Turner 2nd Year – Transparencies

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CENTRAL INSTRUCTIONAL MEDIA INSTITUTE, MADRAS

ANINDO – GERMAN PROJECT

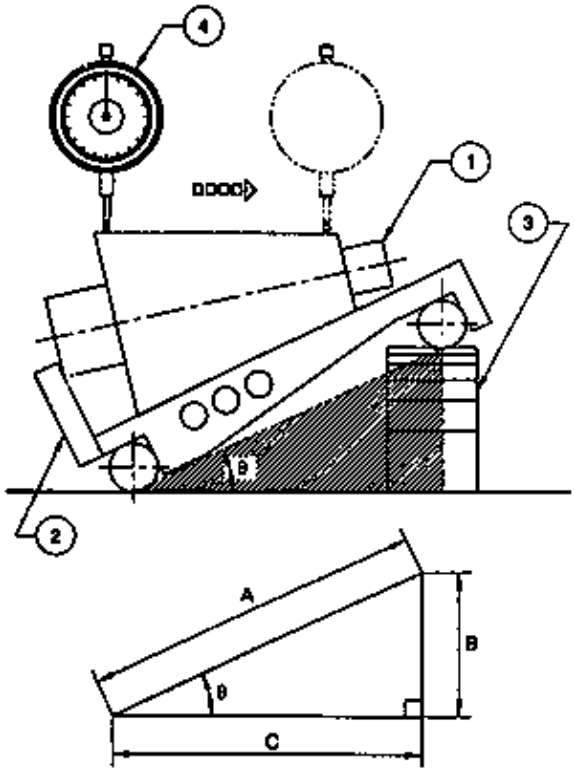
Directorate General of Employment & Training, Ministry of Labour, Govt. of India

Developed by
CENTRAL INSTITUTIONAL MEDIA INSTITUTE
in collaboration with DEUTSCHE GESELLSCHAFT FEUR TECHNISCHE ZUSAMMENARBEIT (GTZ)
Germany

P.O. Box 3142, 76, GST Road, Guindy, Madras – 600 032. Phone: 234 5256, 234 5257, Fax: (0091–44) 234 2791

MEASUREMENT OF TAPER ANGLE USING SINEBAR

TR 01 02 10 01 95

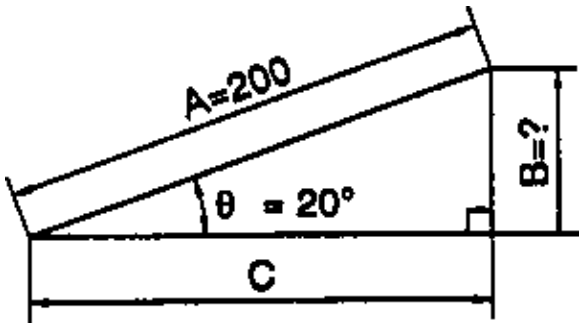


To calculate the angle of taper formed on a round rod, the job (1) is placed on sine bar (2). One end of the sine bar (i.e. smaller dia. end on job) is lifted up and slip gauges (3) are placed in between sine bar roller and the surface plate. The top surface of the taper portion should be brought to 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,

