Fitter 2nd Year – Transparencies

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Fitter 2nd Year – Transparencies

Directorate General of Employment & Training, Ministry of Labour, Govt. of India.

Developed by

CENTRAL INSTRUCTIONAL MEDIA INSTITUTE

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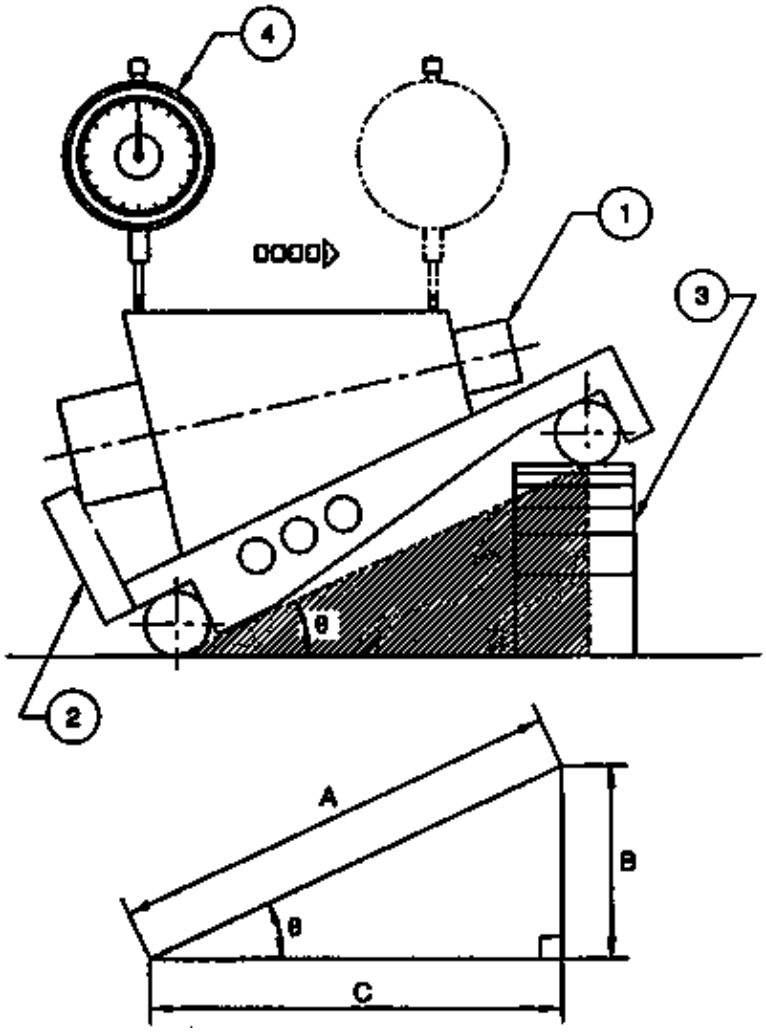
MEASUREMENT OF TAPER ANGLE USING SINEBAR – TR 01 02 10 01 95



To calculate the angle of taper formed on a round rod, the job (1) is placed on sine bar (2). One end of the sine bar (i.e. smaller dia. end on job) is lifted up and slip gauges (3) are placed in between sine bar roller and the surface plate. The top surface of the taper portion should be brought to perfect horizontal line by placing additional slip gauges, and testing with dial test indicator (4). A right angled triangle is formed, with the slip gauge height as opposite side (B) and the length of sine bar as hypotenuse (A). By applying the

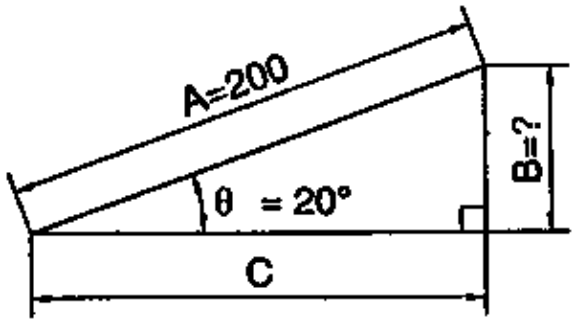
trigonometrical ratio formula,

$\sin e\theta = \frac{\text{Opposite side}}{\text{Hypotenuse}}$, we get sine ? value in degrees i.e. the included angle of the tapered job.

TAPER CALCULATION USING SINEBAR – TR 01 02 10 02 95

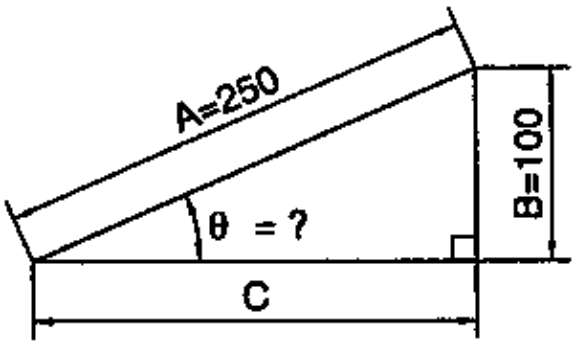
1. $\text{Sine}20^\circ = \frac{B}{A} = \frac{B}{200}$

Therefore B = 68.404.



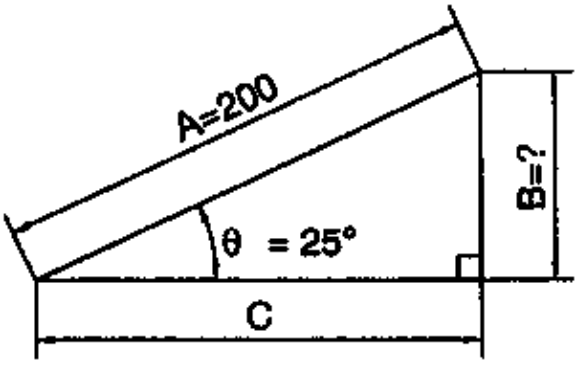
2. $\text{Sine}\theta = \frac{B}{A} = \frac{100}{250}$

Therefore ? = 23°34' 41"



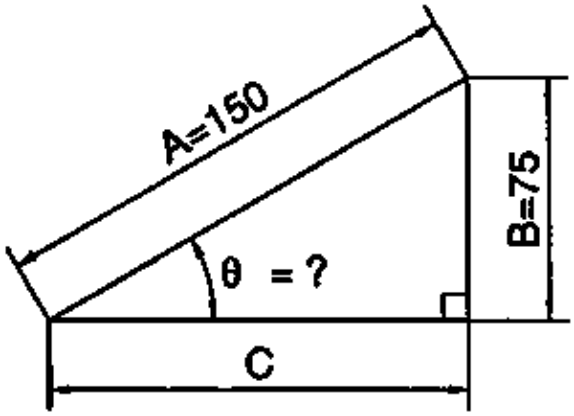
3. $\text{Sine}25^\circ = \frac{B}{A} = \frac{B}{200}$

Therefore B = 84.524



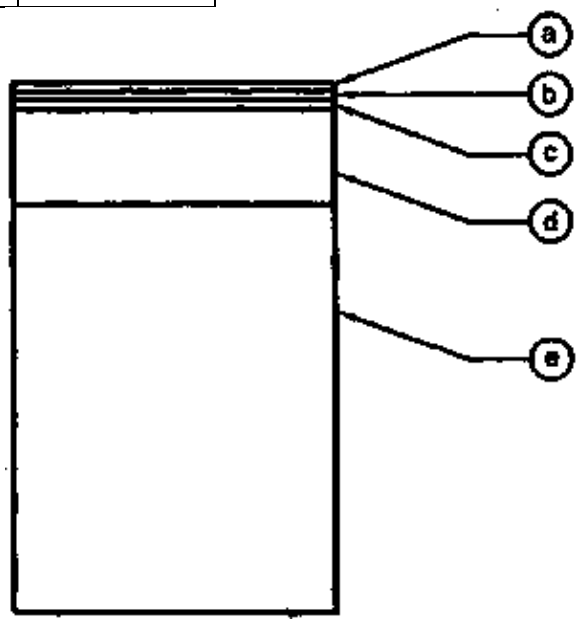
4. $\text{Sine}\,\theta = \frac{B}{A} = \frac{75}{150}$

Therefore ? = 30°



DETERMINING SLIP GAUGE SIZES – TR 01 02 10 03 95

Set of 112 pieces		
Range (mm)	**Steps (mm)**	**No. of pieces**
1.0005	–	1
1.001 to 1.009	0.001	9
1.01 to 1.49	0.01	49
0.5 to 24.5	0.5	49
25 to 100	25	4
Total pieces		**112**



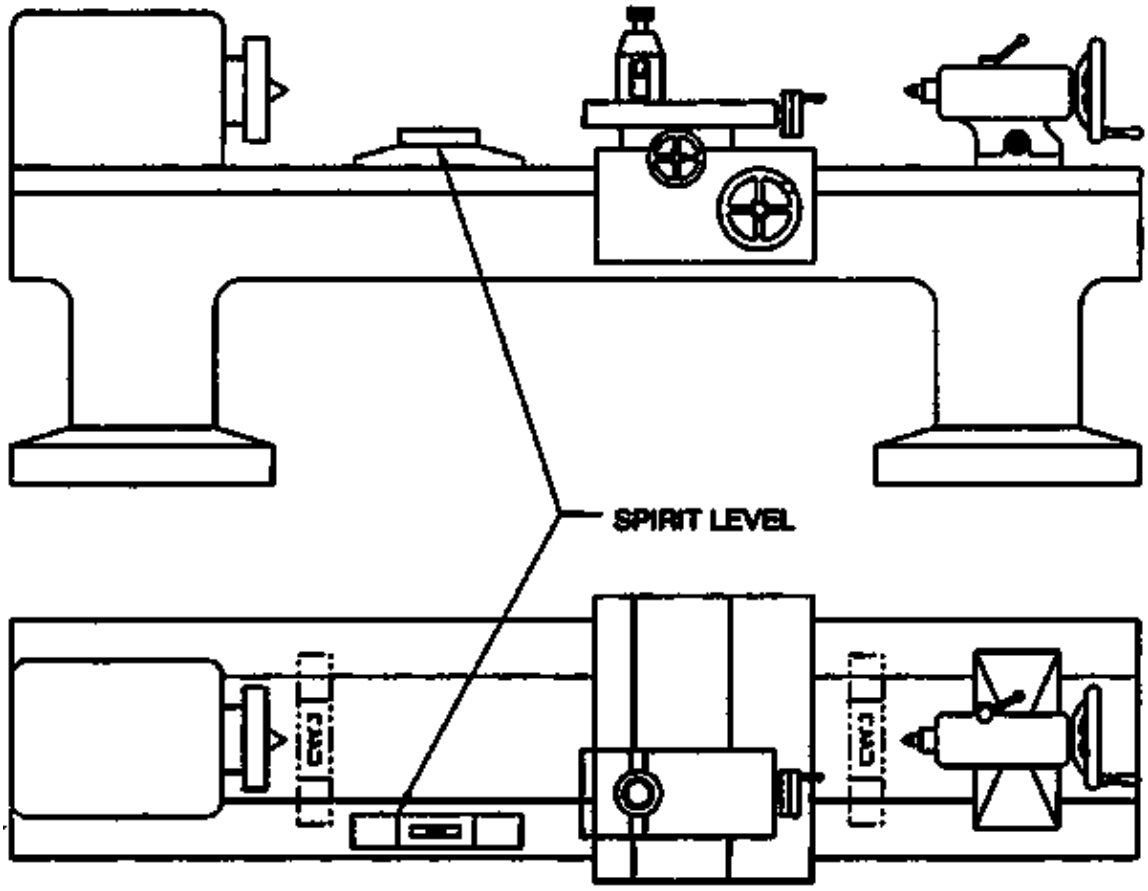
	Steps	**Slip size**	**Calculation**
1.	First write the required dimension.		64.7235

