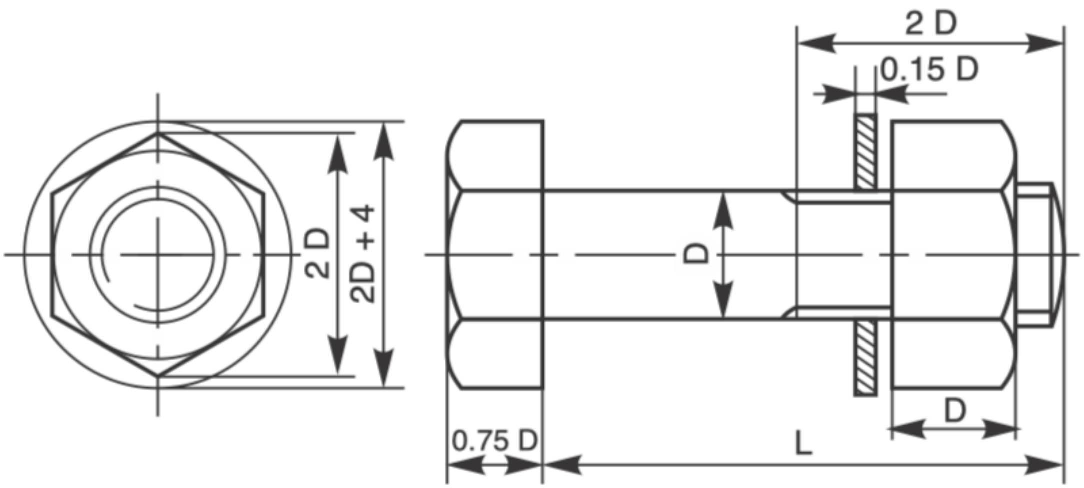


Fig. 5.17 A hexagonal headed bolt with a nut and a washer in position

Springs

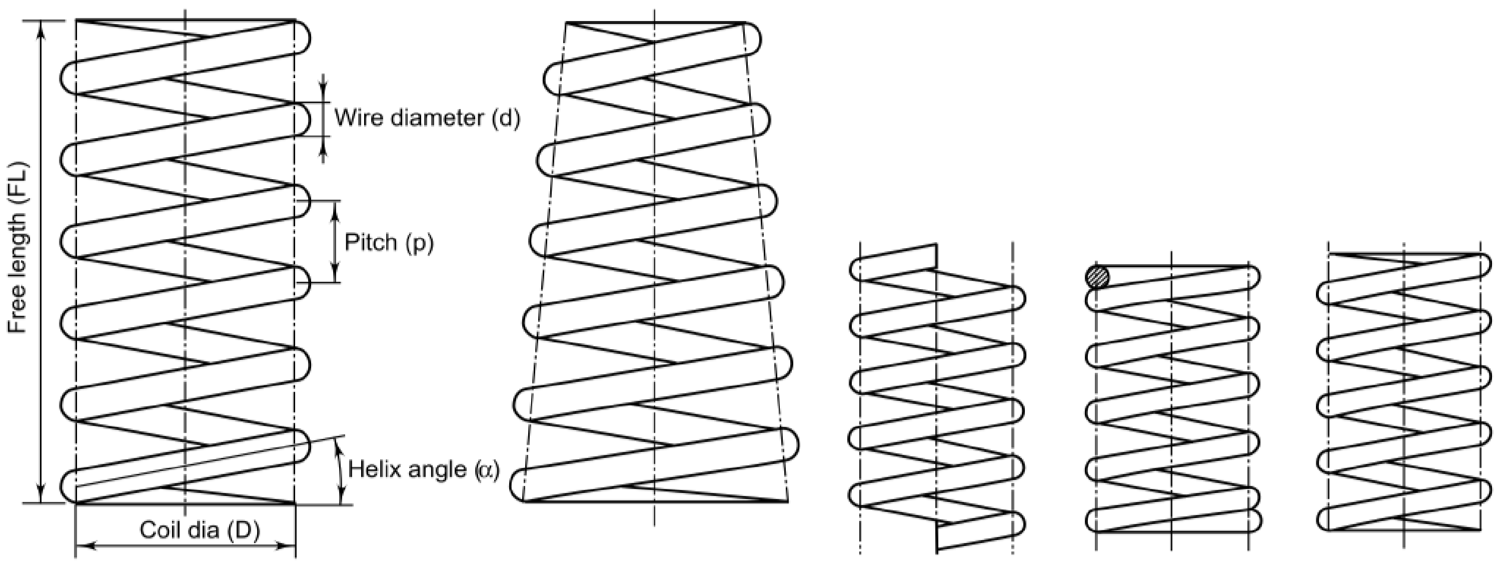
A According to Deflection due to Load

Tension spring	It gets elongated when load is applied.
Compression spring	It gets compressed when load is applied.
Spiral spring	It gets twisted when load is applied.

B According to Geometrical Shape

Helical spring	The wire is wound in a helical fashion (Fig. 23.1).
Leaf spring	Rectangular strips of steel are bent in the shape of an arc and joined together (Fig. 23.8).
Torsion spring	A thin steel strip is wound in a spiral form (Fig. 23.9).
Torsion bar	A long rod is fixed at one end and twisted at the other end.
Diaphragm spring	A steel disk bent in the shape of a saucer (Fig. 23.11).

