11. Mounting and dismounting

Proper operation of rolling bearings is also determined by a proper selection of the solution of mounting and dismounting, considering the type and size of bearing, fit, adequate tools for these operations, performance etc.

As being precision components, rolling bearings should be handled carefully when storing or mounting. Thus, the following conditions should be observed:

- storing in their original package, on special shelves, in dry room, temperature of + 18°C... + 20°C, maximum molsture degree of 60%
- handling bearings while storing and mounting should be carefully done so that original package to be protected and not to be deteriorated.
- bearings should be unpacked only when they are to be mounted.

They shouldn't be washed if original package hasn't been destroyed.

- as the adjoint parts of bearings are accurate, without burrs, chips or hits, special care should be taken

Mounting of bearings with cylindrical bore

Bearings with cylindrical bore which are to have tight fit on shaft or in housing respectively, will be mounted by mechanical, thermic or hydraulic means.

The pressing force should be transmitted only by the ring which is pressed on the shaft or into the housing bore. Transmission by rolling bearings should be avoided as they can get deformed and premature damage can occur.

Special sleeves with one or two ribs, fig.11.1, a and b are used when mounting small and medium-sized bearings, which are to be mounted with transition fit. In case of self-aligning ball bearings or spherical roller thrust bearings, a plate is mounted for a proper location of the outer ring, as shown in fig. 11.2.

Mechanical or hydraulic presses are used as shown in fig. 11.3, in case of serial production so that force can be continuously and gradually applied.

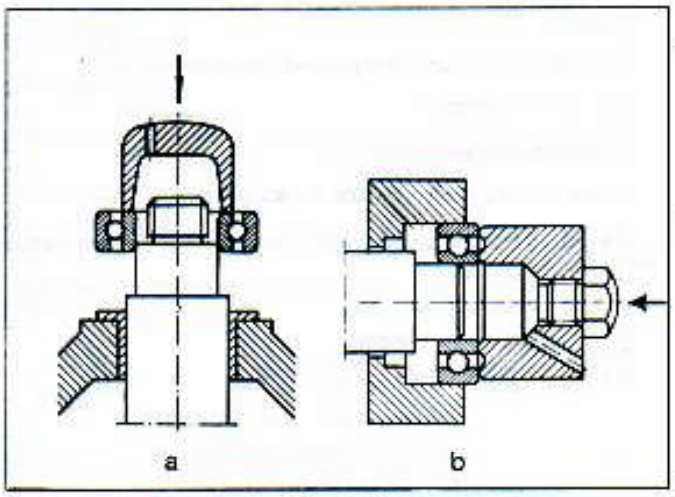

Fig. 11.1

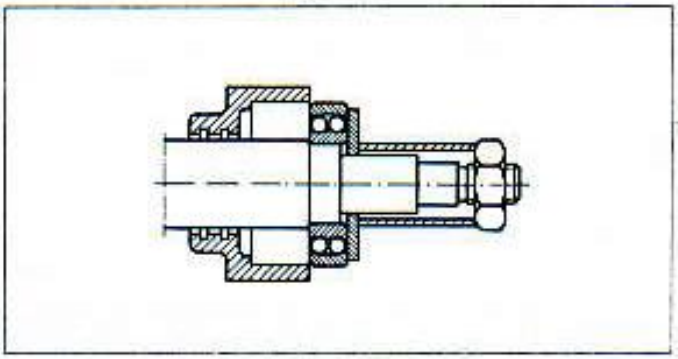

Fig. 11.2

For the mounting of bearings with clearance fit into the housing or on the shaft, the ring with transition or tight fit should be mounted first, after which the shaft-bearing assembly will be mounted into the housing as shown in fig.11.4, a and b.

In case of dismountable bearings, rings can be mounted separately - fig. 11.5, even if an tight fit is required for both rings.