2. Select the slip gauge having the 4th decimal place.	**(a)** 1.0005	Subtract	1.0005 / 63.723
3. Select 1st series slip that has the same last figure.	**(b)** 1.003	Subtract	1.003 / 62.72
4. Select the 2nd series slip that has the same last figure and that will leave .0 or 0.5 as the last figure.	**(c)** 1.22	Subtract	1.22 / 61.50
5. Select a 3rd series slip that will leave the nearest 4th series slip (61.50–11.50)	**(d)** 11.50	Subtract	11.50 / 50.00
6. Select a slip that eliminates the final figure.	**(e)** 50.00	Subtract	50.00 / 0
	64.7235		

ASSIGNMENT
Determine the slip gauges for the following sizes

1.35.8475 mm
2. 108.648 mm

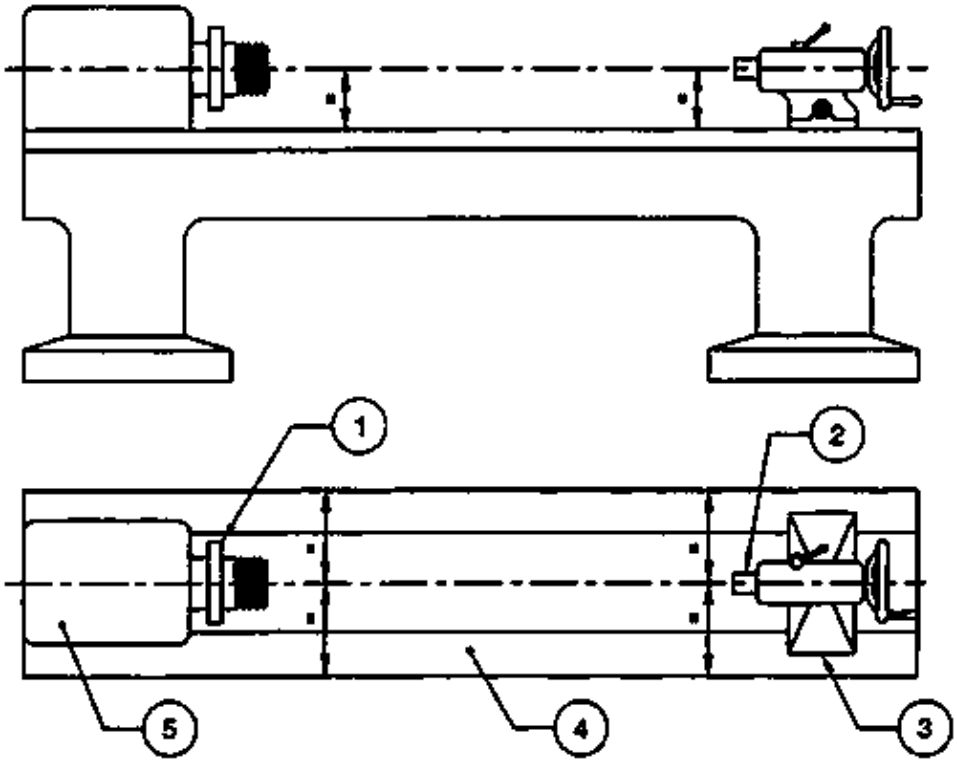
LEVELLING A LATHE – TR 01 07 01 01 95



Note:

A machine is leveled up to ensure that the basic structure of the machine is not twisted. The standard tests for alignment or accuracy should be carried out only after levelling the machine.

BASIC ALIGNMENTS OF A LATHE – TR 01 07 01 02 95



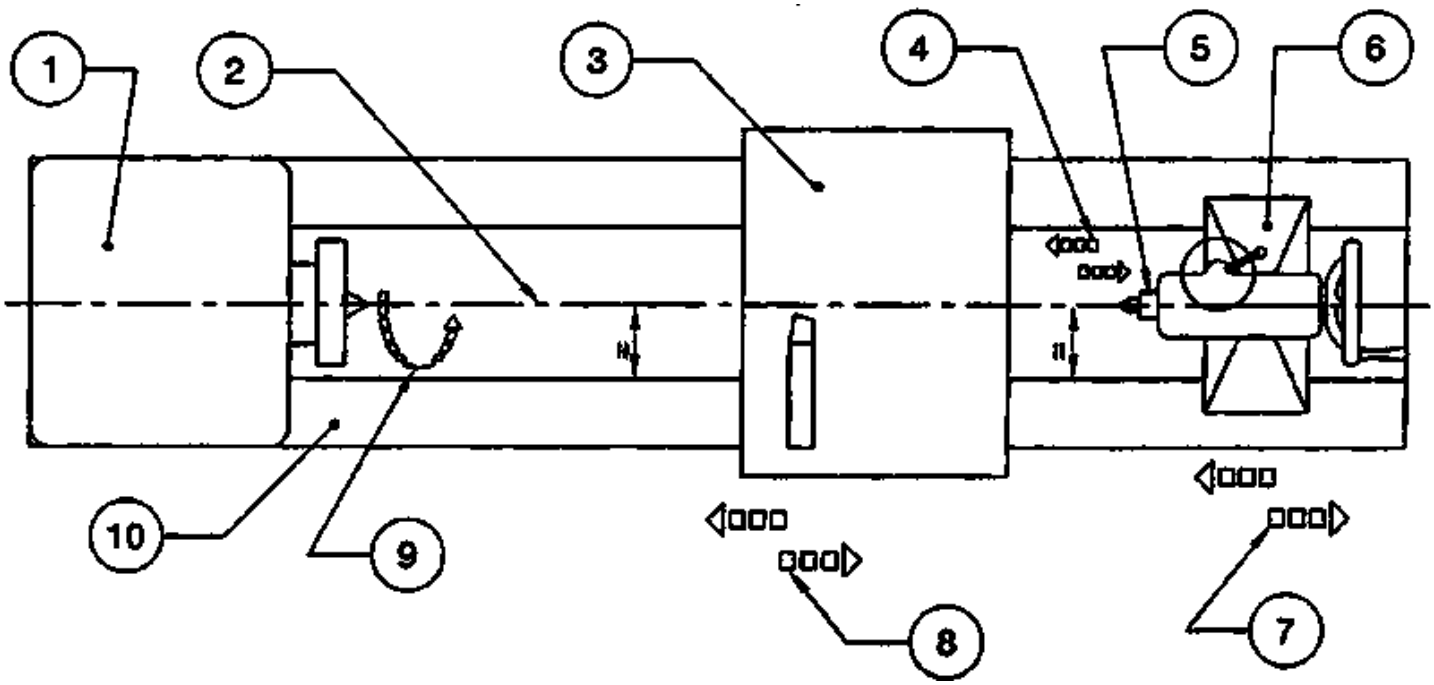
1. Spindle
2. Barrel
3. Tailstock
4. Bed
5. Head stock

Note:

• The figure shows the basic alignment of Head stock (5) tail stock (3) spindle (1) and bed (4) slide ways.

• The spindle and tailstock axis are parallel to the bed slide ways in both vertical and horizontal planes.

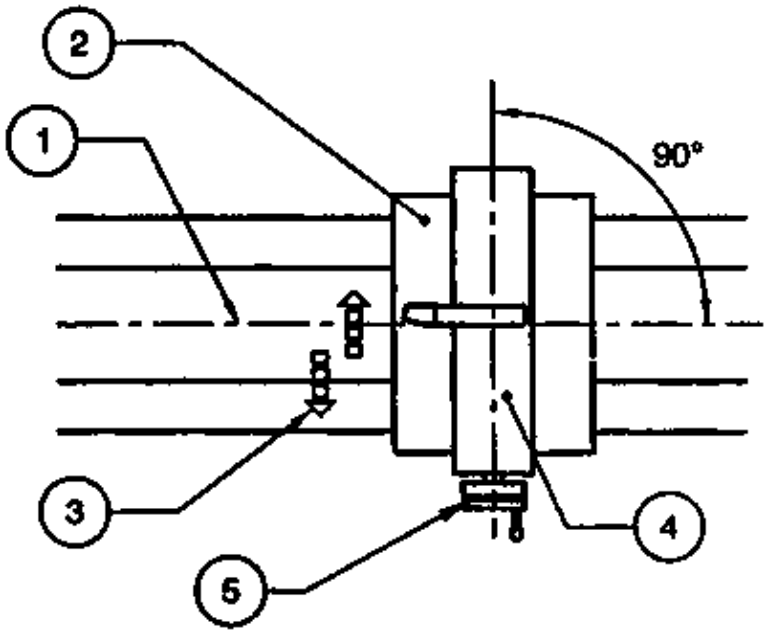
CENTRE LATHE BASIC GEOMETRY – (1) – TR 01 07 01 03 95



The carriage or saddle provides the basic movement to the cutting tool, parallel to the work axis and this produces true cylindrical surfaces.

1. Headstock
2. Axis of workpiece and spindle rotation
3. Carriage
4. Barrel movement within tailstock
5. Barrel
6. Tailstock
7. Movement of tailstock along bed parallel to spindle axis
8. Movement of carriage along bed parallel to axis of rotation of spindle
9. Spindle rotation
10. Bed slide ways

CENTRE LATHE BASIC GEOMETRY – (2) – TR 01 07 01 04 95



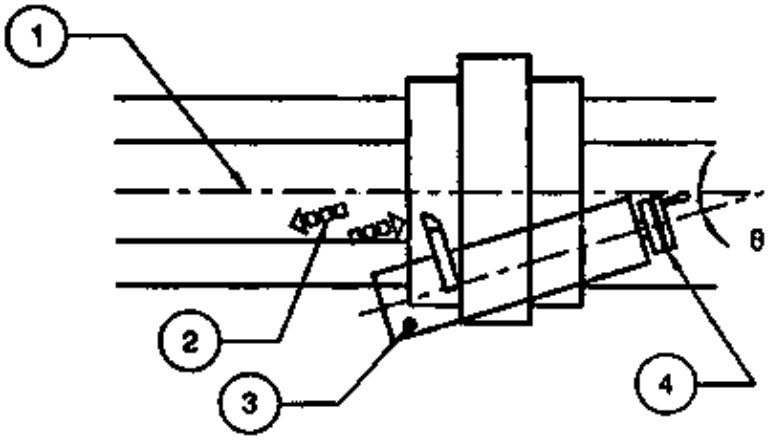
A

A. Cross slide movement

1. Spindle axis
2. Carriage
3. Movement of cross slide
4. Cross slide
5. Micrometer dial

Note:

The cross slide on top of the carriage is aligned at 90° to the spindle axis. Since the slide moves the tool in a path at 90° to the spindle axis it produces plane surfaces.