Helical Compression Springs



(A) Cylindrical helical spring (B) Conical helical spring (A) Open (B) Closed (C) Ground

Springs

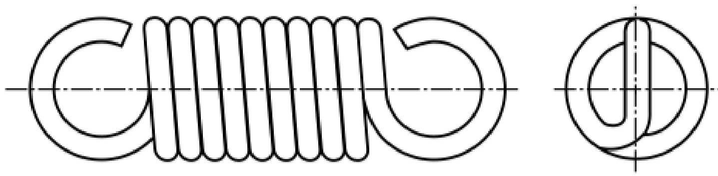


Fig. 23.3 *A Tension Spring (Full Loop End)*

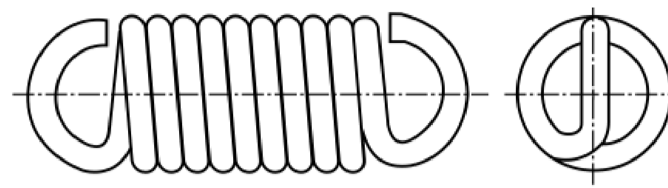


Fig. 23.4 *Ends of a Tension Spring (Half Loop End)*

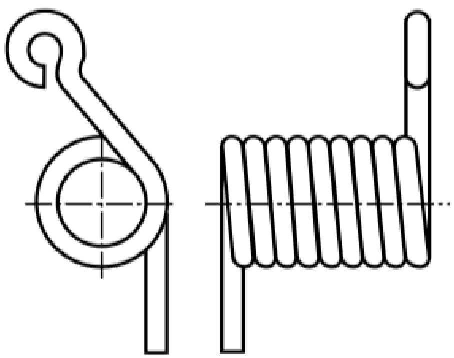


Fig. 23.5 *A Torsion Spring*

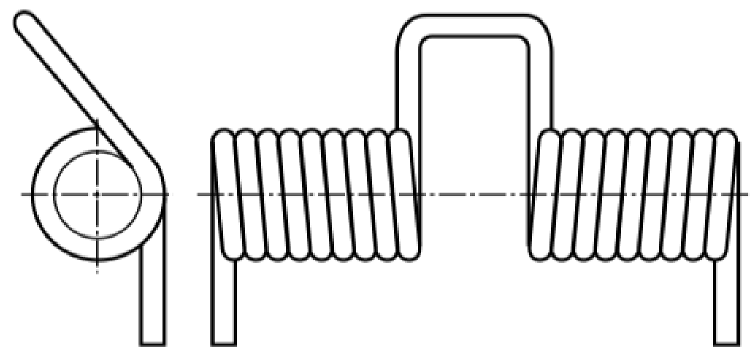


Fig. 23.6 *A Dual Torsion Spring*

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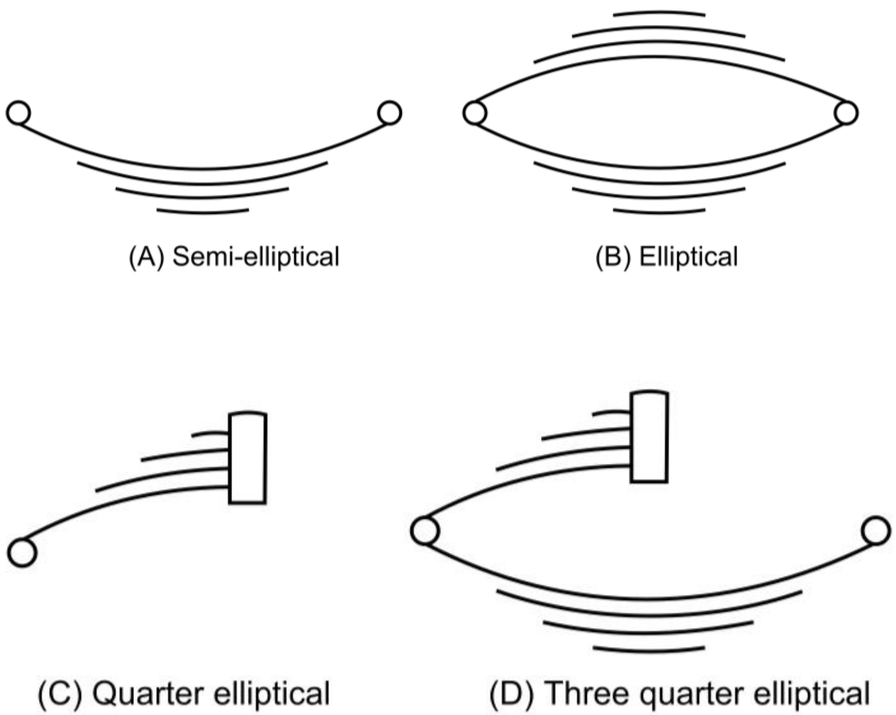
Springs



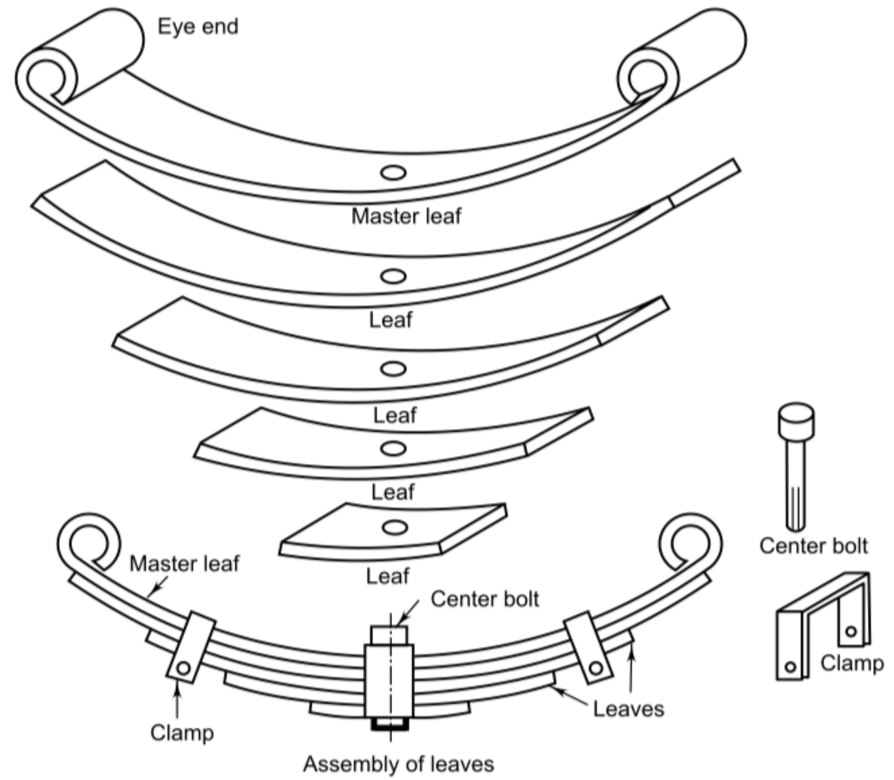


Fig. 23.7 *Components of a Leaf Spring*

Singh, Ajeet. Machine Drawing, Tata McGraw-Hill, 2007.