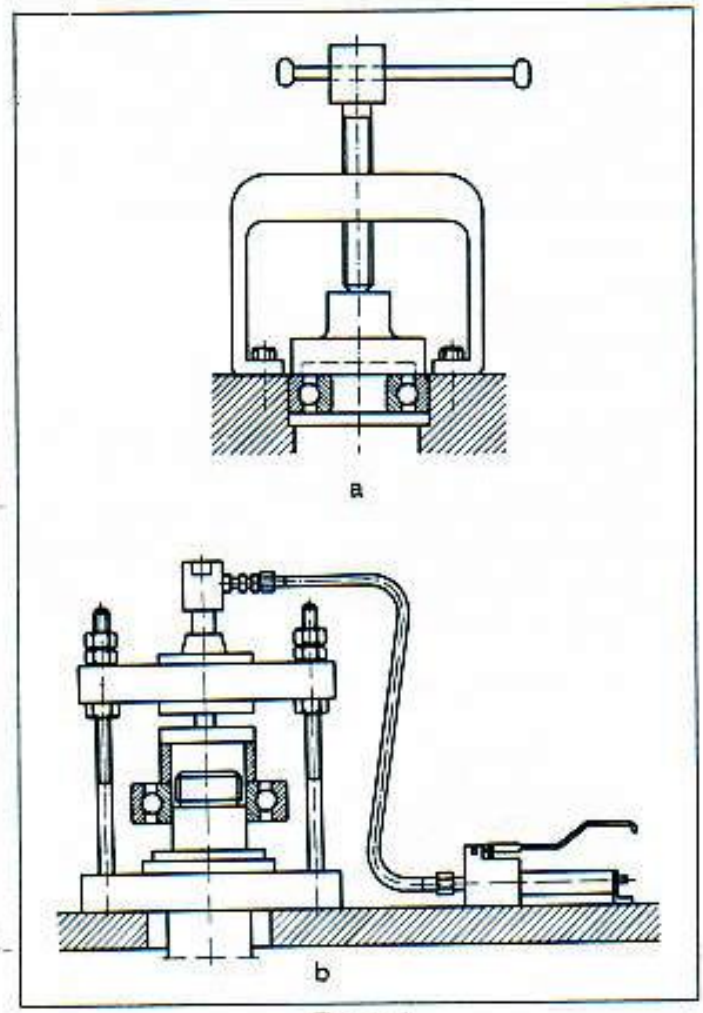

Fig. 11.3

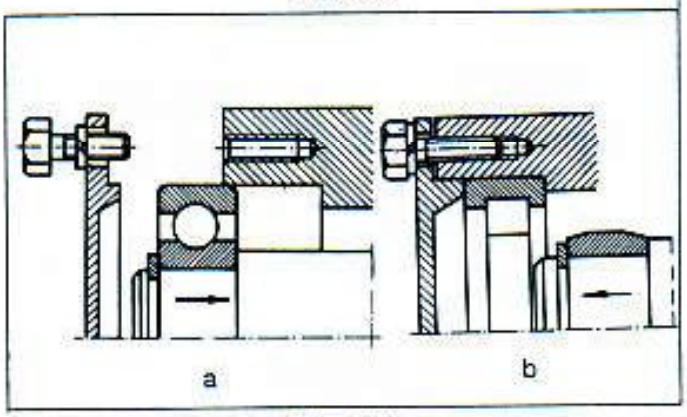

Fig. 11.4

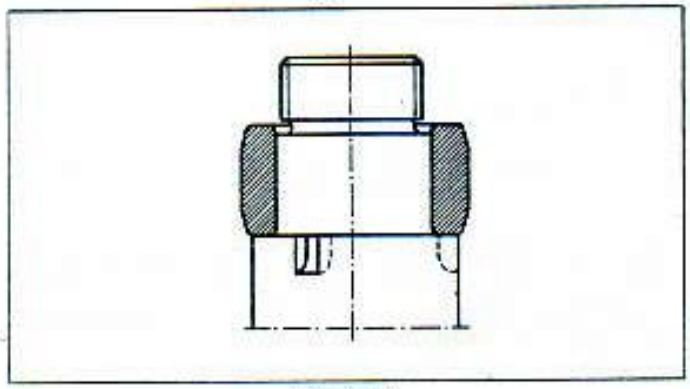

Fig. 11.5

The mounting of medium (d > 50 mm) and large-sized bearings with tight fit, requires much greater pressing forces. That's why in this case heating of bearings up to +80°C... +110°C should be used instead of pressing, excepting shielded bearings, 2Z (2ZR) type and sealed bearings, 2RS (2RSR) type.

For the bearings heating, oil bath, electric range, heating device with thermic ring or induction heating device etc. can be used as shown in fig.11.6, a-d.

The device with thermic ring - fig.11.6 c consists of a split aluminium ring with three grips and cuts which make it be elastic.

Thermic ring bore diameter is equal to inner ring raceway diameter of dismountable bearings.

The ring outside diameter can be calculated using the equation:

$$D_{ex} = \sqrt{4\,d_1^2 - 3d^2},\ mm,$$

where:
D_{ex} = outside diameter of the thermic ring,
d_1 = diameter of the inner ring raceway, mm
d = bearing bore diameter, mm

The weight of the thermic ring is approximately equal to the weight of the bearing inner ring.

In case of large-sized cylindrical roller bearings, heating is done with induction devices. These devices consist of a coil inductor, thermal relays for temperature adjustment and timers. 380 V voltage and 50 - 60 Hz frequency inductors are used for bearings with bore diameter up to 200 mm. For larger-sized bearings, 20... 40 V voltage and 50 - 60 Hz inductors are used.

This device is schematically shown in fig. 11.6.d.