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

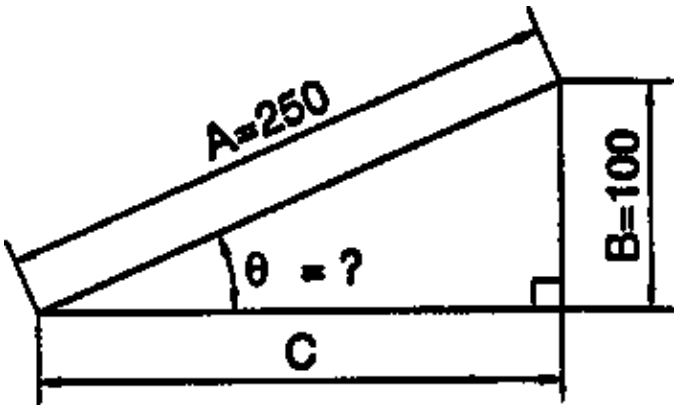
TAPER CALCULATION USING SINEBAR

TR 01 02 10 02 95



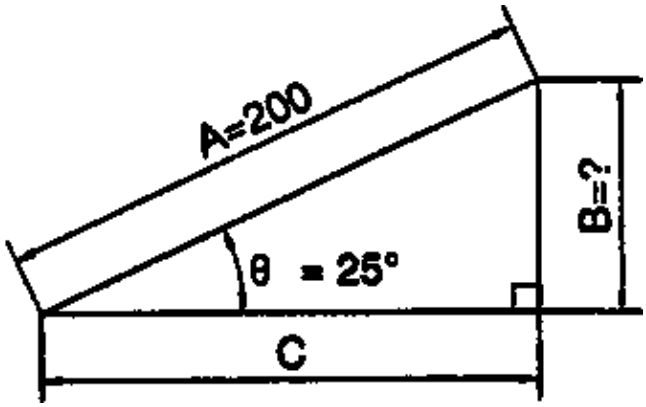
1. $\text{Sine}\,20^\circ = \frac{B}{A} = \frac{B}{200}$

Therefore B = 68.404.



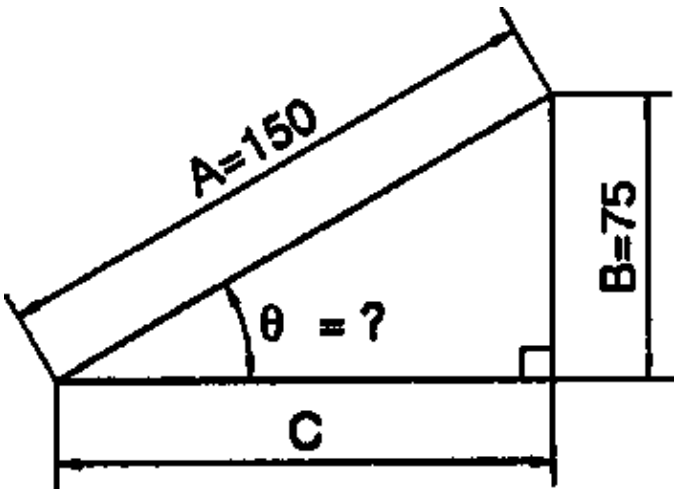
2. $\text{Sine}\,\theta = \frac{B}{A} = \frac{100}{250}$

Therefore ? = 23°34' 41"



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

Therefore B = 84.524

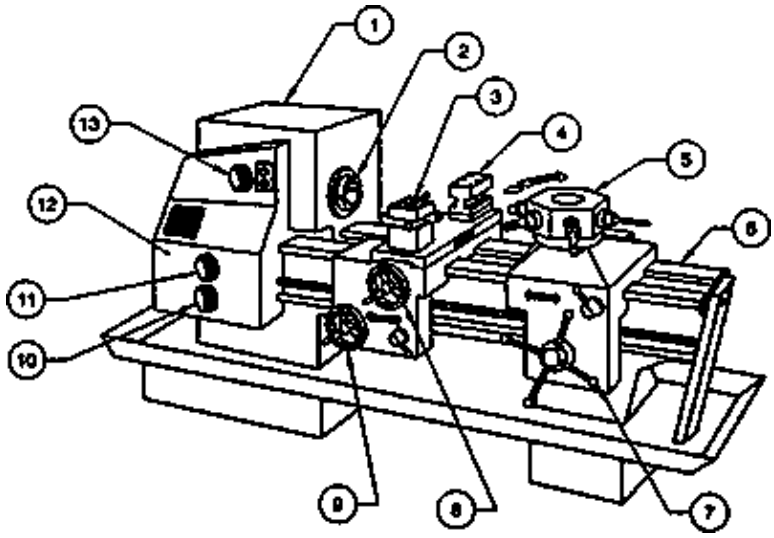


4. $\text{Sine}\,\theta = \frac{B}{A} = \frac{75}{150}$

Therefore ? = 30°

TURRET LATHE (PARTS AND FUNCTION)