B

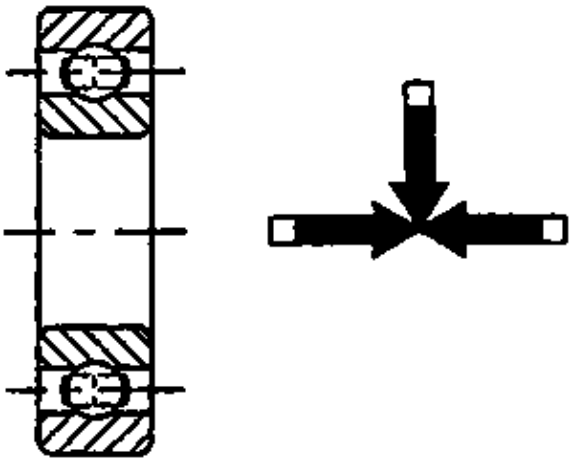
B Compound slide movement

1. Spindle axis
2. Movement of compound slide
3. Compound slide
4. Micrometer dial

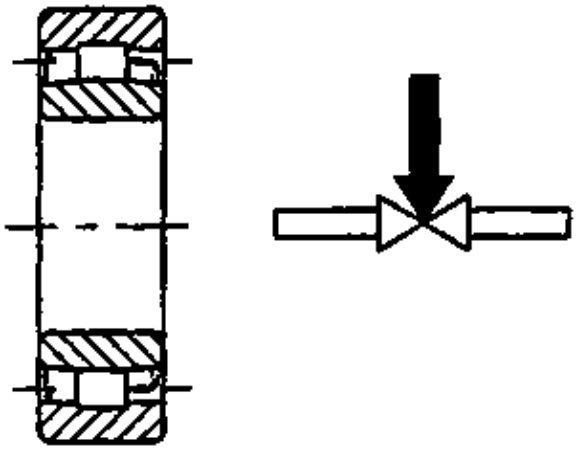
Note:

The compound slide is located on top of the cross slide and can be set accurately at an angle to the spindle axis. It moves the tool in a path at an angle to the spindle axis and is used to produce tapered conical components.

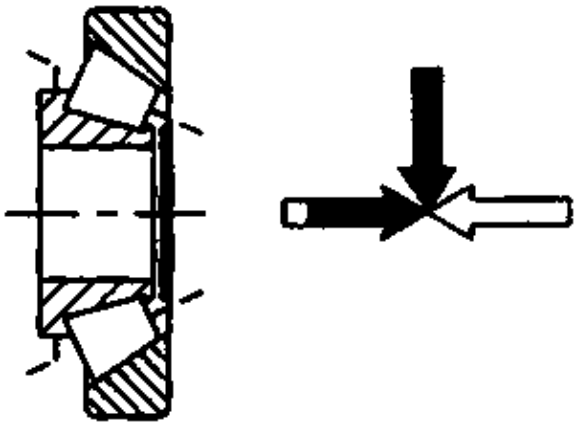
LOAD CONDITIONS FOR BEARINGS – TR 01 07 05 01 95