Symbolic representation of springs

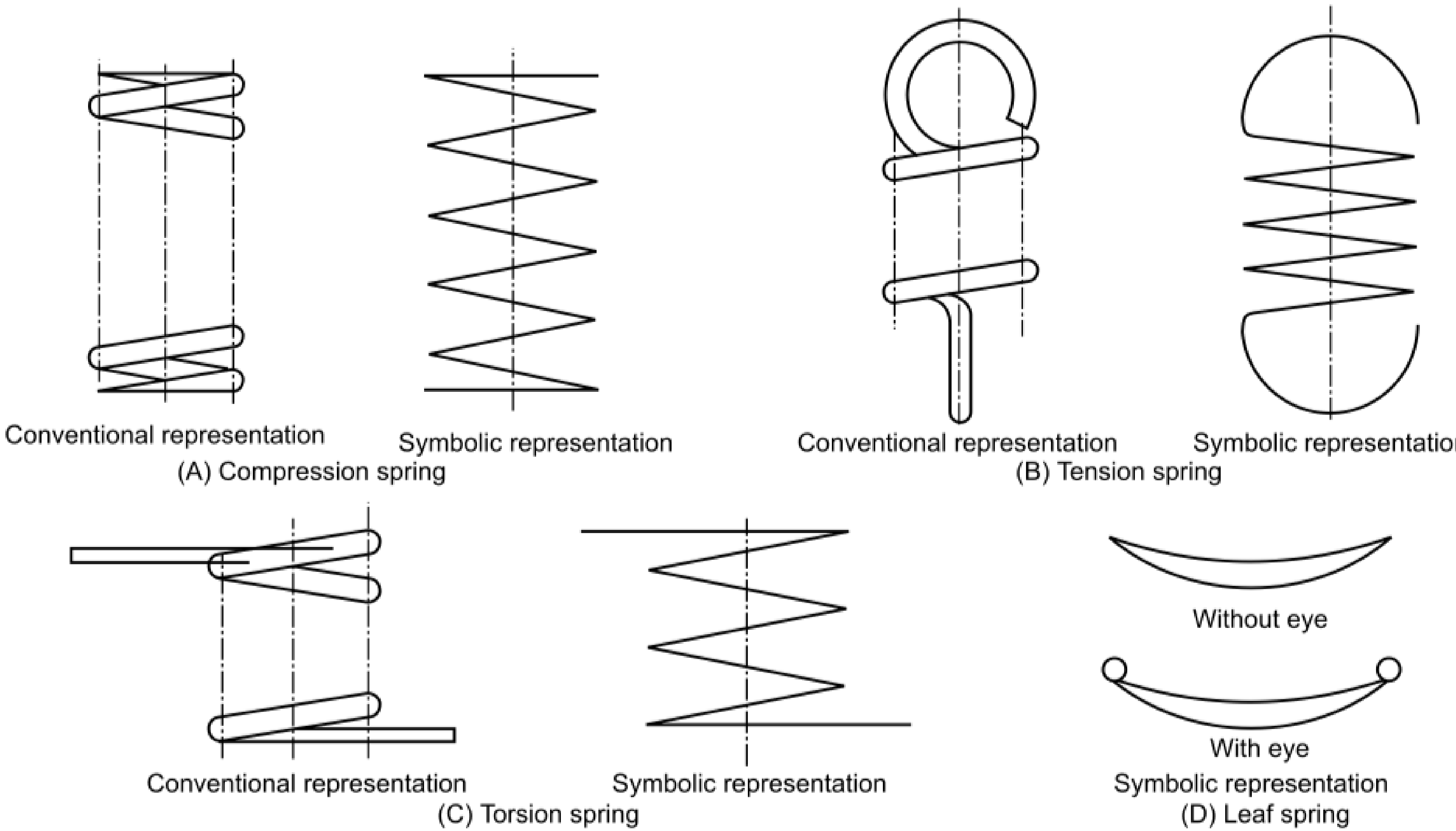


Fig. 23.10 *Symbolic Representations of Springs*

Singh, Ajeet. Machine Drawing, Tata McGraw-Hill, 2007.