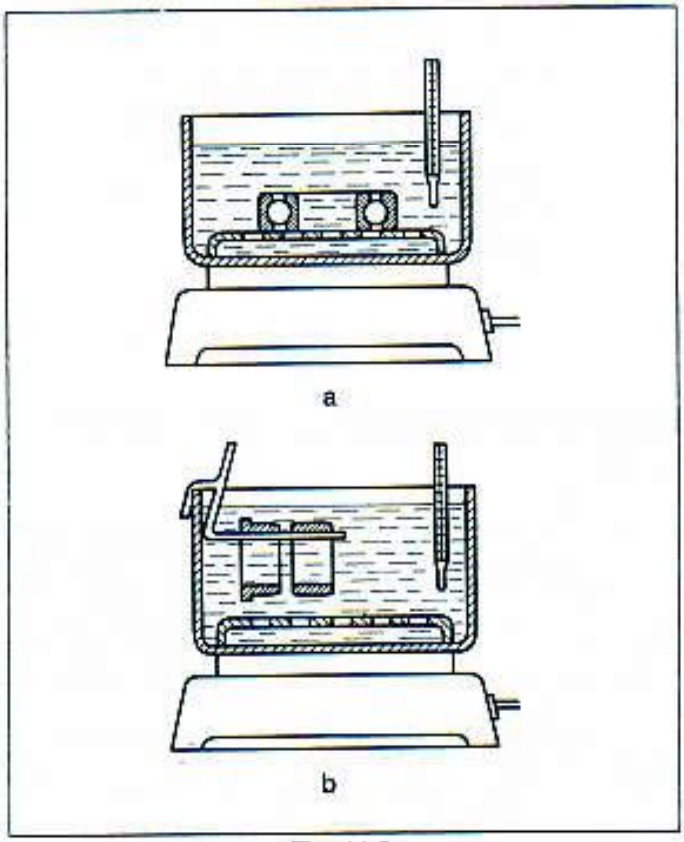

Fig. 11.6

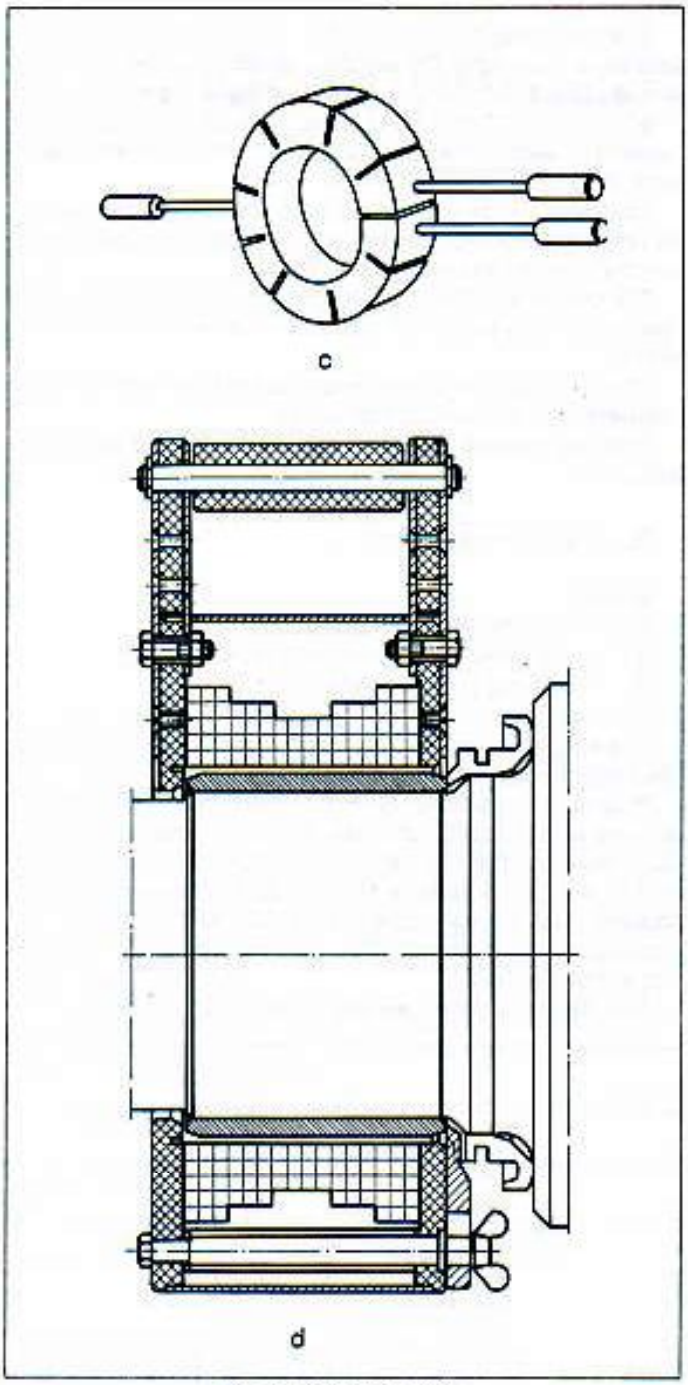

Fig. 11.6 (continued)

Mounting of bearings with tapered bore

Tapered bore bearings can be mounted directly on the shaft, on adapter sleeve or withdrawal sleeve. These bearings should always be mounted only with an tight fit. The tight fit can be done by an axial displacement of the bearing inner ring which is mounted directly on the tapered spindle of the shaft or by an axial displacement of the adapter or withdrawal sleeve.