1 Deep groove ball bearing

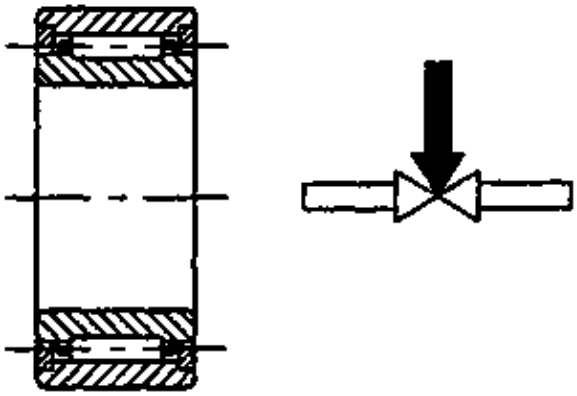


2 Roller bearing

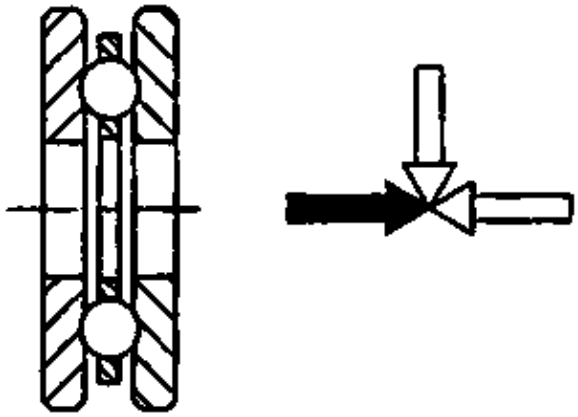


3 Taper roller bearing

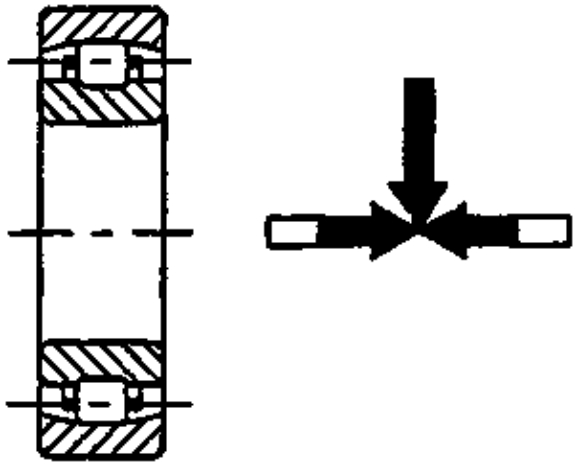
Needle bearing



4 Needle bearing

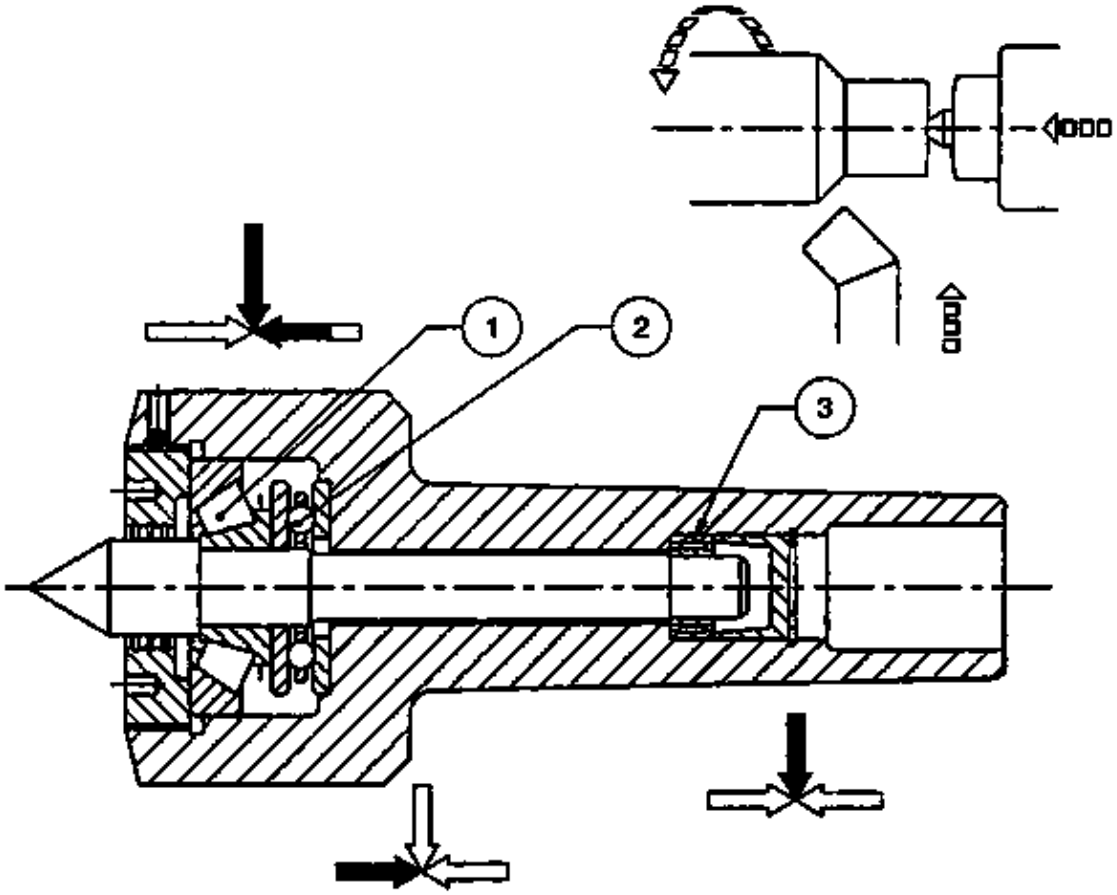


5 Thrust ball bearing



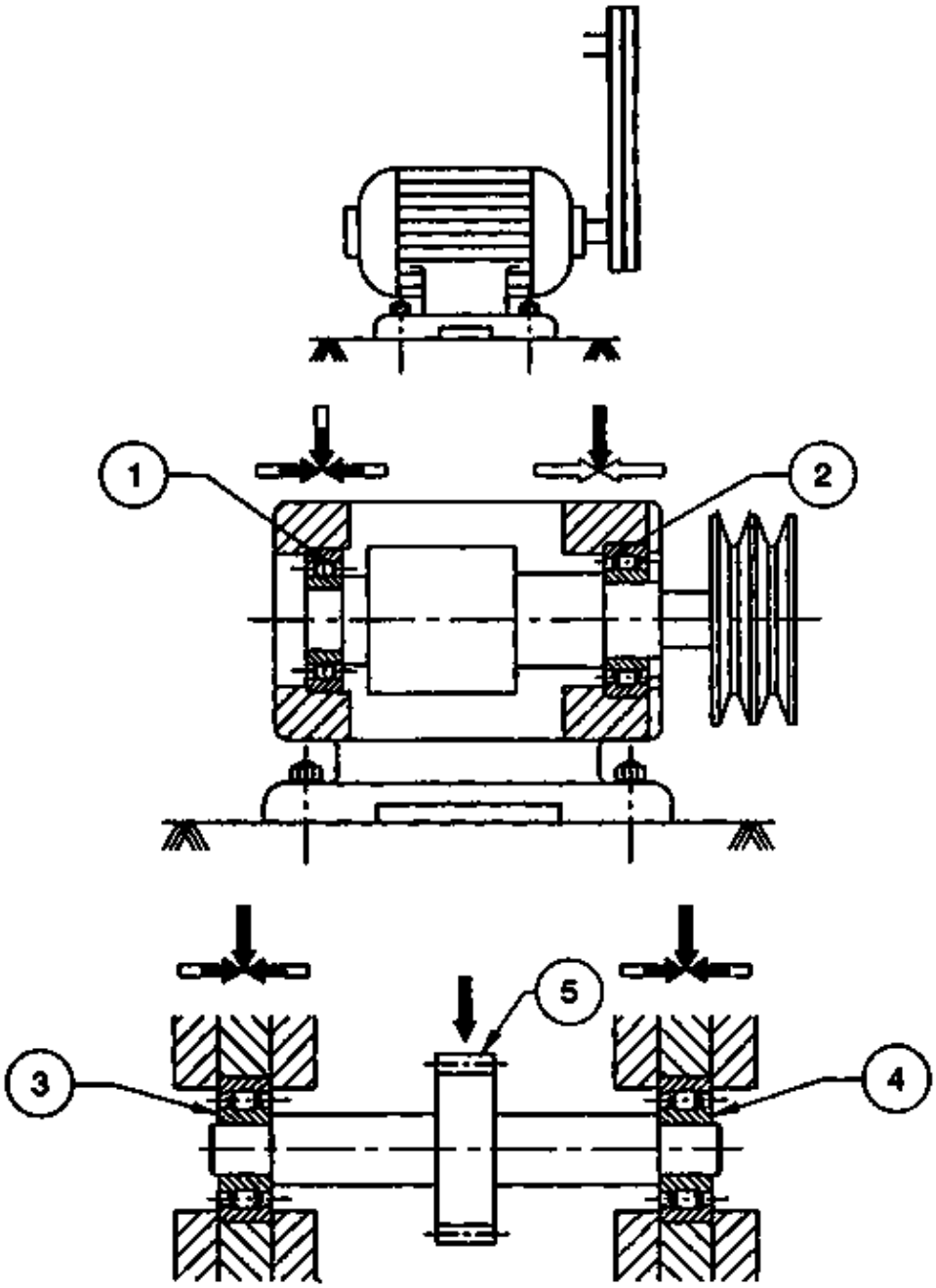
6 Self aligning roller bearing

APPLICATIONS OF BEARINGS – (A) – TR 01 07 05 02 95



1. Taper roller bearing
2. Thrust ball bearing
3. Needle bearing

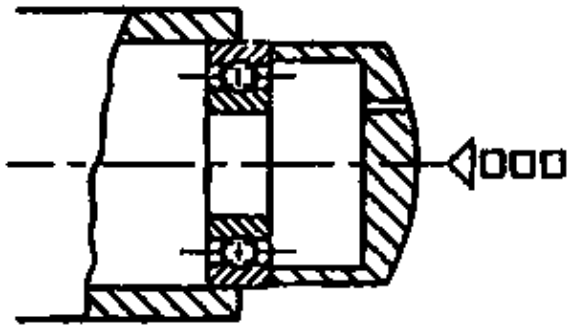
APPLICATIONS OF BEARINGS – (B) – TR 01 07 05 03 95



1 – Deep groove ball bearing
2 – Roller bearing
3 & 4 – Self aligning roller bearing
5 – Pulley

FITTING AND DISMANTLING OF BEARINGS – TR 01 07 05 04 95

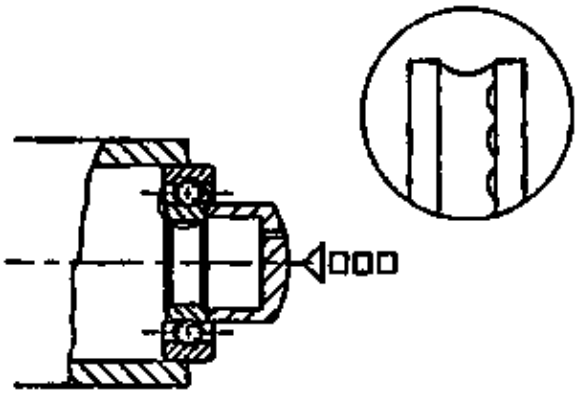
Note: A sleeve is used for mounting small bearings.



1

Correct Method

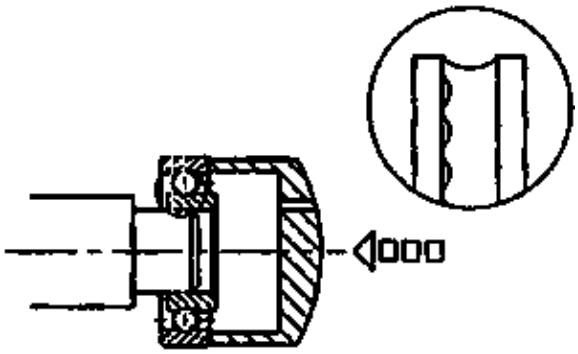
When assembling bearing in housing the force must act on the outer race.



2

Wrong Method

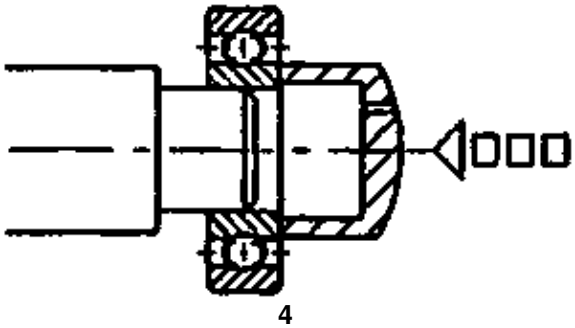
When the force acts on the inner race, the inner race will be damaged.



3

Wrong Method

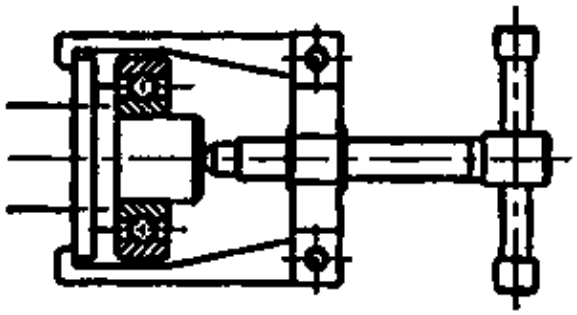
When the force acts on the outer race, the outer race will be damaged.



4

Correct Method

When assembling bearing on shaft the force must act on the inner race.



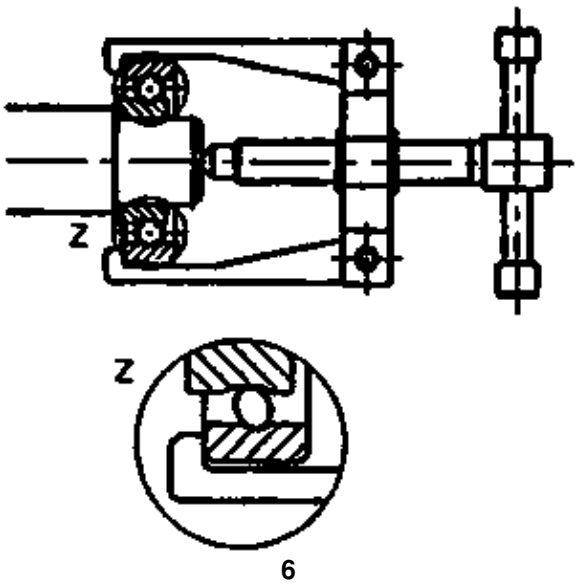
5

Disassembling by puller

When dismounting the force directly acts at the tightly fit ring.

Correct Method

The bearing is dismounted by a puller and a puller plate.

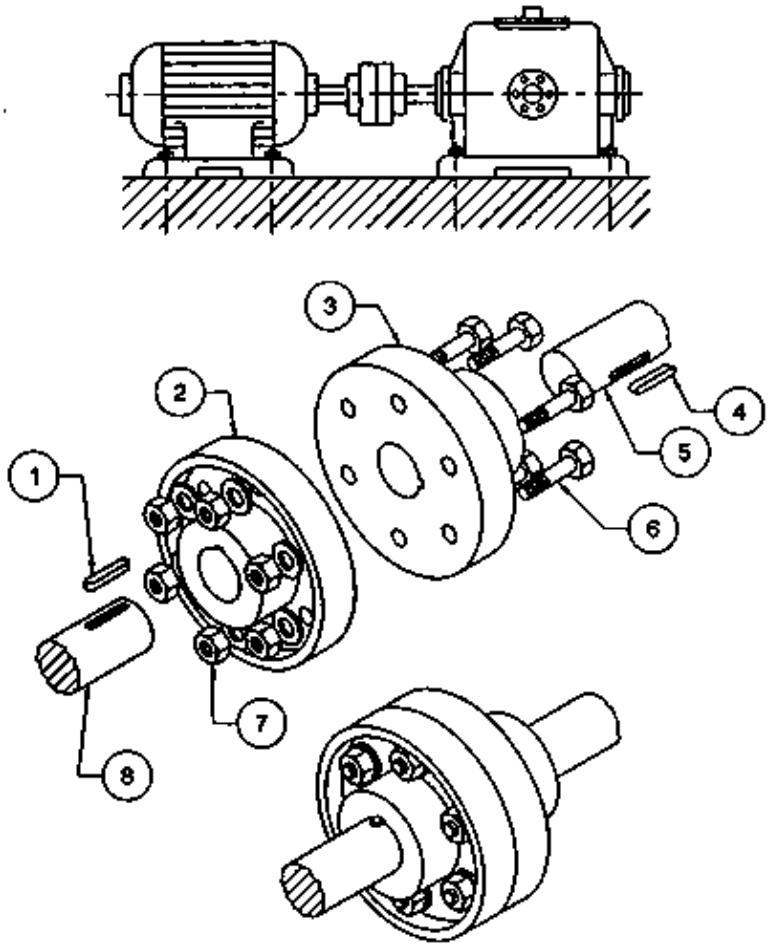


6

Wrong Method

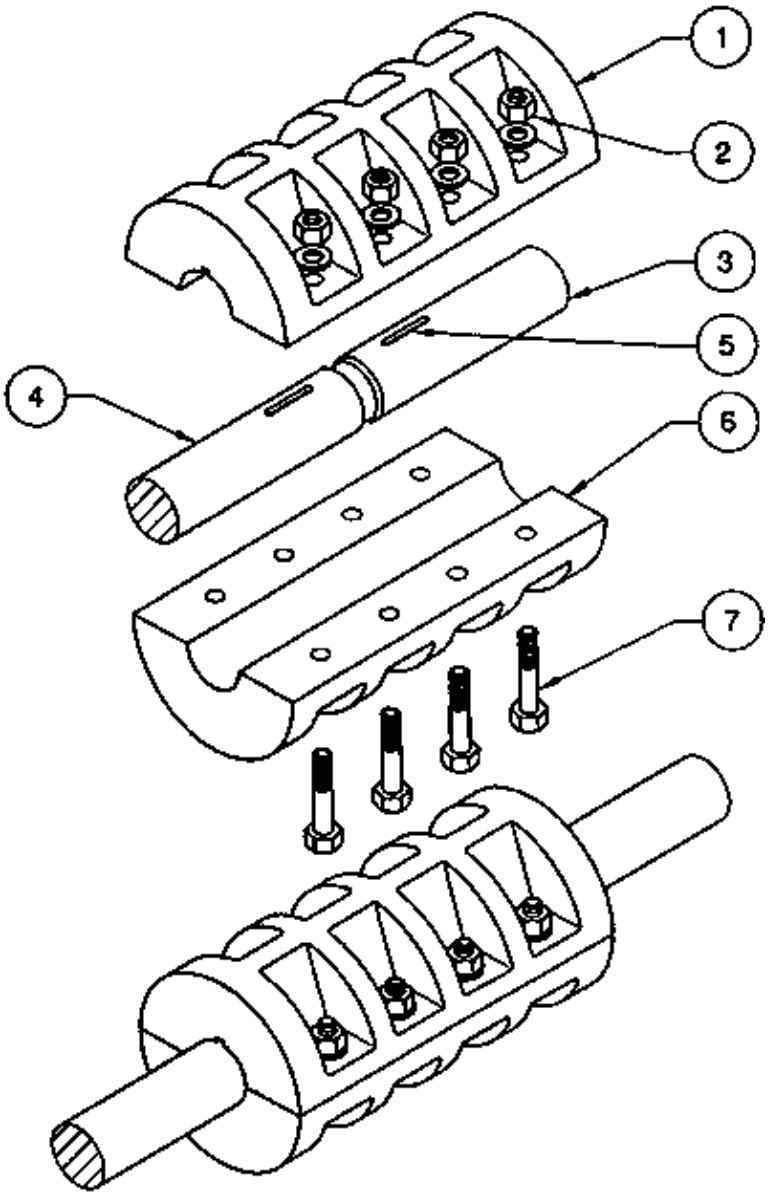
When dismounted without puller plate, the race way and rolling elements will be damaged.