TR 01 12 02 01 95

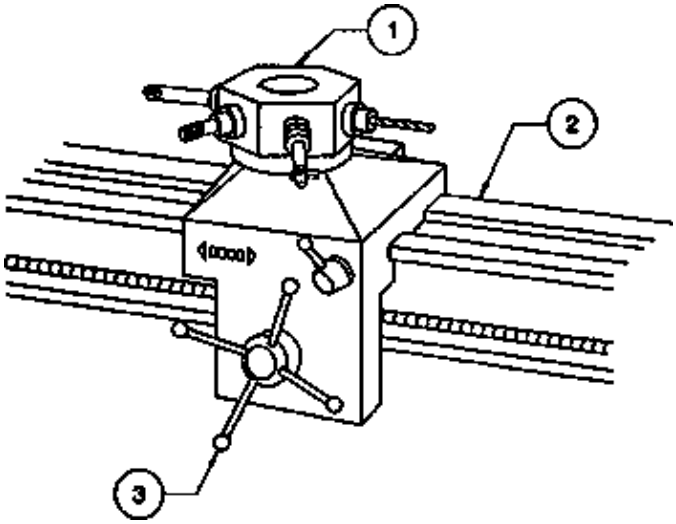


1. Head stock	Speed changing gears and spindle are housed in the head stock.
2. Spindle	Collets and chucks are mounted on the spindle for work holding.
3. Square tool post	Four different tools can be set at a time.
4. Rear tool post	Parting−off tool can be set in this tool post in inverted position.
5. Turret head	The turret head has six faces and can hold six different tools.
6. Main bed	Carriage and the turret head slide, over the bed.
7. Handwheel for the longitudinal motion of turret	Moves the turret head along the bed.
8. Cross slide hand wheel	Moves the cross slide to give depth of cut.
9. Carriage hand wheel	Moves the carriage along the bed.
10. Feed drive for turret	Knob for turret automatic feed.
11. Feed drive for cross slide	Knob for cross−slide automatic feed.

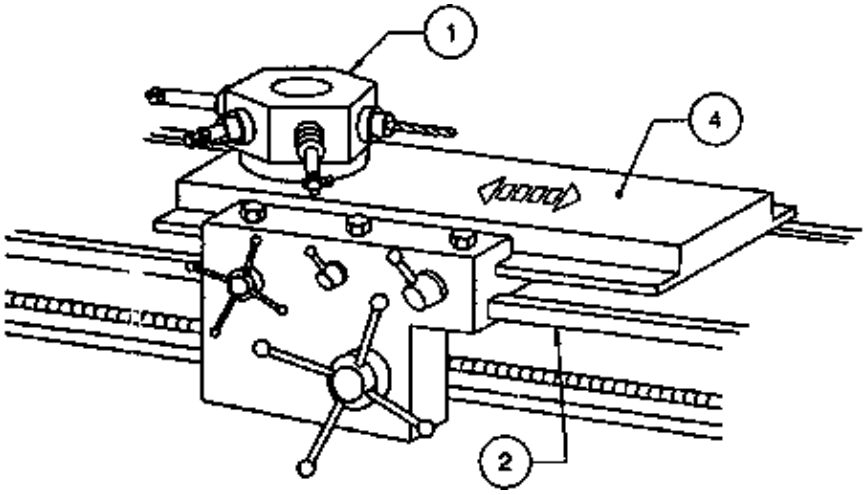
12. Feed gear box	This will have a number of gears and provide different feed rates for longitudinal and crosswise movements.
13. Spindle speed	Different spindle speeds can be obtained by rotating the selector to different positions.