The values of reduction in radial clearance are given in tables 11.1 and 11.2, as function of axial displacement on shaft of self-aligning ball bearings and spherical roller thrust bearings. After mounting the initial radial clearance is to be considered.

After mounting, radial clearance of radial and self-aligning ball bearings are in accordance with table 11.1.

The values of tightening are estimated by the values of the radial clearance reduction or of axial displacement. Axial displacement of the mounted bearing is measured by means of a limit gauge, as shown in fig. 11.7, a and b. The thickness of the limit gauge can be calculated from:

$$m = S - a$$

where:
m = thickness of the limit gauge, mm
S = distance initially measured, mm
a = axial displacement, from table 11.1, mm

Example A bearing 22252, d = 260 mm, taper 1:12, distance s = 10 mm, distance "a" from table 11.1 = 1,90 mm, m = 10 - 1,9 = 8,10 mm

Small-sized bearings with tapered bore which are to be mounted directly on the shaft or with adapter or withdrawal sleeves can be axially displaced by means of a nut as shown in fig. 11.8, a, or by means of a special sleeve as in fig. 11.8 b,c.

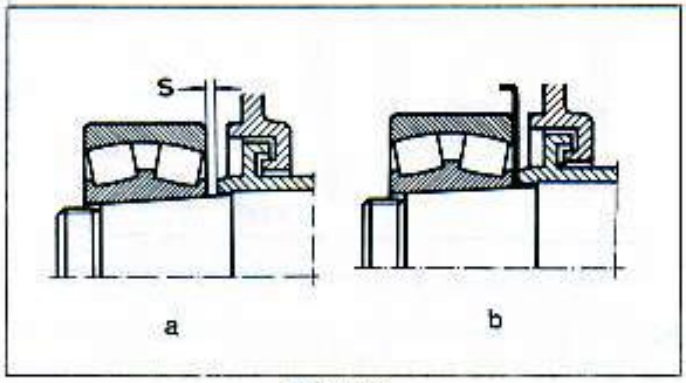

Fig. 11.7

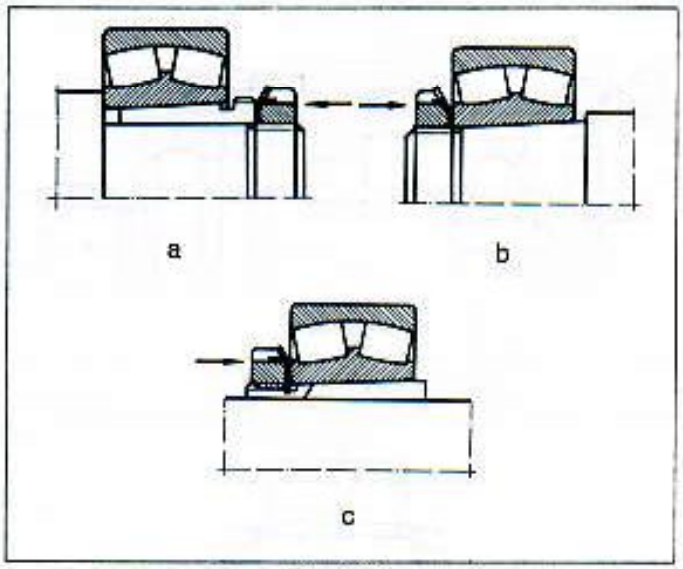

Fig. 11.8

Medium-sized bearings can be axially displaced by means of a special nut as shown in fig. 11.9 and some screws. Then, the nut is to be dismounted and replaced with a nut for axial fastening.

Values for self-aligning ball bearings radial clearance, after mounting

Values in mm

Table 11.1

Bore diameter d		Reduction of radial clearance		Axial displacement "a", taper 1:12				Minimum radial clearance after mounting, in case of clearance group	
				on tapered shaft		on tapered sleeve			
over	up to	low	high	low	high	low	high	normal	C3
–	20	0,003	0,010	0,22	0,23	0,24	0,25	0,01	0,02
20	30	0,005	0,010	0,22	0,23	0,23	0,24	0,01	0,02
30	40	0,008	0,015	0,30	0,30	0,32	0,32	0,01	0,02
40	50	0,010	0,018	0,31	0,34	0,35	0,37	0,015	0,025
50	65	0,012	0,018	0,39	0,41	0,40	0,42	0,015	0,03
65	80	0,015	0,025	0,43	0,47	0,45	0,50	0,02	0,04
80	100	0,022	0,030	0,54	0,60	0,56	0,62	0,02	0,04
100	120	0,025	0,035	0,58	0,70	0,60	0,75	0,025	0,055