Diaphragm Springs

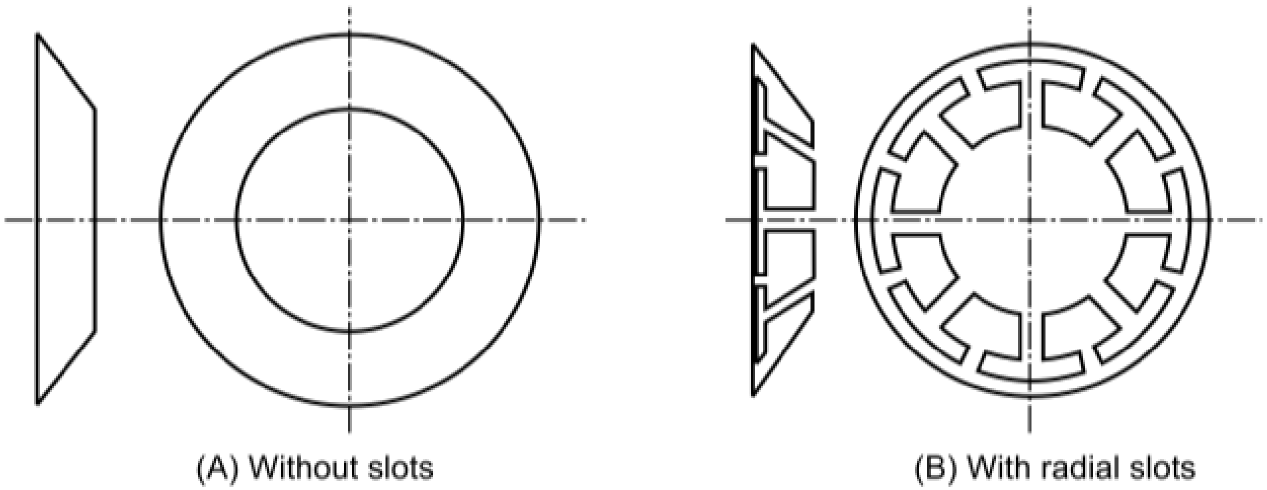


Fig. 23.11 *Diaphragm Springs*

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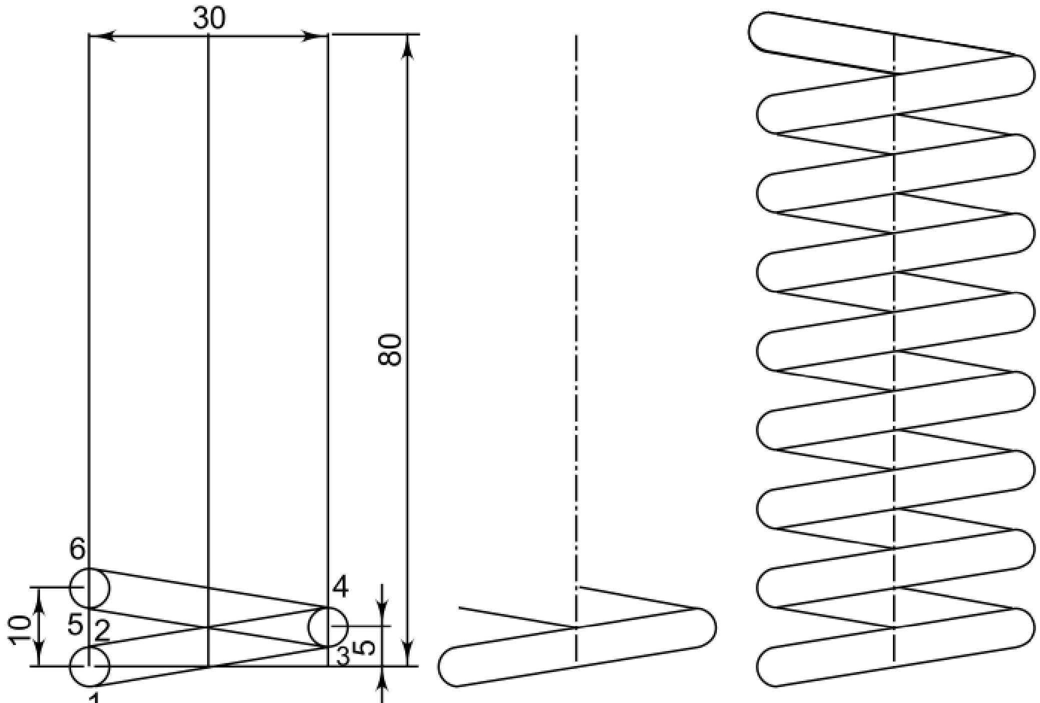
Springs

Draw a helical coil compression spring of 8 turns for a wire diameter of 5 mm and coil diameter 30 mm. Gap between the coils is 5 mm.



(A) Stage 1 (B) Stage 2 (C) Stage 3

Singh, Ajeet. Machine Drawing, Tata McGraw-Hill, 2007.

Bearing

A. According to load bearing media

- Hydrodynamic – Working fluid (generally oil) is supplied at atmospheric pressure.
- Hydrostatic – Working fluid oil or air is supplied at high pressure.
- Rolling – Rolling elements like balls/rollers/needles are provided. (Anti-friction bearings).

B. According to type of load

- Radial – Axis of load is radial (90° to axis).
- Axial – Axis of load is along the shaft axis.
- Radial and axial – Load is radial and also along shaft axis.

C. According to material used for bearing

- Cast iron
- Aluminum
- Brass or Bronze
- Teflon/Nylon
- Babbit (Tin and lead base alloys)

D. According to relative movement between bearing and shaft

- Rotating – Majority of the shafts rotate in the bearings.
- Oscillating – Shaft oscillates in the bearing like small end of connecting rod of an engine.
- Sliding – Movement is linear along an axis, e.g. carriage of type writer, CNC M/C slides.

Singh, Ajeet. Machine Drawing, Tata McGraw-Hill, 2007.