TURRET AND CAPSTAN LATHE (COMPARISON)

TR 01 12 02 02 95



TURRET LATHE



CAPSTAN LATHE

1. Both the lathes are used for mass production work.

2. Turret lathe is a heavy duty machine and Capstan lathe is a light duty machine.

3. In a turret lathe the turret head (1) is directly mounted on the main bed (2).

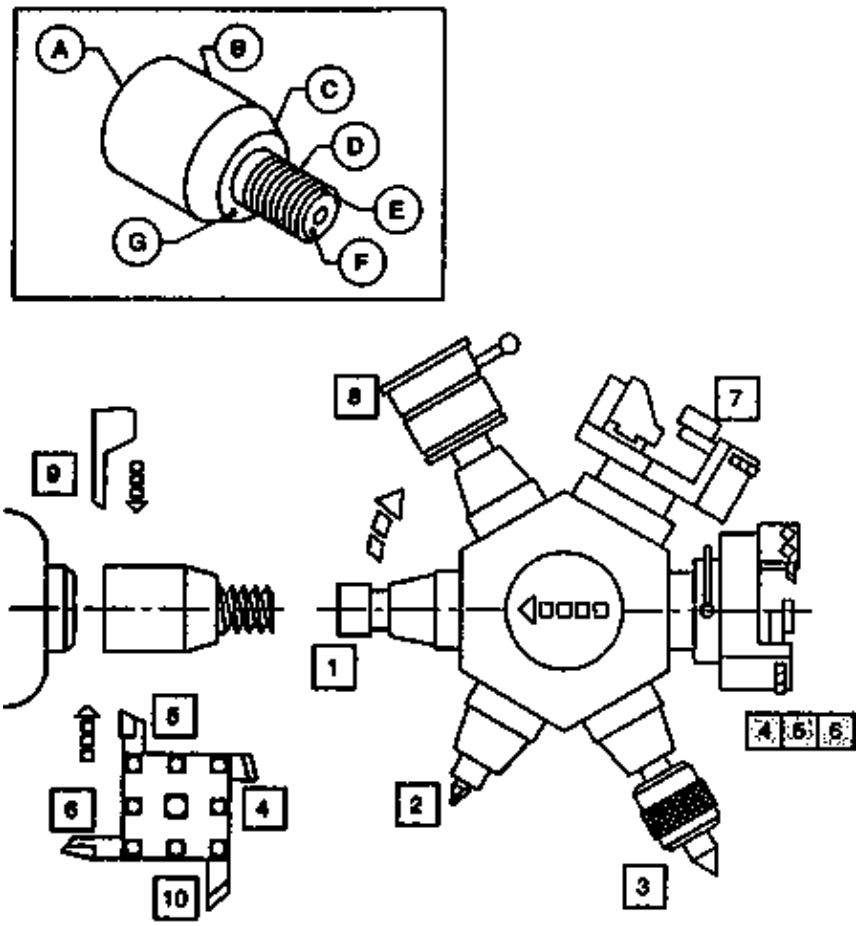
4. In a capstan lathe the turret head (1) is mounted on an additional slide (4).

5. In a turret lathe the turret head (1) can be moved over the main bed (2) from one end to the other end.

6. In a capstan lathe, the turret head (1) can be moved over the additional slide (4) within its limitations.

TURRET LATHE TOOL SETUP (EXTERNAL TURNING)