Values for spherical roller bearings radial clearance, after mounting

Values in mm

Table 11,2

Bore diameter d		Reduction of radial clearance		Axial displacement a, taper 1:12				Axial displacement "a", taper 1:30				Minimum radial clearance after mounting, in case of clearance group		
				on tapered shaft		on tapered sleeve		on tapered shaft		on tapered sleeve				
over	up to	low	high	low	high	low	high	low	high	low	high	Normal	C3	C4
30	40	0,02	0,025	0,35	0,4	0,35	0,45	–	–	–	–	0,015	0,025	0,04
40	50	0,025	0,03	0,4	0,45	0,45	0,5	–	–	–	–	0,02	0,03	0,05
50	65	0,03	0,04	0,45	0,6	0,5	0,7	–	–	–	–	0,025	0,035	0,055
65	80	0,04	0,05	0,6	0,75	0,7	0,85	–	–	–	–	0,025	0,04	0,07
80	100	0,045	0,06	0,7	0,9	0,75	1	1,7	2,2	1,8	2,4	0,035	0,05	0,08
100	120	0,05	0,07	0,7	1,1	0,8	1,2	1,9	2,7	2	2,8	0,05	0,065	0,1
120	140	0,065	0,09	1,1	1,4	1,2	1,5	2,7	3,5	2,8	3,6	0,055	0,08	0,11
140	160	0,075	0,1	1,2	1,6	1,3	1,7	3	4	3,1	4,2	0,055	0,09	0,13
160	180	0,08	0,11	1,3	1,7	1,4	1,8	3,2	4,2	3,3	4,6	0,06	0,1	0,15
180	200	0,09	0,13	1,4	2	1,5	2,2	3,5	4,5	3,6	5	0,07	0,1	0,16
200	225	0,1	0,14	1,6	2,2	1,7	2,4	4	5,5	4,2	5,7	0,08	0,12	0,18
225	250	0,11	0,15	1,7	2,4	1,8	2,6	4,2	6	4,8	6,2	0,09	0,13	0,2
250	280	0,12	0,17	1,9	2,6	2	2,9	4,7	6,7	4,8	6,9	0,1	0,14	0,22
280	315	0,13	0,19	2	3	2,2	3,2	5	7,5	5,2	7,7	0,11	0,15	0,24
315	355	0,15	0,21	2,4	3,4	2,6	3,6	6	8,2	6,2	8,4	0,12	0,17	0,26
355	400	0,17	0,23	2,6	3,6	2,9	3,9	6,5	9	6,8	9,2	0,13	0,19	0,29
400	450	0,2	0,26	3,1	4,1	3,4	4,4	7,7	10	8	10,2	0,13	0,2	0,31
450	500	0,21	0,28	3,3	4,4	3,6	4,8	8,2	11	8,4	11,2	0,16	0,23	0,35
500	560	0,24	0,32	3,7	5	4,1	5,4	9,2	12,5	9,6	12,8	0,17	0,25	0,38
560	630	0,26	0,35	4	5,4	4,4	5,9	10	13,5	10,4	14	0,2	0,29	0,41
630	710	0,3	0,4	4,6	6,2	5,1	6,8	11,5	15,5	12	16	0,21	0,31	0,45
710	800	0,34	0,45	5,3	7	5,8	7,6	13,3	17,5	13,6	18	0,23	0,35	0,51
800	900	0,37	0,5	5,7	7,8	6,3	8,5	14,3	19,5	14,8	20	0,27	0,39	0,57
900	1 000	0,41	0,55	6,3	8,5	7	9,4	15,8	21	16,4	22	0,3	0,43	0,64
1 000	1 200	0,45	0,6	6,8	9	7,6	10,2	17	23	18	24	0,32	0,46	0,7
1 200	1 250	0,49	0,65	7,4	9,8	8,3	11	18,5	25	19,6	26	0,34	0,64	0,77

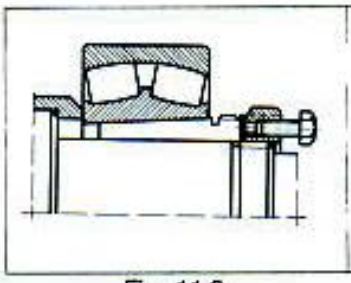

Fig. 11.9

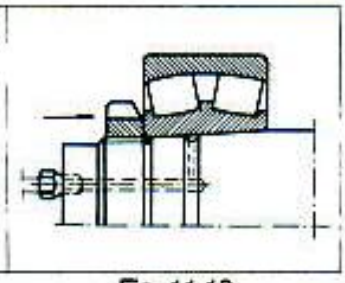

Fig. 11.10

Special hydraulic presses - fig. 11.10 or special hydraulic nuts - fig. 11.11 are used to mount medium and large-sized bearings.