Hydrodynamic Bearing

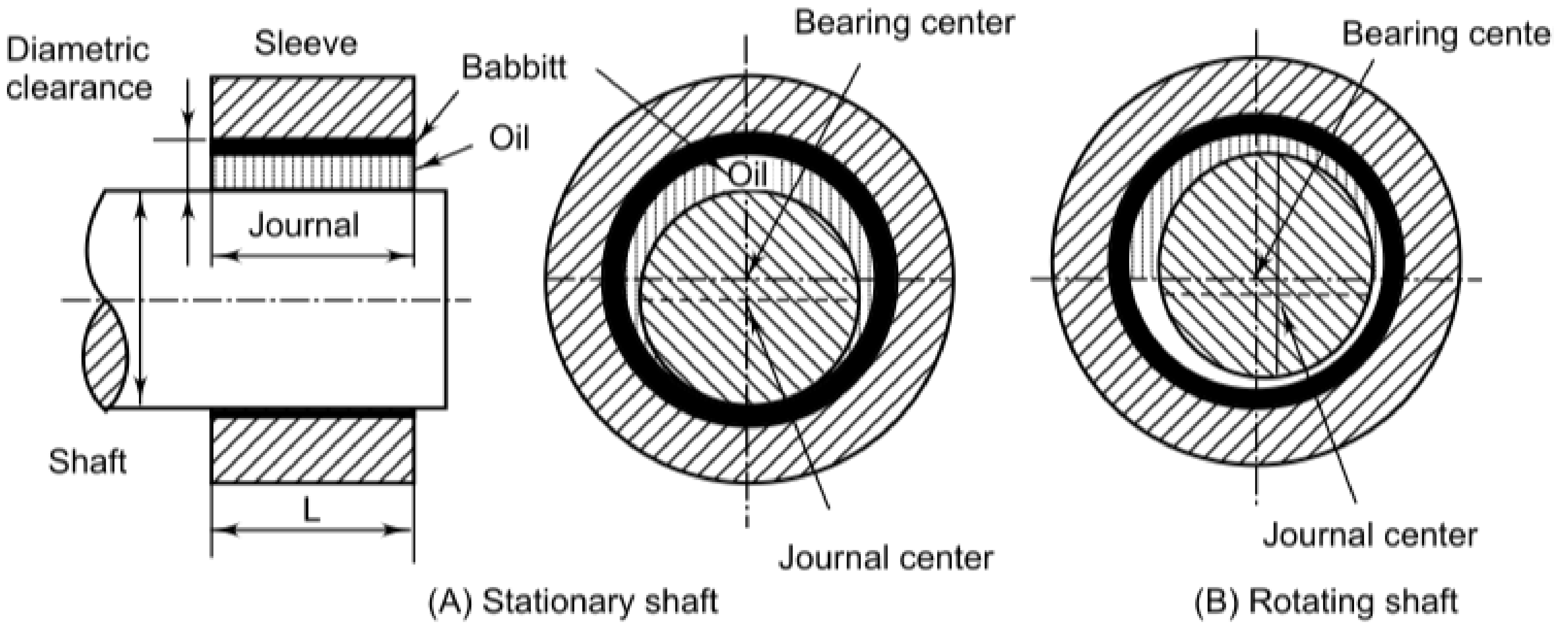


Fig. 25.1 *Hydrodynamic Bearing*

Singh, Ajeet. Machine Drawing, Tata McGraw-Hill, 2007.

Bearing Support

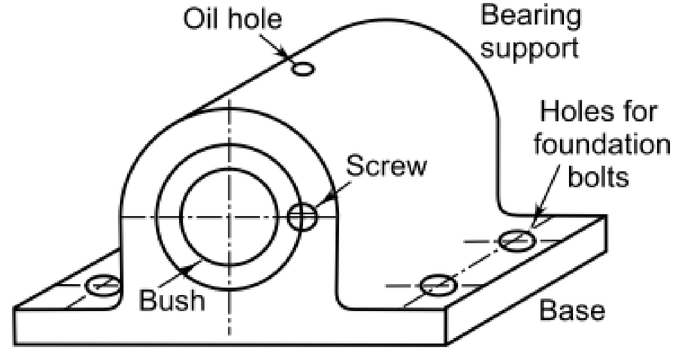


Fig. 25.3 *Isometric View of a Simple Bearing Support*

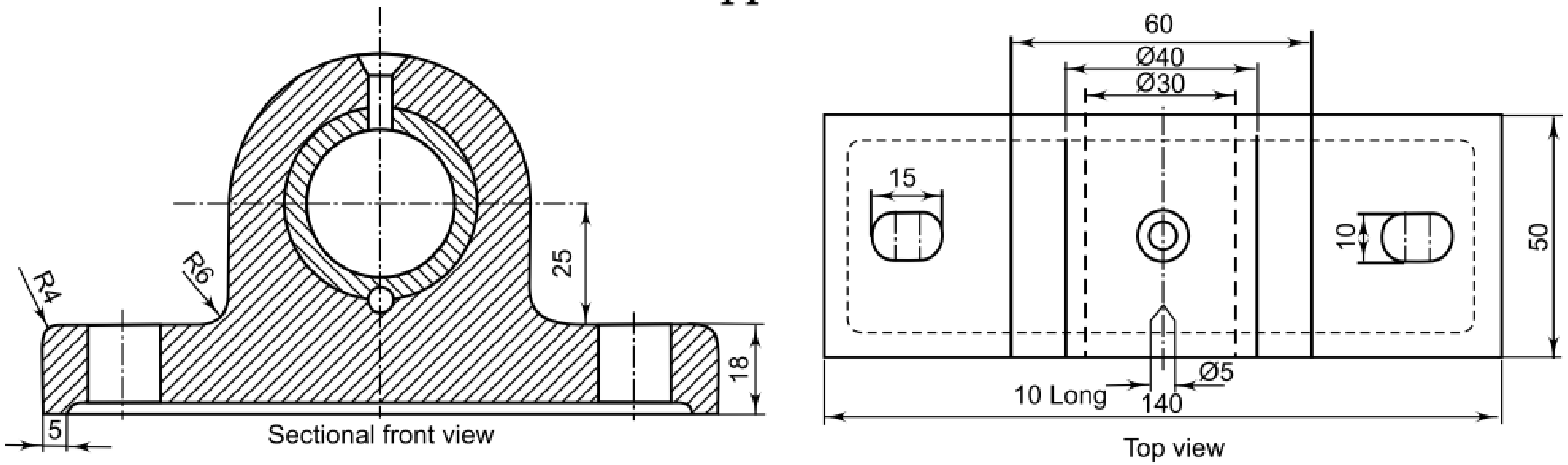


Fig. 25.4 *Sectional View of a Simple Bearing Support*

Singh, Ajeet. Machine Drawing, Tata McGraw-Hill, 2007.