TR 01 12 02 03 95



TOOLING SEQUENCE

1. Bar stop
2. Step turning
3. Centre drilling
4. Taper (Form turning)
5. Shoulder facing

Note: To be discussed along with the

Transparencies
No. TR 01 12 02 04 95
TR 01 12 02 05 95

Work centre is supported during machining steps

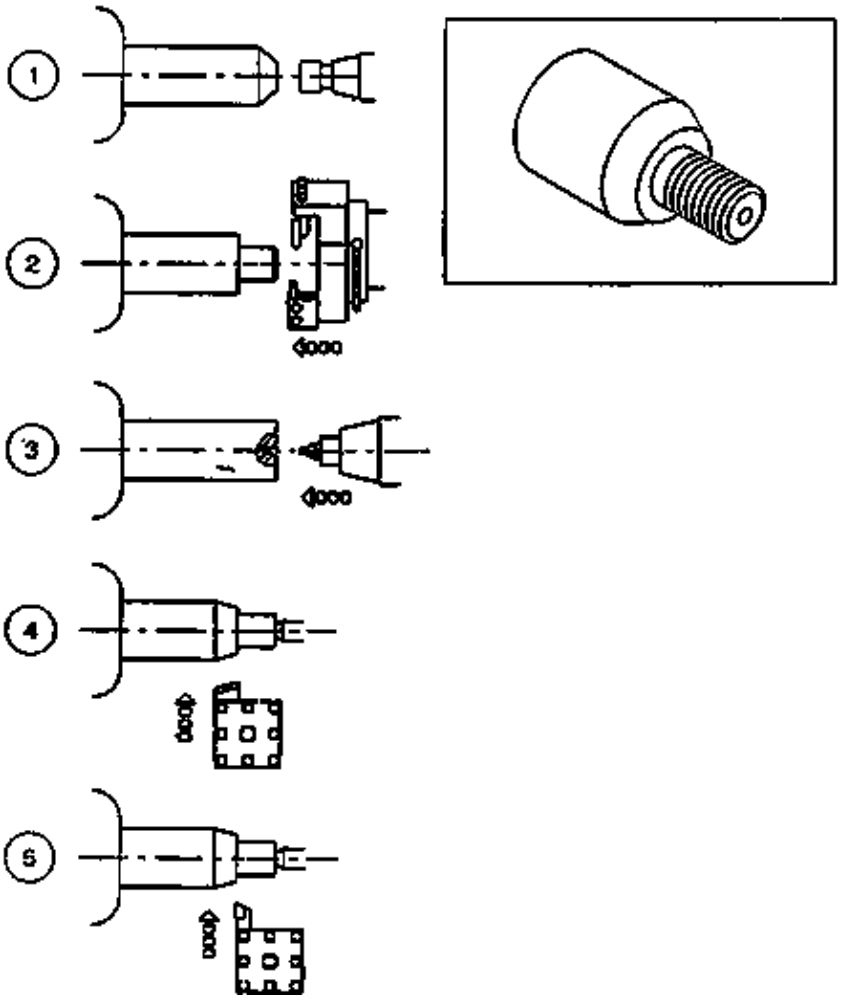
4 5 6

OPERATIONS ON THE COMPONENT

A Parting–off
B O.D. Turning
C Form turning
D Thread cutting
E Chamfering
F Facing