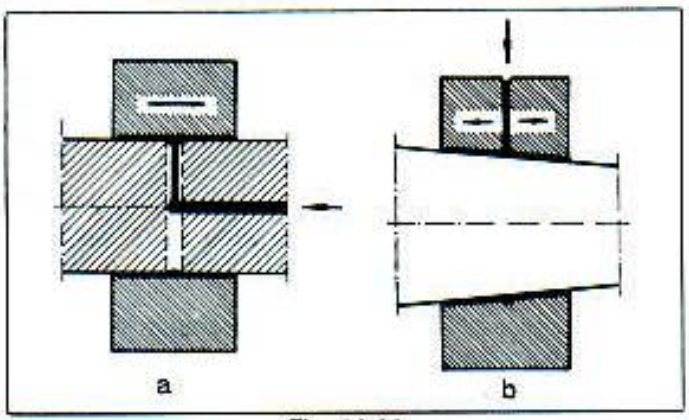

Fig. 11.11

To reduce the bearing displacing force in case of large -sized bearings, pressurized oil is to be introduced between the tapered surfaces of the shaft spindle, bearing and adapter or withdrawal sleeves, as shown in fig. 11.11a and b, by means of an oil pump - fig.11.10 or oil injector - fig. 11.12. One or more grooves should be provided as shown in fig. 11.13, a and b so that oil can be distributed between the mounting surfaces.

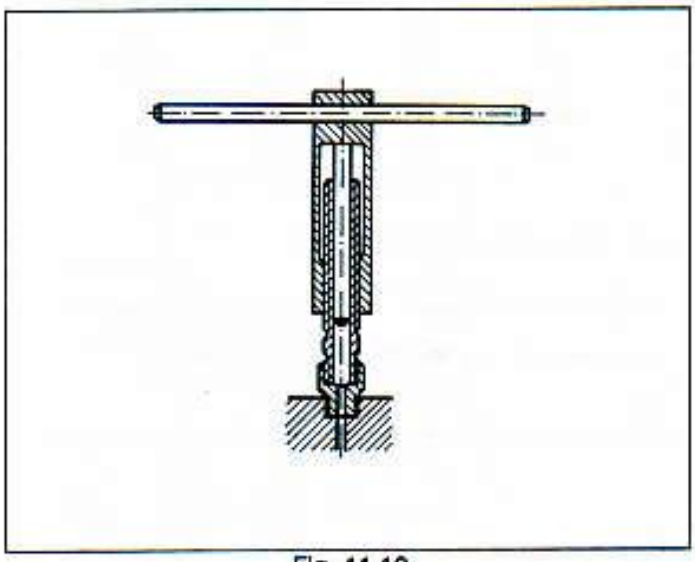

Fig. 11.12

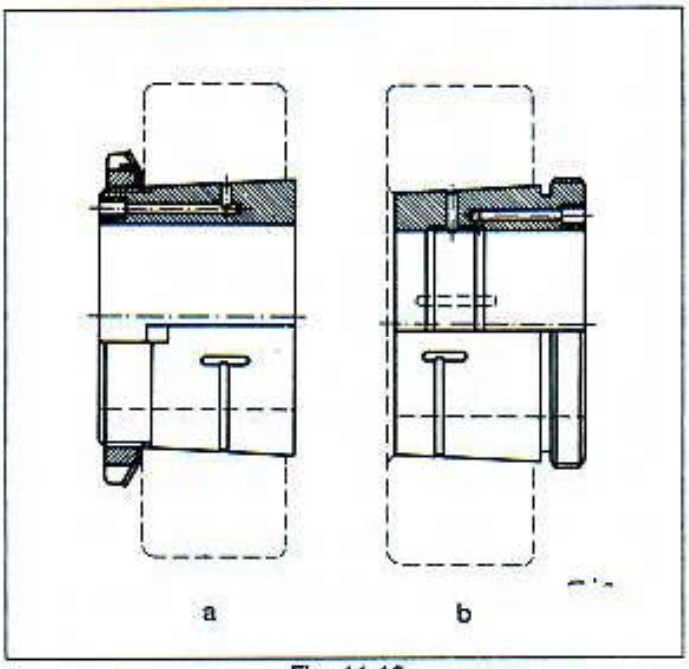

Fig. 11.13

Bearing dismounting

When bearings with tapered bore are to be dismounted from the shaft or housing, the succession of operations is inversely done than in case of mounting.

Thus, the assembly mounted with clearance fit or small tightening is to be dismounted first and then the parts mounted with greater tightening, as shown in fig. 11.14 and fig. 11.15.