Hanging Bearing Support

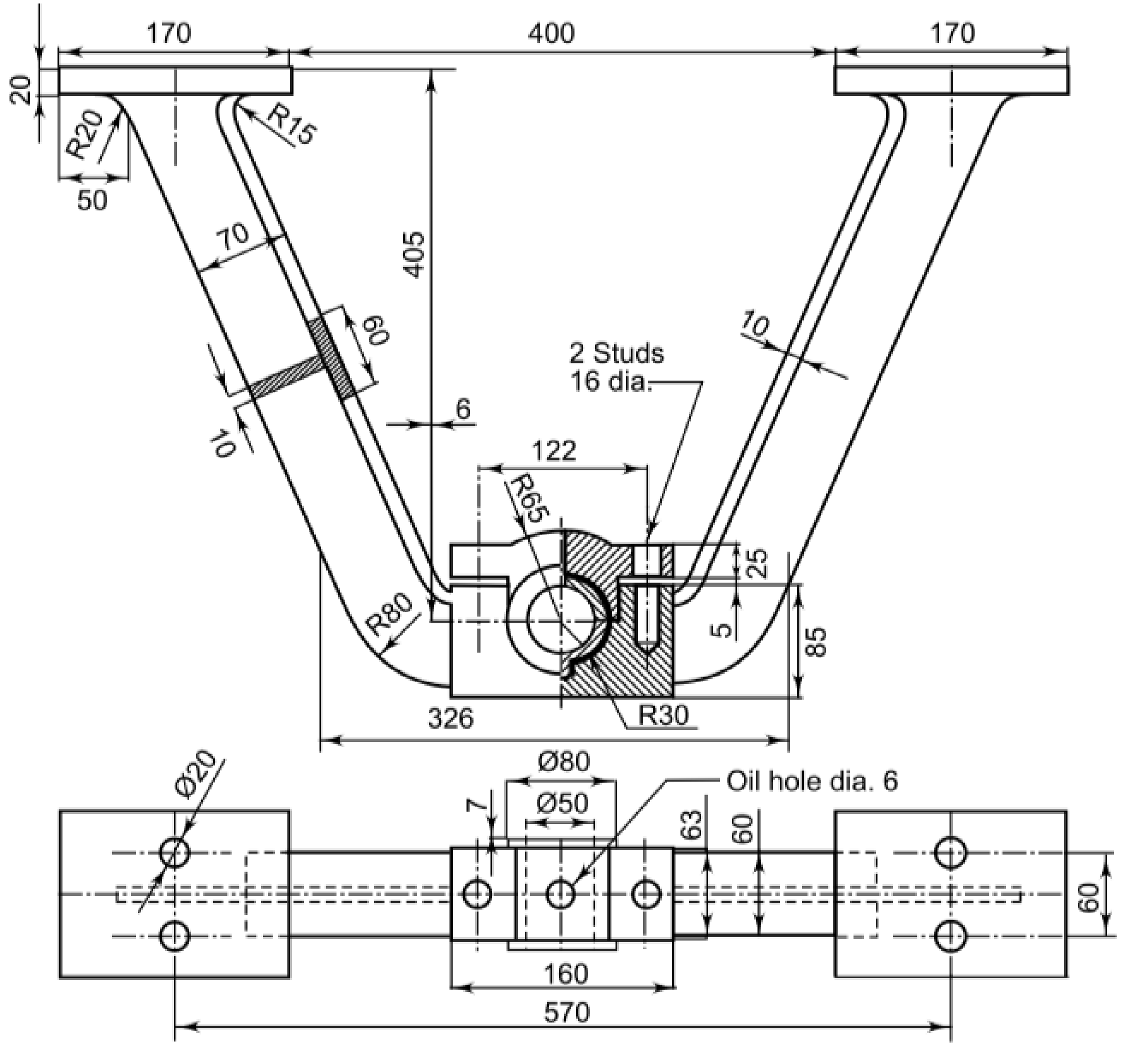


Fig. 25.10 *U Hanger*

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Bearing Specifications

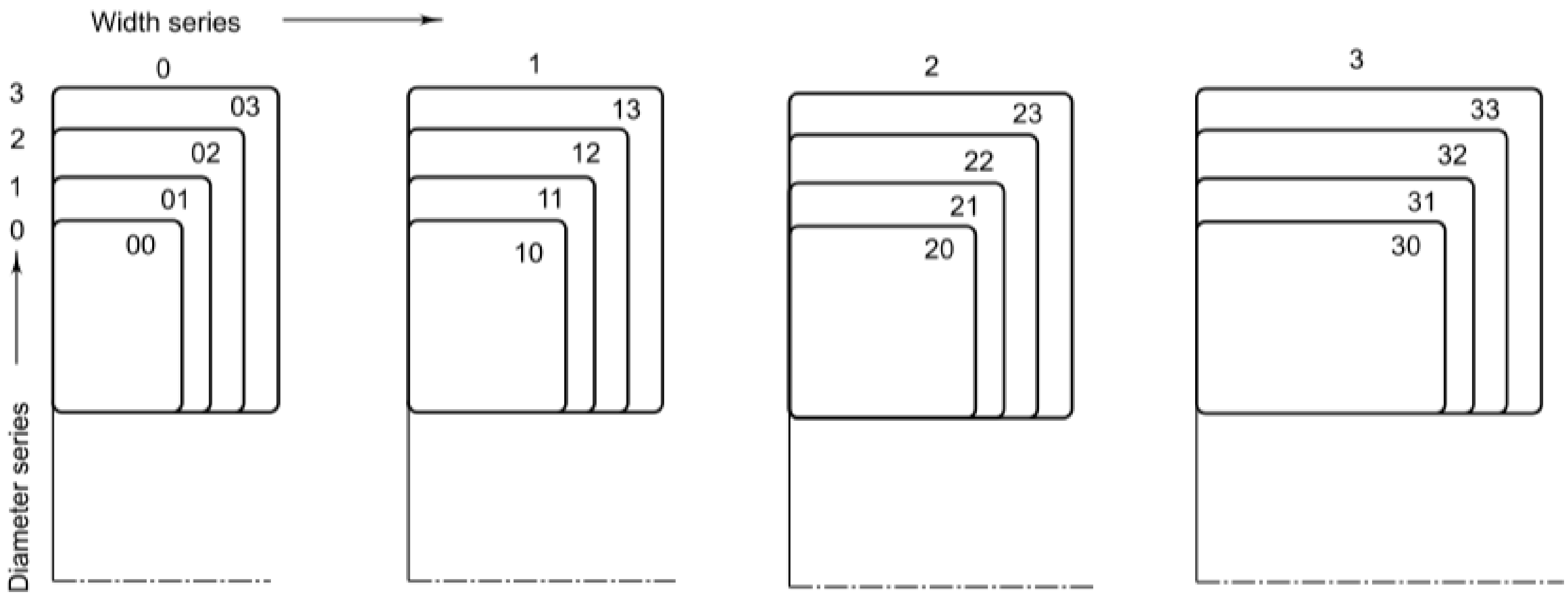

Fig. 25.15 *Specifications of Rolling Bearings*

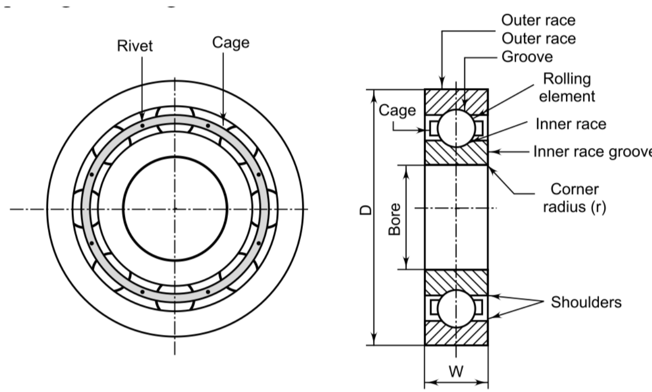

Fig. 25.12 *A Rolling Ball Bearing*

Singh, Ajeet. Machine Drawing, Tata McGraw-Hill, 2007.

Bearing Specifications

Table 25.1 Ball bearing dimensions in mm of series 02

Bore	*Outside diameter*	*Width*	*Shoulder diameter 1*	*Shoulder diameter 2*	*Fillet radius*
10	30	9	12.5	27	0.6
12	32	10	14.5	28	0.6
15	35	11	17.5	31	0.6
17	40	12	19.5	34	0.6
20	47	14	24	41	0.6
25	52	15	30	47	0.6
30	62	16	35	55	1.0
35	72	17	41	[illegible]	[illegible]
40	80	18	46	[illegible]	[illegible]
45	85	19	52	[illegible]	[illegible]
50	90	20	56	[illegible]	[illegible]
55	100	21	63	[illegible]	[illegible]
60	110	22	70	[illegible]	[illegible]
65	120	23	74	[illegible]	[illegible]
70	124	24	79	[illegible]	[illegible]
75	130	24	86	[illegible]	[illegible]
80	140	26	93	[illegible]	[illegible]
85	150	28	99	[illegible]	[illegible]
90	160	30	104	[illegible]	[illegible]
95	170	32	110	156	2.0