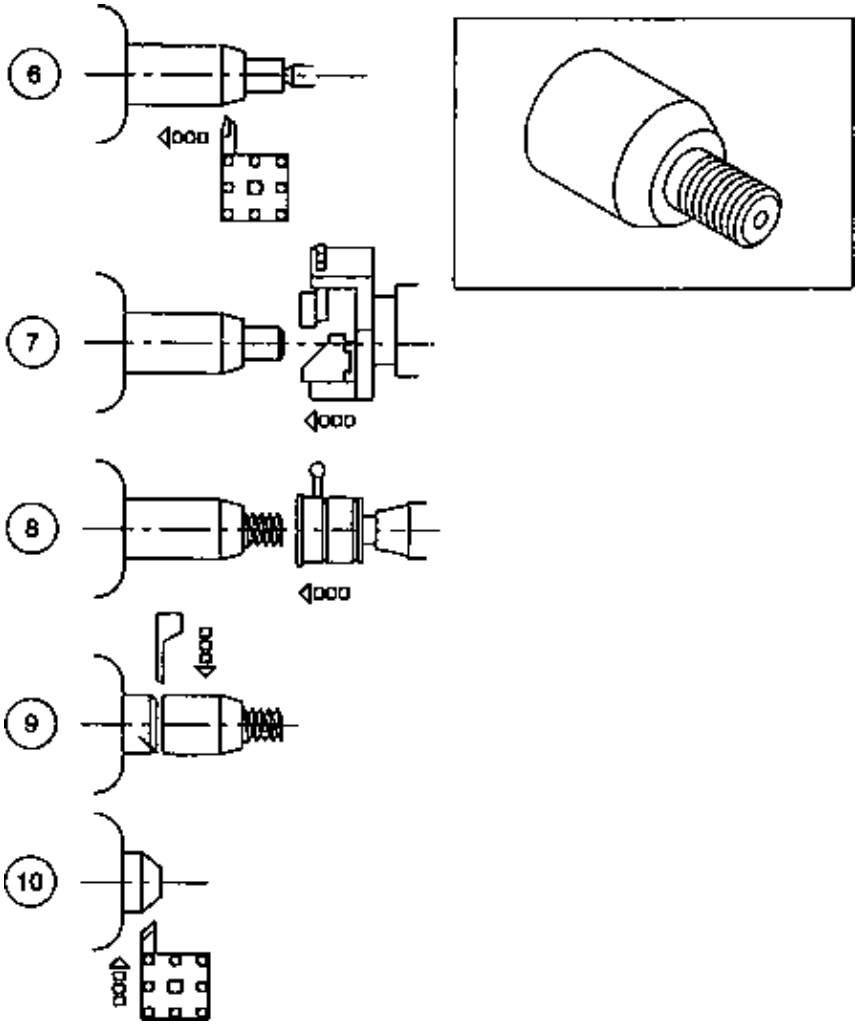
TURRET LATHE (EXTERNAL TURNING SEQUENCE)

TR 01 12 02 04 95



1. Bar stop
2. Step turning
3. Centre drilling
4. Centre support and forming taper
5. Centre support and shoulder facing

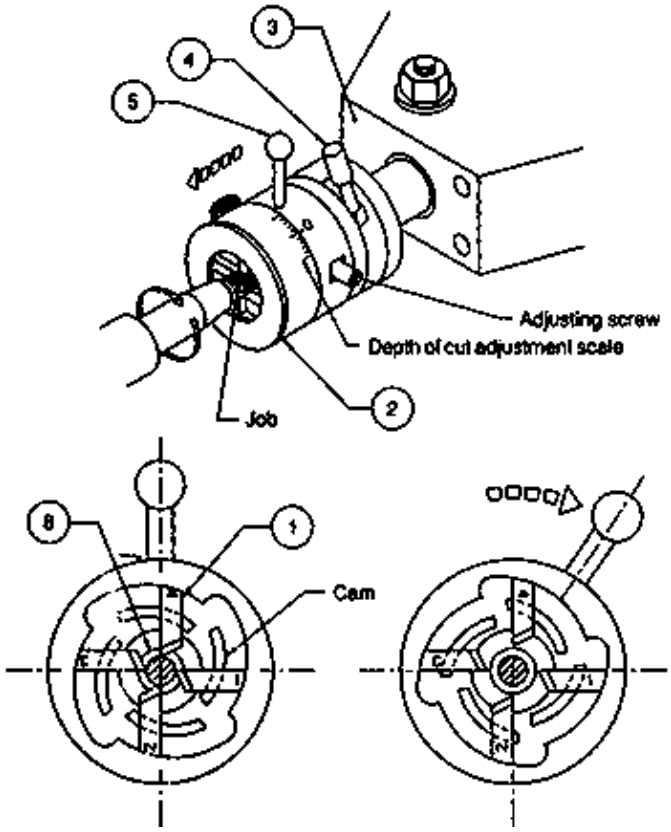
TR 01 12 02 05 95



6. Centre support and O.D. turning
7. Chamfering
8. Threading
9. Parting off
10. Forming end

SELF OPENING DIE–HEAD (WORKING PRINCIPLE)

TR 01 12 02 06 95



After setting the required size of chasers (1) in the die head (2), it is initially fed to the work by the operator. Then it is feeds itself along the work and follows with the turret (3). The turret stopper is set slightly short of the thread length.