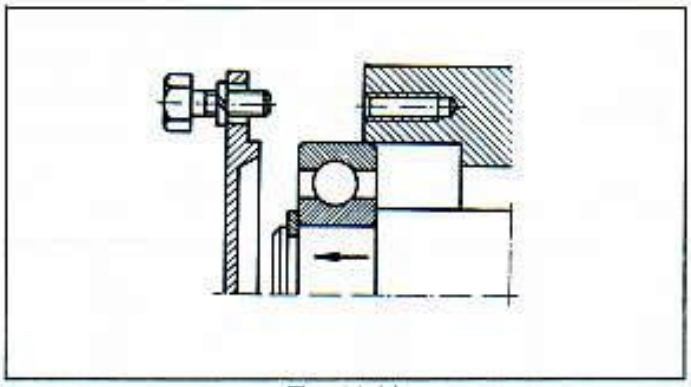

Fig. 11.14

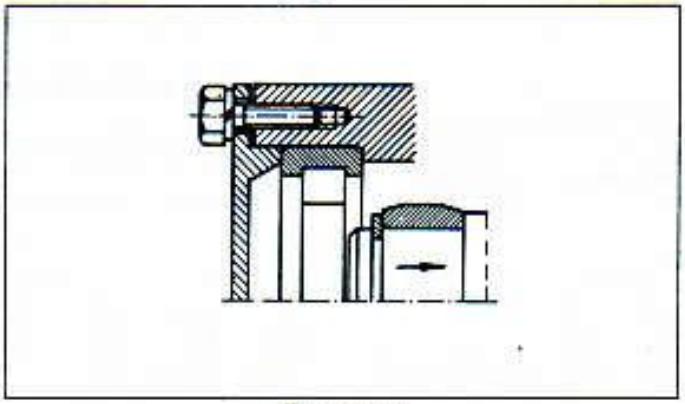

Fig. 11.15

To use mechanical or hydraulic instruments when dismounting bearings, a special design of the shaft and housing is required, as shown in fig. 11.16, a-b: withdrawal grooves (a), threaded bores (b), grooves for oil distribution, fig.11.13.

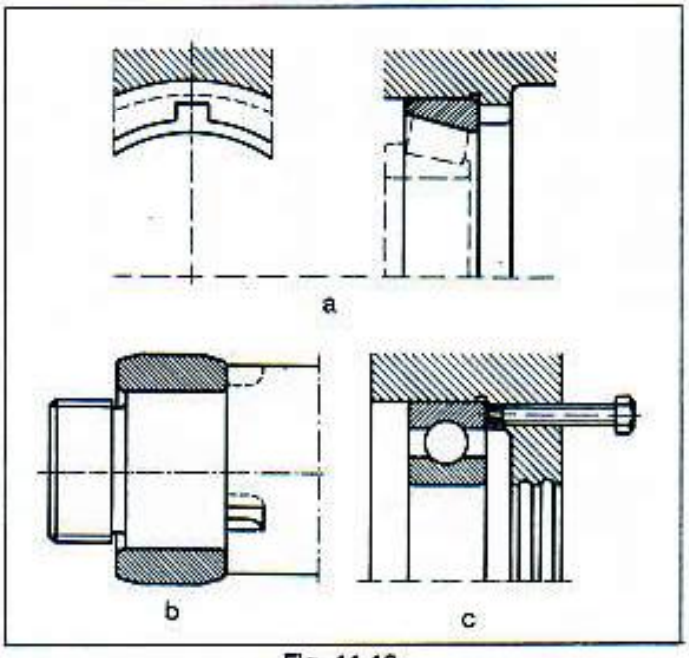

Fig. 11.16

Medium and small-sized bearings which are mounted with an tight fit are dismounted from the shaft by means of a soft steel or copper mandrel or by means of mechanical or hydraulic presses - fig.11.17, a-c.