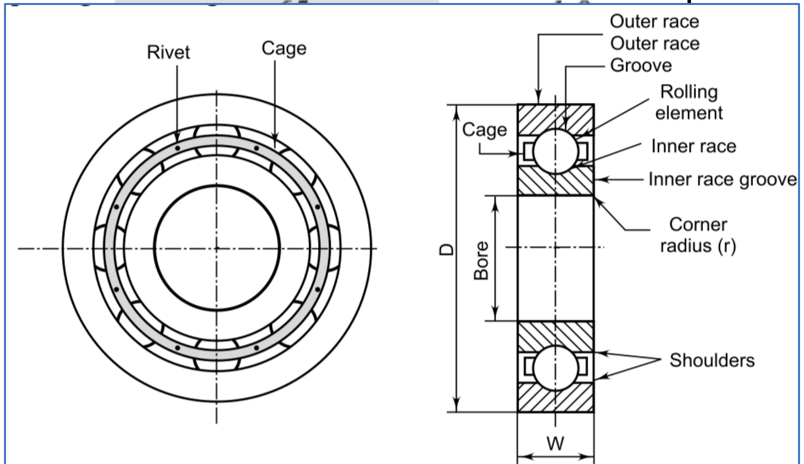

Fig. 25.12 *A Rolling Ball Bearing*

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Ball Bearing

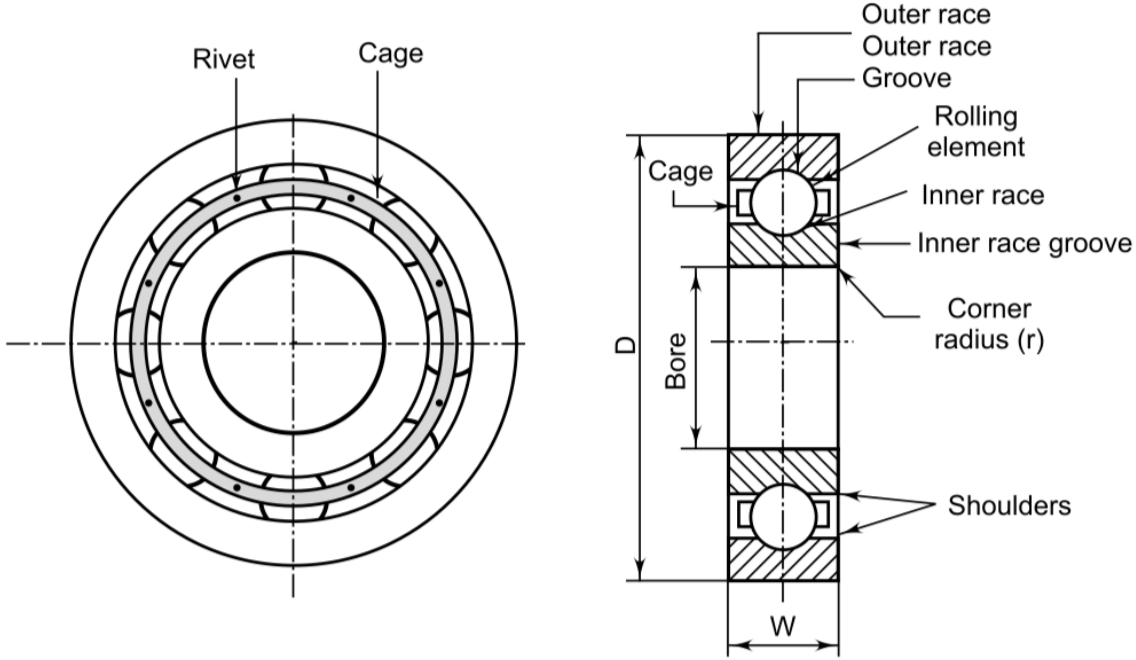

Fig. 25.12 *A Rolling Ball Bearing*

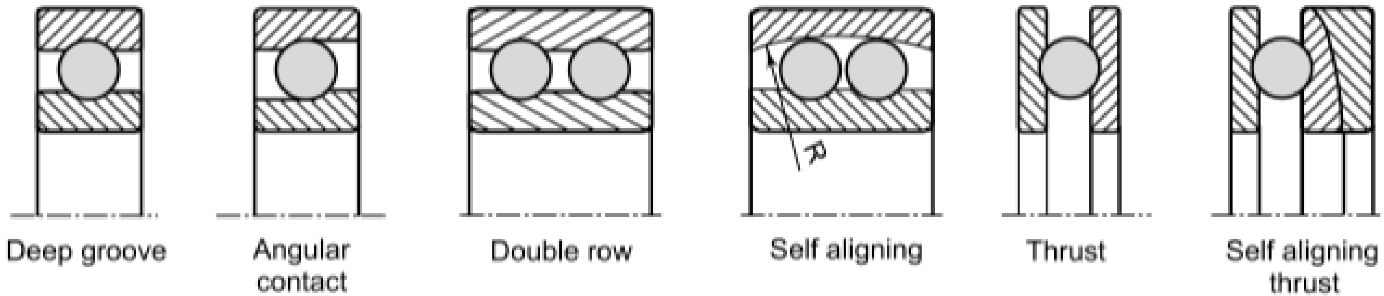

Fig. 25.13 *Types of Ball Bearings*

Singh, Ajeet. Machine Drawing, Tata McGraw-Hill, 2007.

Roller Bearing