COUPLING ASSEMBLY – TR 01 07 06 01 95



1 & 4 Keys
2 & 3 Coupling flanges
5 & 8 Shafts
6 Bolts
7 Nuts

CLAMP COUPLING – TR 01 07 06 02 95



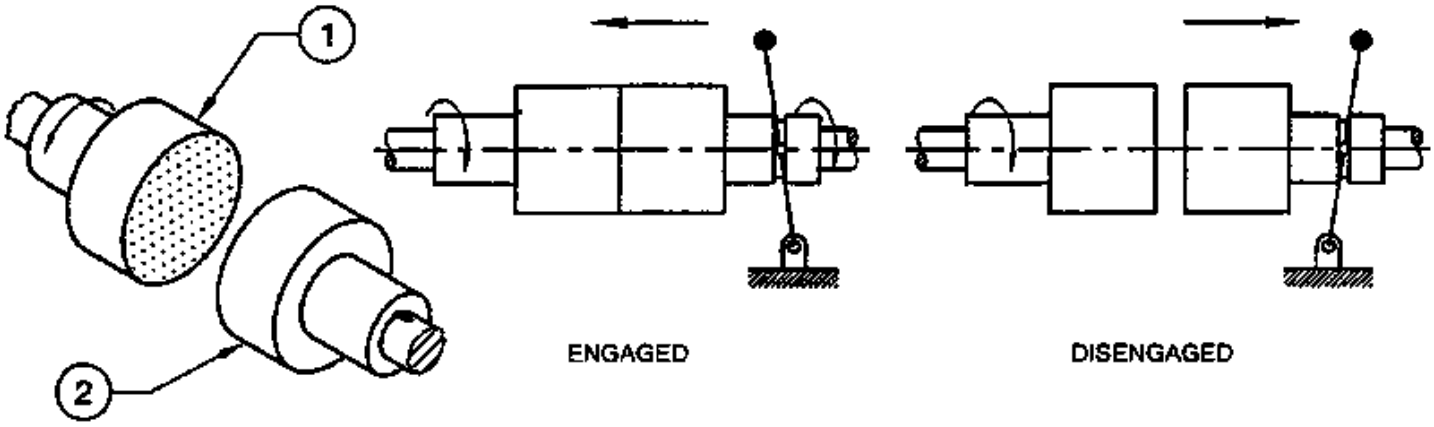
1 – Clamp top
2– Nut
3 & 4– Shafts
5 – Keyway
6 – Clamp bottom
7 – Bolts

Note:– Shafts 3 & 4 are keyed to the clamp top 1 while assembly.

APPLICATION OF CLUTCHES (FRICTION AND FORM FITTING) – TR 01 07 06 03 95

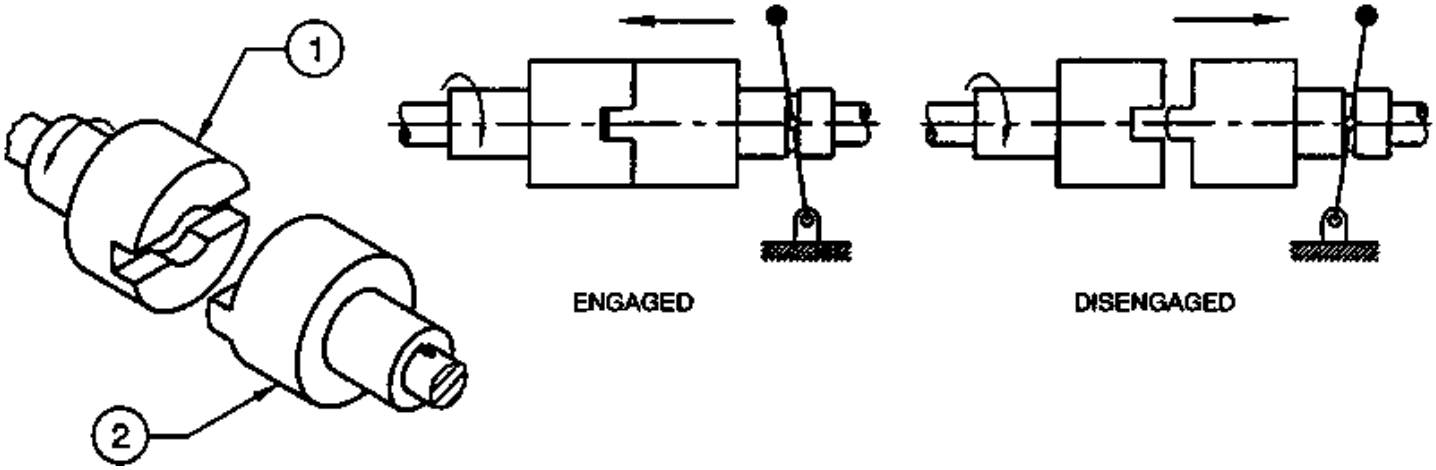
A. FRICTION CLUTCH

1. FIXED PART
2. MOVABLE PART

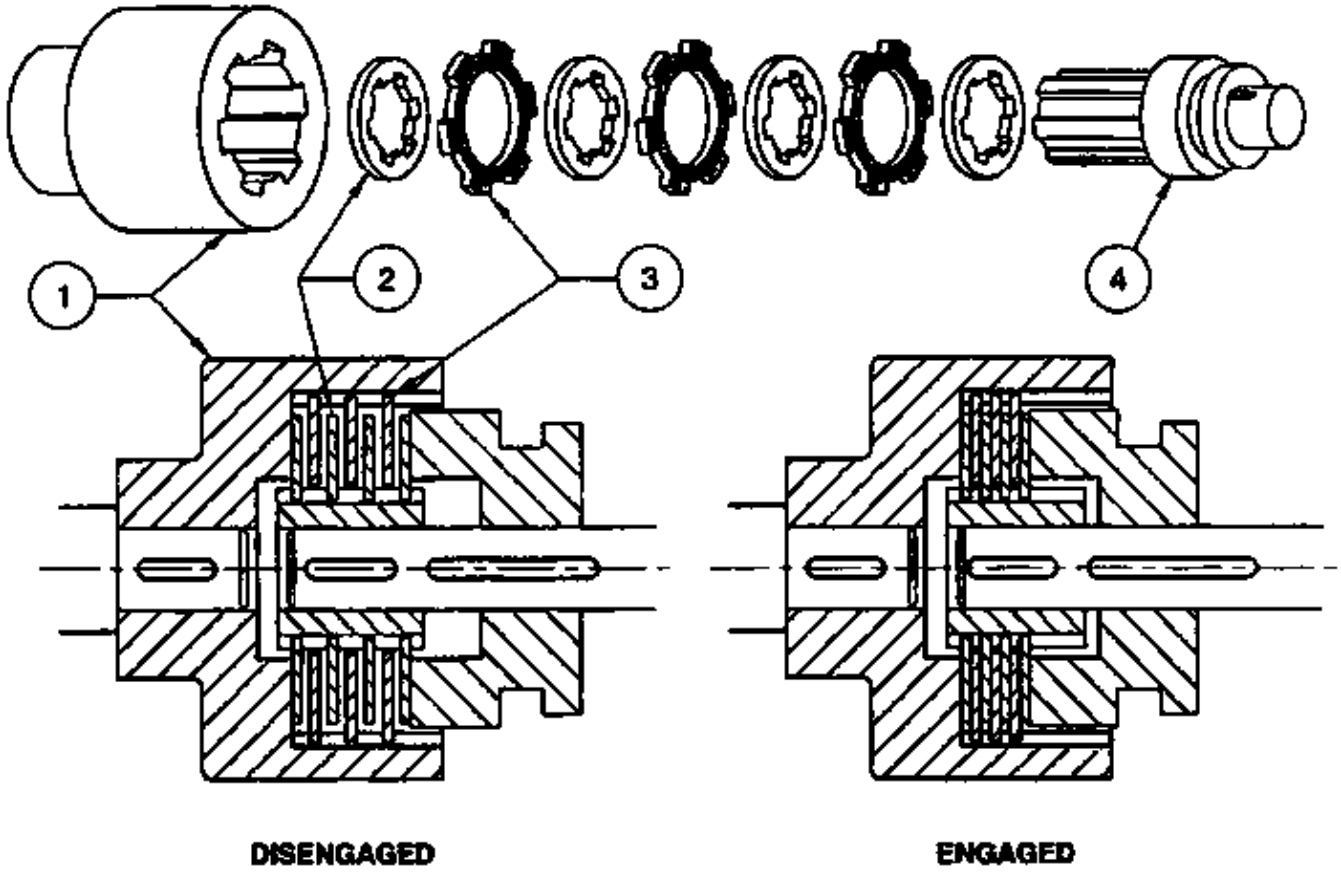


B. FORM FITTING CLUTCH

1. FIXED PART
2. MOVABLE PART



MULTIPLE DISK CLUTCH – TR 01 07 06 04 95



1. Housing
2. Pressure plates
3. Clutch disc
4. Spline shaft

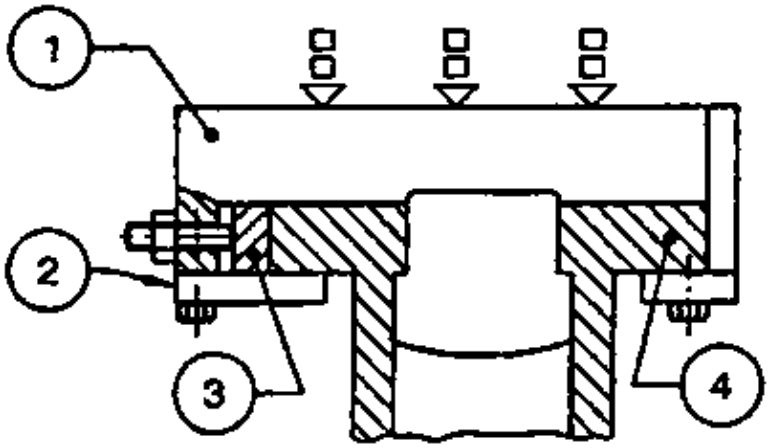
In the case of a single plate clutch, bigger fly wheels and clutch plates are used to transmit torque. But in the case of multiple plate clutch, the frictional area is increased by the use of more number of smaller clutch discs. The pressure plates (2) and clutch discs (3) are alternately arranged on the spline shaft (4). The plates and the shaft are then assembled in a housing (1) having splined hole.

The clutch discs and the pressure plates are pressed together in the housing when the clutch is engaged. When the clutch is disengaged the clutch discs and pressure plates are separated. The torque cannot be transmitted in this condition.