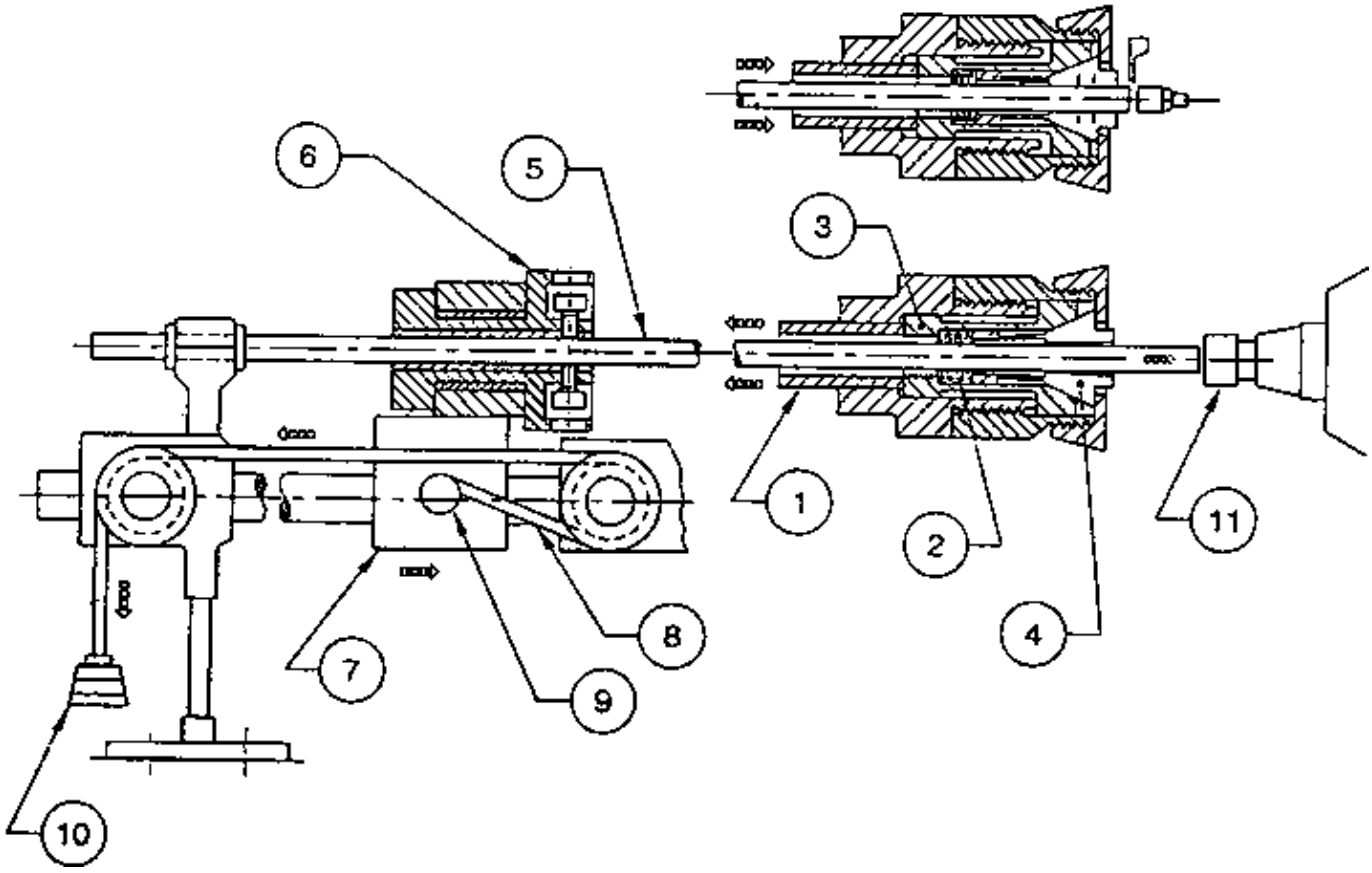
When the turret movement is stopped by its stopper, the die head (2) continues to move forward under self feeding action.