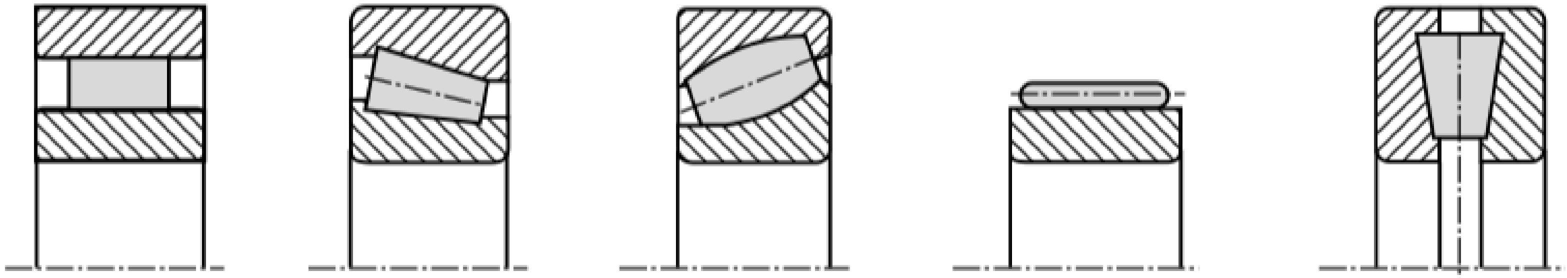

Fig. 25.14 *Types of Roller Bearings*

Singh, Ajeet. Machine Drawing, Tata McGraw-Hill, 2007.

MOUNTING

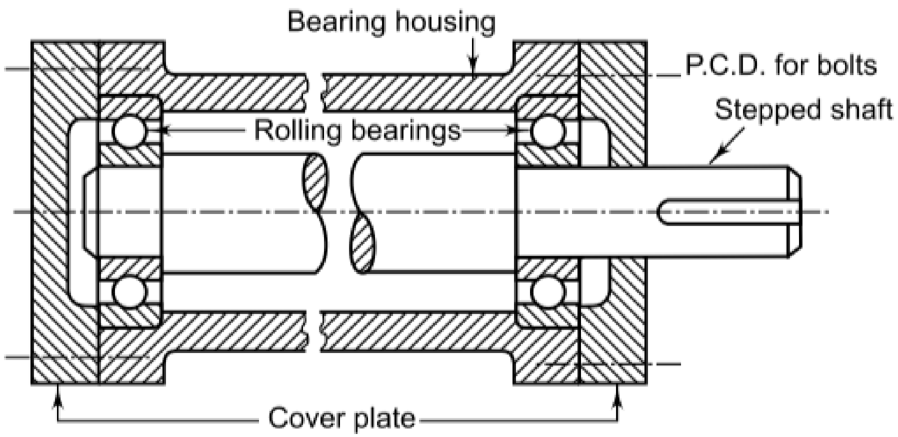

Fig. 25.16 *Mounting of Ball Bearings in a Housing*

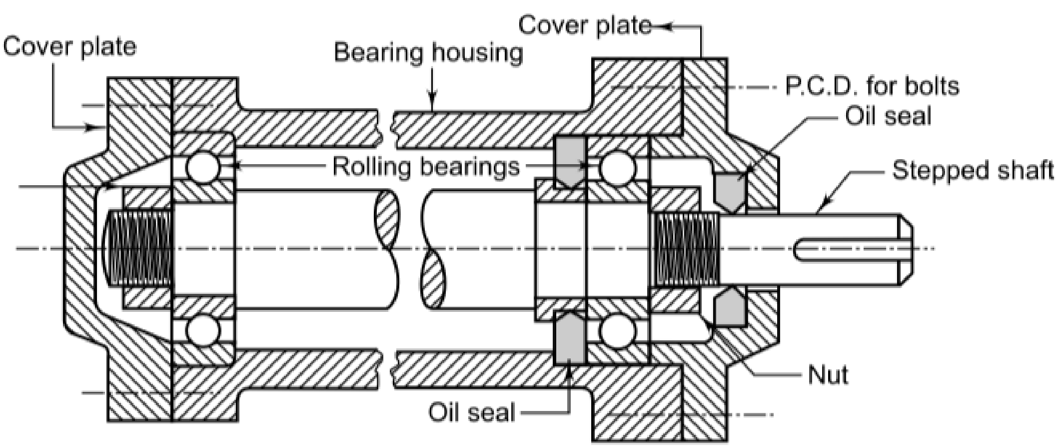

Fig. 25.18 *Mounting of Ball Bearings in a Housing with Seals*

Singh, Ajeet. Machine Drawing, Tata McGraw-Hill, 2007.

Thank you !!!