SLIDE WAYS AND WEAR ADJUSTMENT – TR 01 07 07 01 95

SLIDEWAYS ARE LINEAR BEARINGS WHICH SUPPORT AND GUIDE THE SLIDING MEMBERS OF A MACHINE TOOL

FLAT SLIDEWAYS

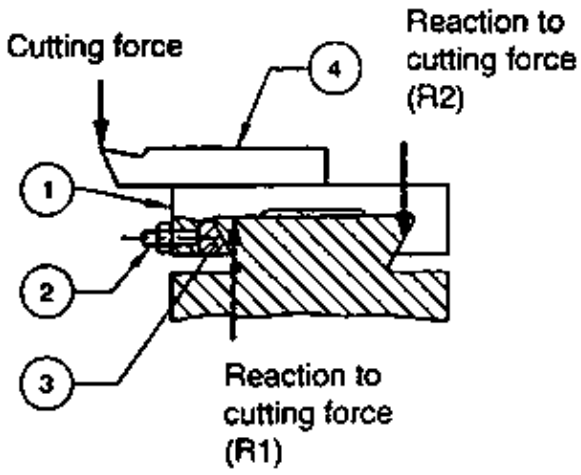


1. Sliding member
2. Keeper plate
3. Adjustable gib strip (Fixed to sliding member)
4. Flat slide ways (Fixed member)

Note:–

* This slide way is strong and gives accurate guidance when new
* Wear on the sides of the slides is taken up by the adjustable gib strip
* Keeper plates under the slides prevents tilting or lifting in case of excessive loading.

DOVETAIL SLIDEWAYS



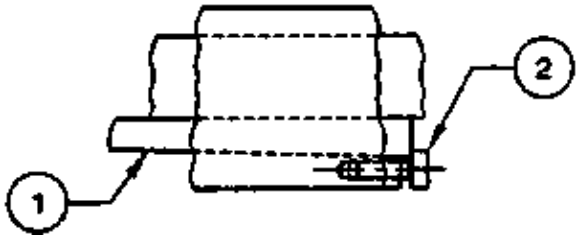
1. Sliding member
2. Adjusting screw
3. Adjustable gib strip
4. Tool

Note:–

This slide way is used
* When the applied forces form a couple which tries to rotate the sliding member
* Where the applied force lies outside the slide

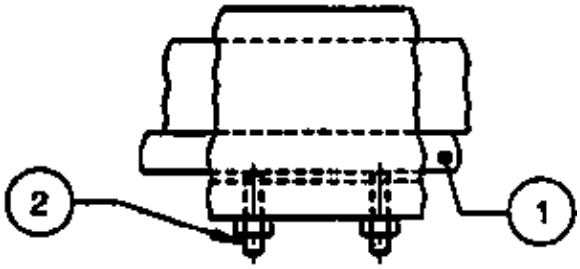
WEAR ADJUSTMENT BY GIB STRIP

TAPER GIB



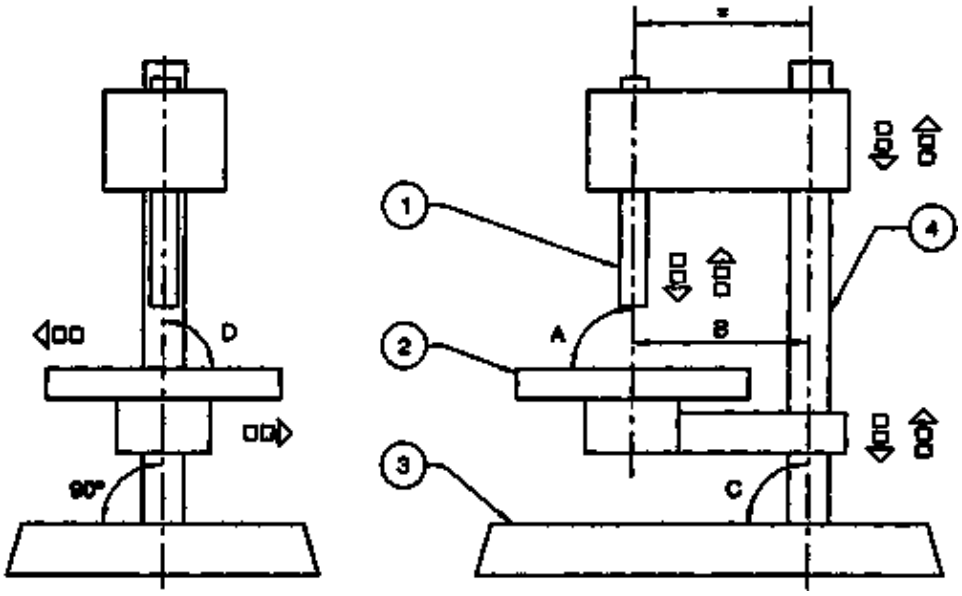
1. Taper Gib
2. Adjusting screw

PARALLEL GIB



1. Parallel Gib
2. Adjusting screw

DRILLING MACHINE – ALIGNMENT GEOMETRY – TR 01 07 08 01 95



1. Spindle
2. Table
3. Base
4. Column

• The geometry of the drilling machine is designed to maintain the alignments between the spindle axis and the workpiece (Angle A)

• Spindle (1) is mounted on precision bearings and housed in a sleeve that can move in the head of the drilling machine.

• Sleeve travels to or from the workpiece in a path parallel to the axis of the spindle.

• Spindle axis is perpendicular to the surface of the work table (2)/workpiece.

• The table is adjustable up and down a precision ground column (4) It can also be rotated around the column maintaining the perpendicularity of spindle (D).

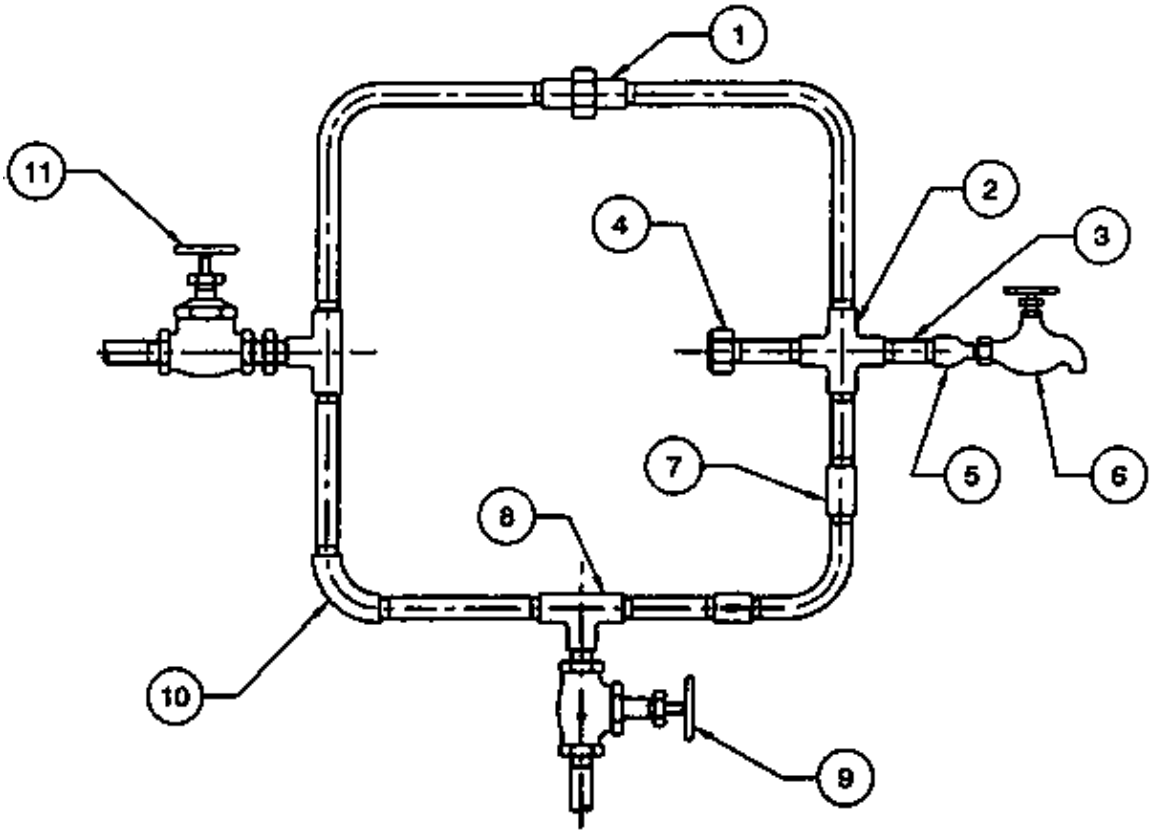
• The axis of the column and the axis of the spindle are parallel (B)

• The axis of the column is perpendicular (C) to the machine base (3)

• The spindle head can be moved up and down over column (4)

ANY INACCURACY IN THESE ALIGNMENTS WILL RESULT IN INACCURACIES IN DRILLING.

STANDARD PIPE FITTING ASSEMBLY – TR 01 08 02 01 95



1. Union – A device used to connect pipes
2. Cross – Allows flow in different directions
3. Barrel nipple – Tubular pipe fittings used to connect 2 or more pipes
4. Cap – Used for closing the end of a pipe or a fitting which has external thread
5. Reducer – Used to connect 2 pipes of different diameters
6. Bib cock – controls the outlet
7. Plain coupling – Used to connect 2 pipes of the same diameter
8. Tee – Helps the pipeline to branch off at 90°
9. Globe valve – Used for controlling the flow of water, steam etc in the main line
10. Elbow – Provides deviation of 90° & 45° in pipe system
11. Gate valve – Provides an unobstructed waterway when fully opened.