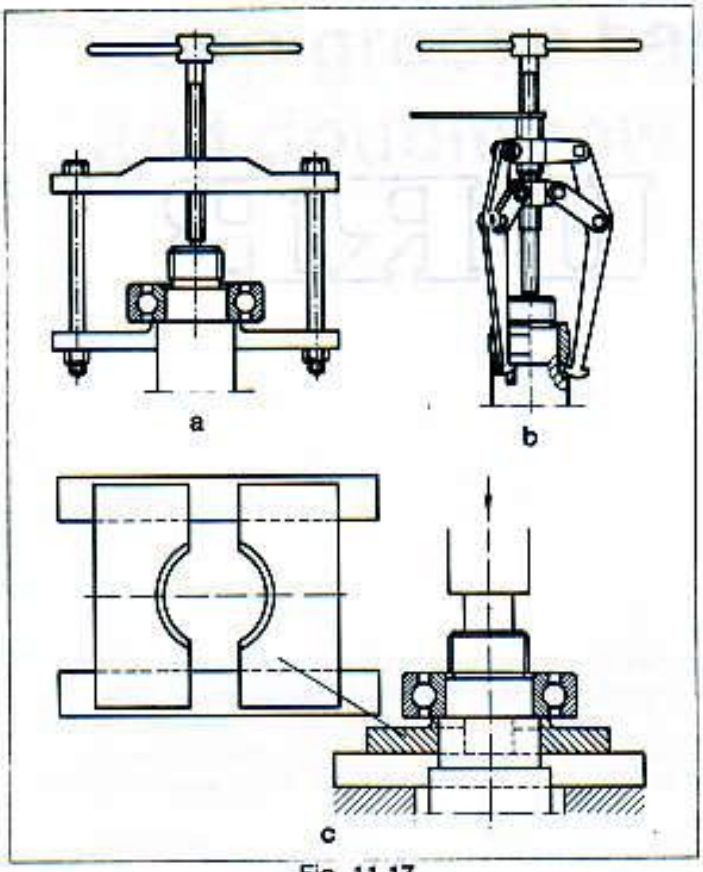

Fig. 11.17

To reduce the frictional force when dismounting large-sized bearings which were mounted on shaft with tight fit, pressurized oil should be introduced, as in case of mounting - fig.11.11.

To dismount bearings with tapered bore which were mounted directly on the shaft or bearings which were mounted with withdrawal or adapter sleeves, the nut axially fastened should be first stripped. Then, dismounting is to be done by light hammering on the inner ring by means of a soft steel or copper mandrel, as shown in fig. 11.18, a and b.

In case of bearings mounted with withdrawal sleeves, a nut is to be screwed up on the threaded part provided for this purpose, as shown in fig. 11.19, a and b.

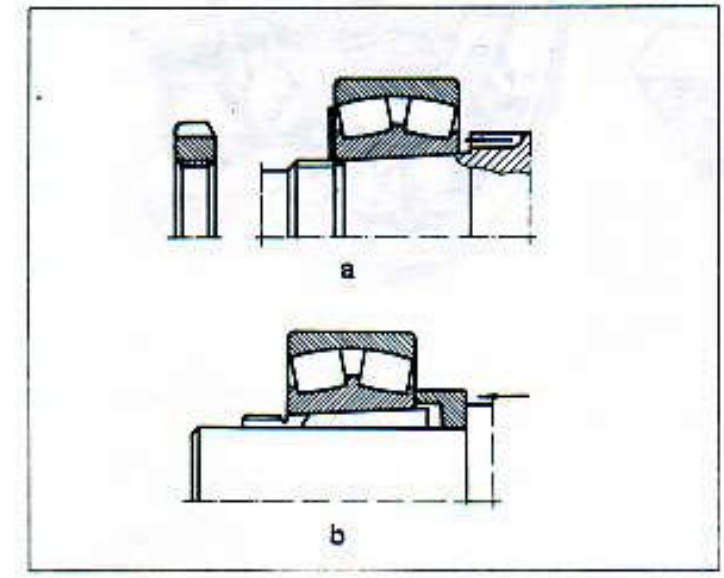

Fig. 11.18

In case of large-sized bearings, hydraulic devices are used as in case of mounting.

Some solutions for dismounting bearings with tapered bore mounted directly on the shaft spindle, with adapter or withdrawal sleeve are given in fig. 11.20, a and b.

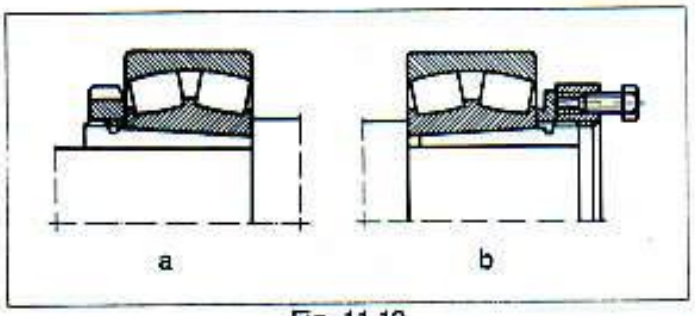

Fig. 11.19

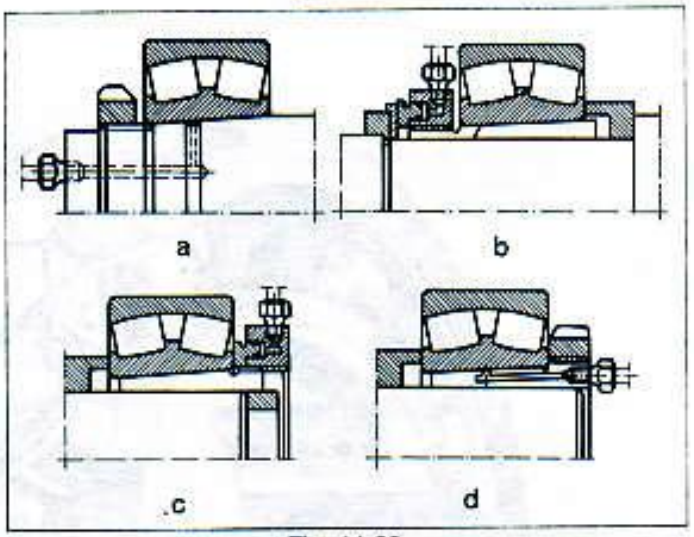

Fig. 11.20