GLOBE VALVE – PARTS AND FUNCTION – TR 01 08 04 01 95

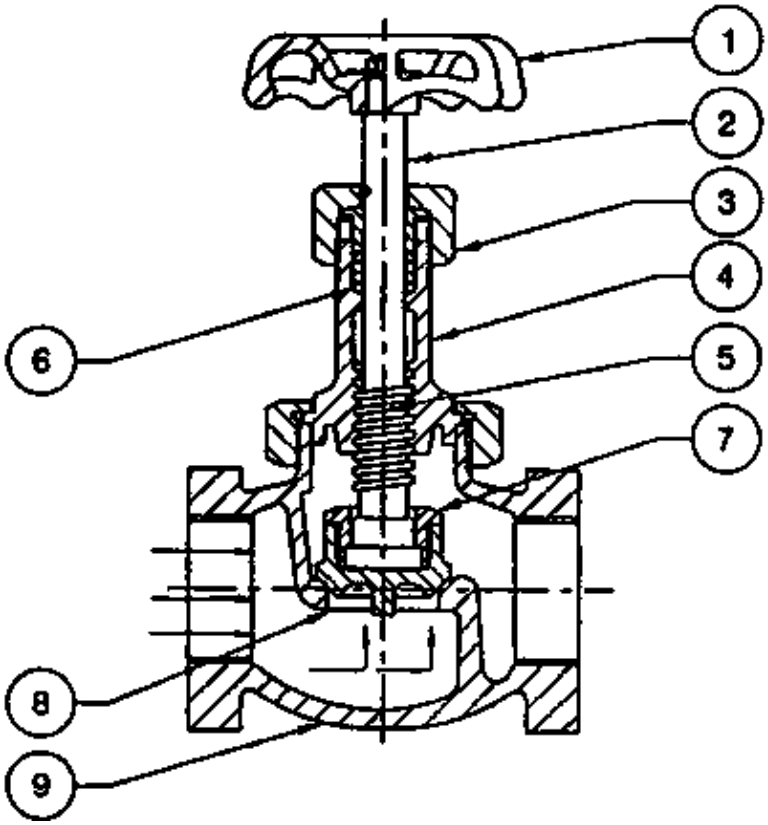


Fig a

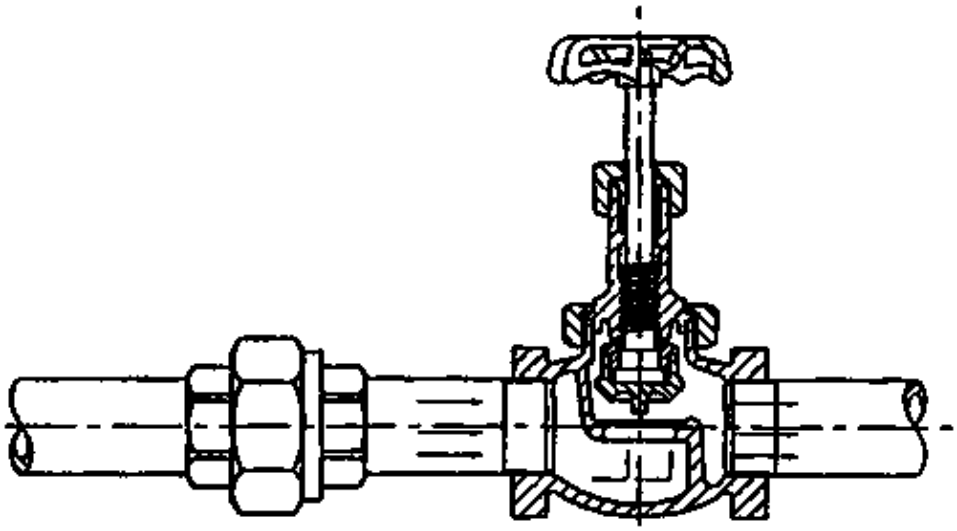


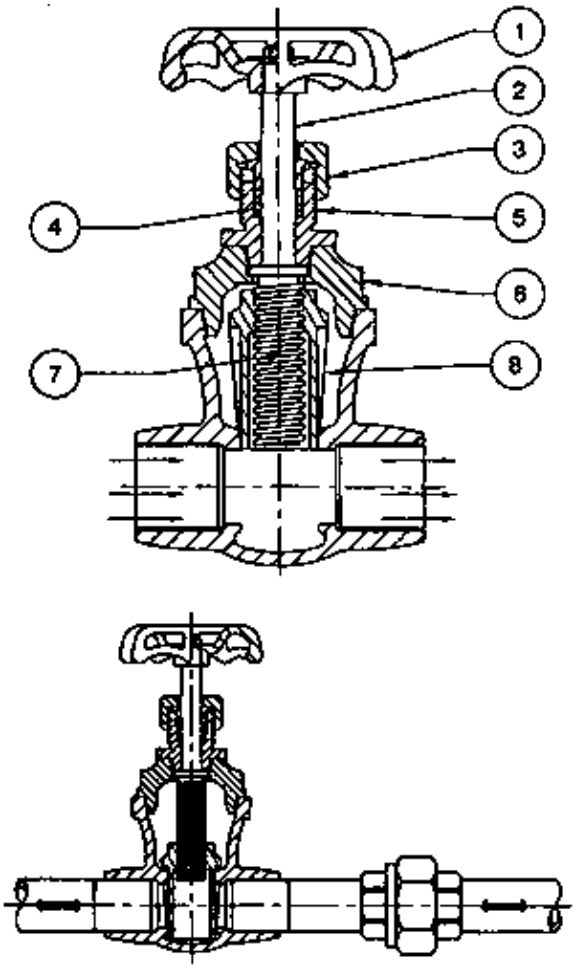
Fig b

1. Hand wheel
2. Spindle
3. Gland nut
4. Bonnet
5. Threaded portion of spindle
6. Gland packing
7. Disc holder with rubber washer
8. Valve seat
9. Body

Note:–

Figure (a) Valve in closed position
Figure (b) Valve in open position – Flow in one direction only

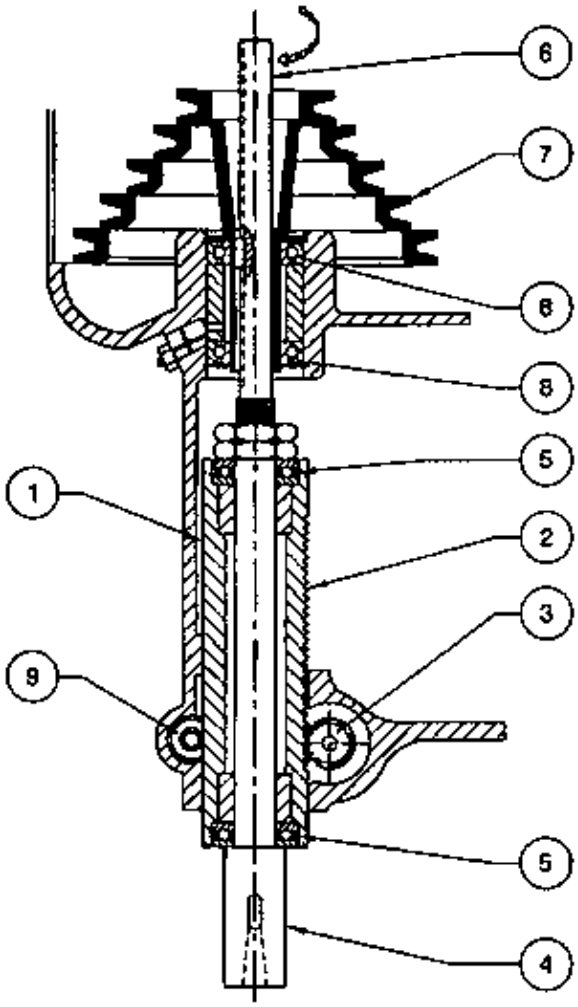
GATE VALVE – PARTS AND FUNCTION – TR 01 08 04 02 95



1. Hand wheel
2. Shaft (spindle)
3. Gland nut
4. Gland packing
5. Stuffing box
6. Bonnet
7. Threaded portion of spindle
8. Seat and disk gate

Note: Flow in both direction

DRILLING MACHINE SPINDLE ASSEMBLY – TR 01 08 09 01 95



1. Sleeve
2. Rack
3. Pinion
4. Spindle
5. Thrust bearings
6. Spindle extension
7. Pulley
8. Journal bearings
9. Sleeve lock

Drill sleeve **(1)** has a rack **(2)** on one side. **(2)** meshes with pinion **(3)** which can be moved by a hand lever. By moving this lever, **(1)** can be moved up and down along with the spindle **(4)**.

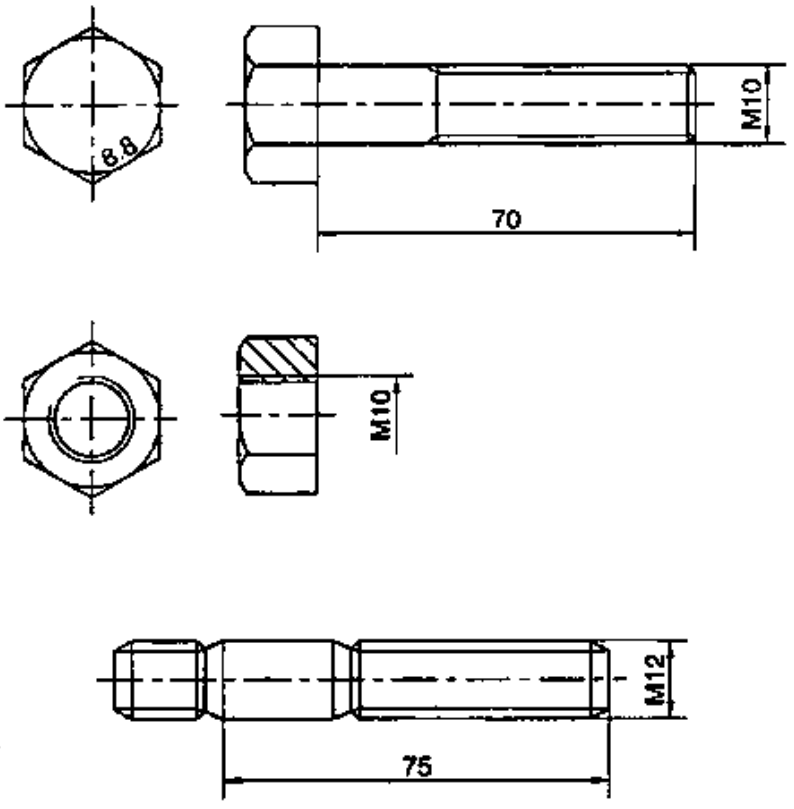
(4) is supported with in the sleeve by Journal bearings **(5)**.

Spindle extension shaft **(6)** is splined and it passes through the matching splined hole in the pulley **(7)** driven by a motor.

(7) is supported by journal bearings **(8)**. This enables **(4)** to rotate freely at any position when it is moved up or down during drilling operation.

In some type of drilling machines sleeve lock **(9)** is provided to lock the sleeve when not in use.

SPECIFICATION OF MACHINE SCREW – NUT AND STUD – TR 01 11 02 01 95



M 10 x 70 **BOLT (Hex-Screw)**
- Length 70mm
- Major diameter 10mm
- Metric thread

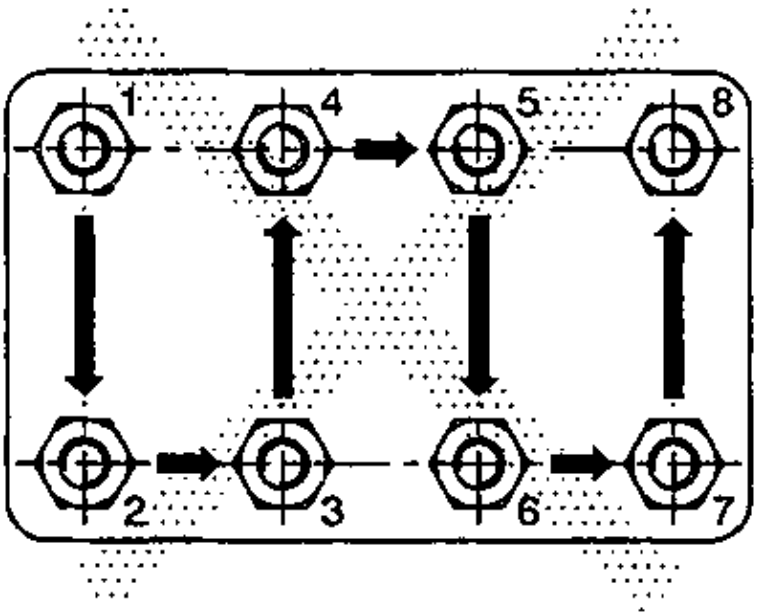
8.8 **PROPERTY CLASS**
- Yield point ratio 8 x 8 x 10N/mm²
- Tensile strength 8 x 100 N/mm²

M 10 **HEXAGON NUT**
- Major dia 10mm
- Metric thread

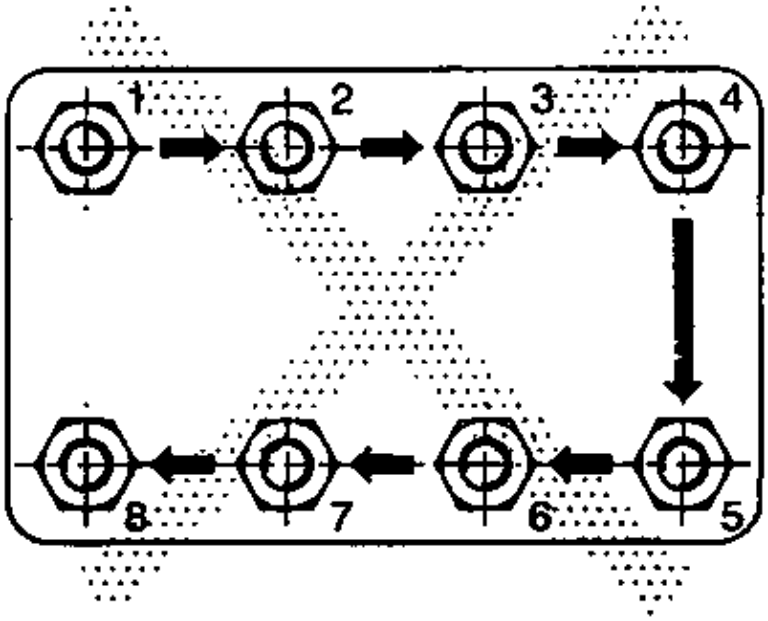
M 12 x 75 **STUD**
- Length 75mm
- Major diameter 12
- Metric thread

Note:– The specifications M10 × 1.25 × 70 indicates a fine thread the pitch is 1.25 mm.

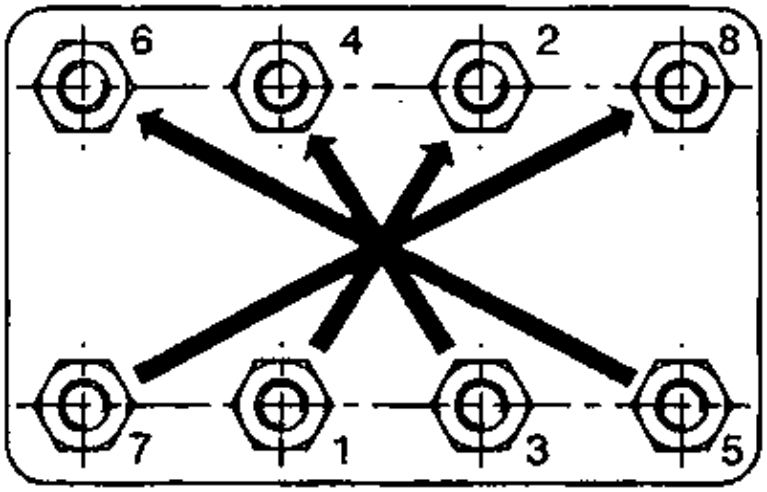
SEQUENCE FOR TIGHTENING NUTS IN ASSEMBLIES – TR 01 21 01 01 95



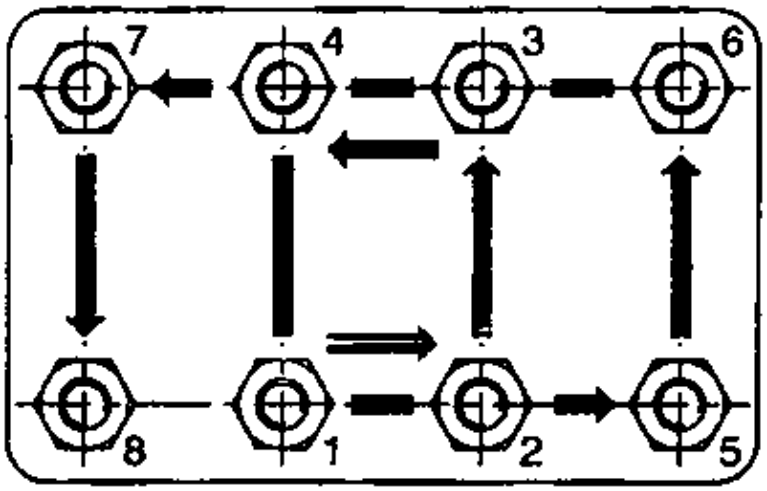
1.



2.



3.



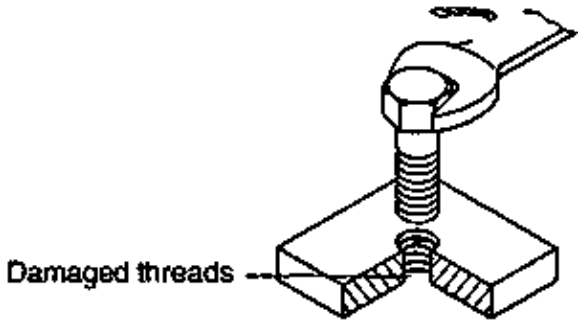
4.

1. Across one after another row
2. Longitudinal order
3. Over cross
4. Circular

Steps:

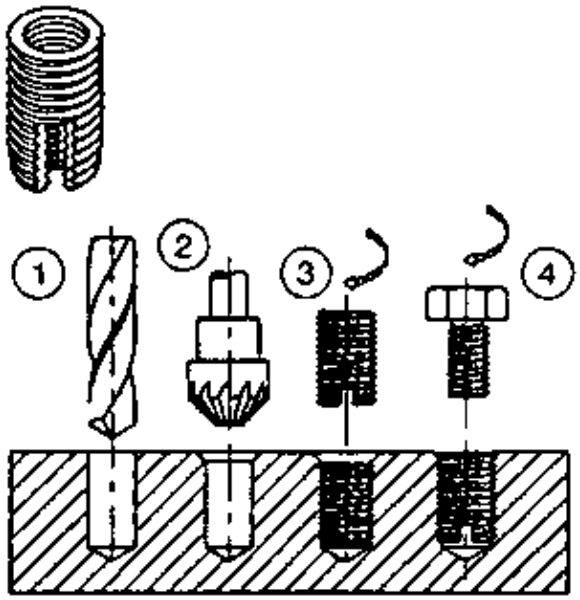
1. Tighten all nuts moderately by in one of the ways shown above
2. Tighten all nuts till full torque is achieved

REPAIRING DAMAGED INTERNAL THREADS – TR 01 21 02 01 95



REASON

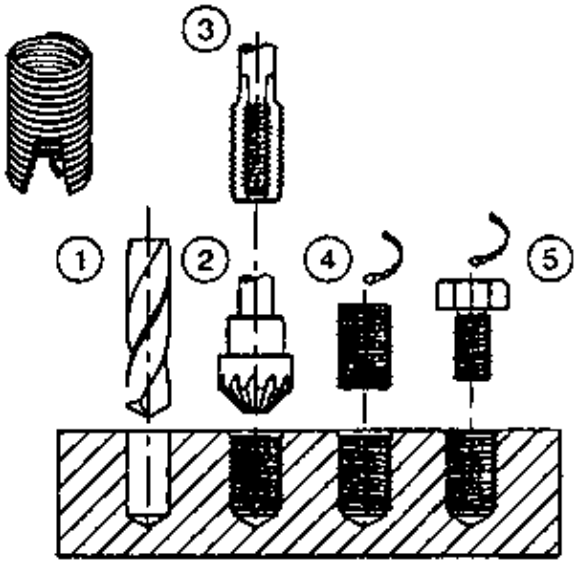
Happens especially when the material of the workpiece is soft (e.g. aluminium)



SCREW BUSH

1. Drilling to tap drill size
2. Countersinking
3. Fitting screw bush
4. Assembly

A screw bush acts like a self–cutting screw

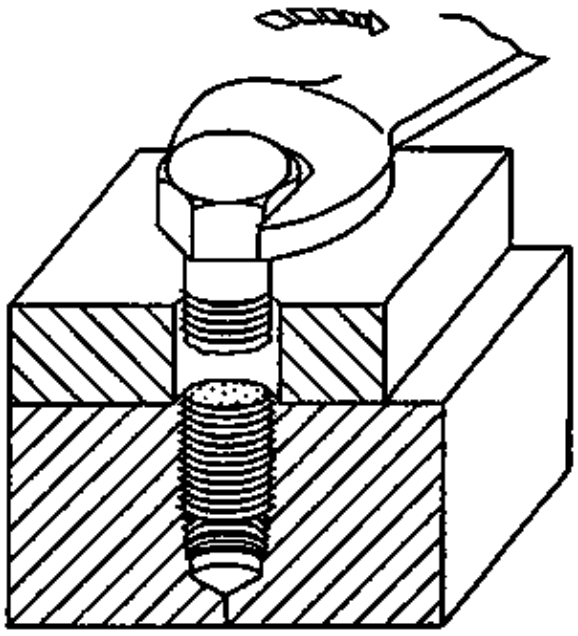


HELICOIL

1. Drilling to tap drill size
2. Countersinking
3. Tapping
4. Fitting helicoil
5. Assembly

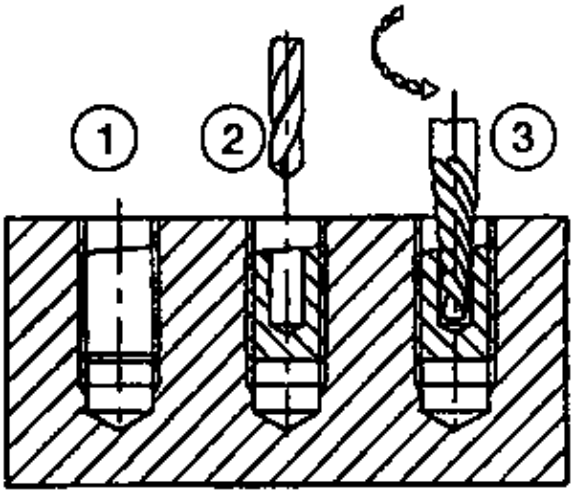
For a helicoil a thread must be tapped.

EXTRACTING BROKEN BOLTS FROM HOLES – TR 01 21 03 01 95



REASON

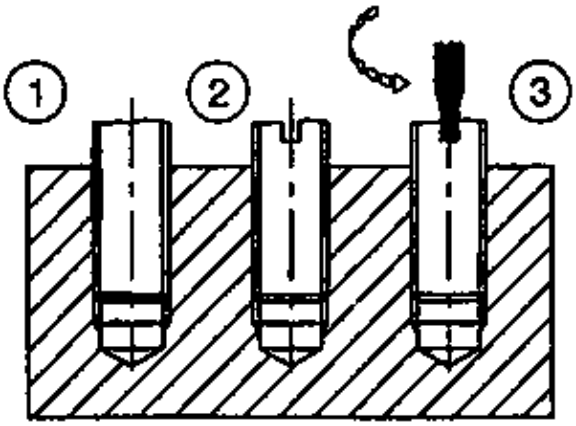
Excessive torque



A. EXTRACTOR

A. EXTRACTOR

1. Broken stud
2. Hole drilled on stud
3. Use of extractor



B. SLOTTING

B. SLOTTING

1. Broken stud
2. Slot cut on stud
3. Turn anticlockwise with screw driver

Note:– to be turned anticlockwise direction for loosening.