When there is no further movement for the die head, an inside trip triggers off, the detent pin (4) goes into action, the closing handle (5) falls to the side and the die opens. The die head is taken out without stopping the machine.

Note: The chasers are numbered as 1,2,3 and 4.

BAR FEEDING MECHANISM (FUNCTION)

TR 01 12 02 07 95

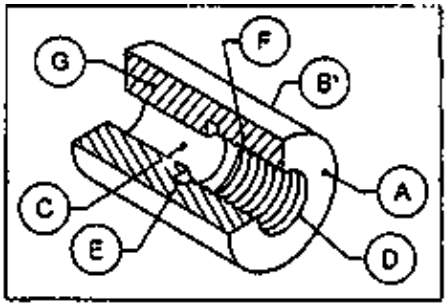


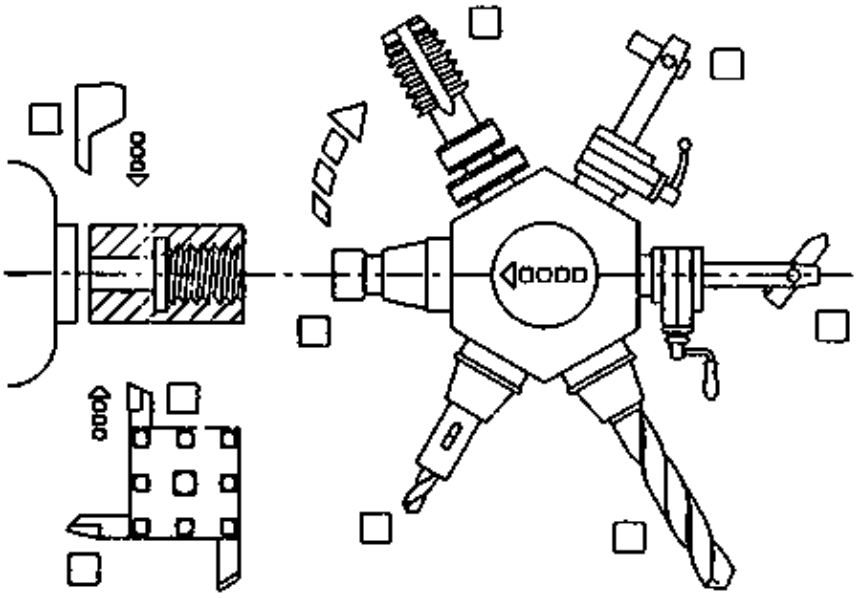
When all operations are completed, the job is parted−off with a parting−off tool. Now, the bar is to be fed for the next component. The push tube (1) is pulled back by operating a lever. The spring (2) pushes back the sliding sleeve (3) resulting in the opening of the collect (4).

The bar (5) is fitted to bar chuck (6) which is resting on sliding bracket (7). One end of the rope (8) is connected to the pin (9) on the sliding bracket and the other end supports the weight (10). When the collet chuck is released, the weight moves in a down−ward direction and the sliding bracket (7) moves forward along with bar chuck and bar, until the bar touches the bar stop (11).

TURRET LATHE TOOL SETUP (INTERNAL TURNING)

TR 01 12 02 08 95





TOOLING SEQUENCE

1 Facing	5 Counter boring
2 O.D. Turning	6 Recessing
3 Spotting (drill)	7 Threading (Tap)
4 Drilling	8 Parting–off

Note: To be discussed along with the

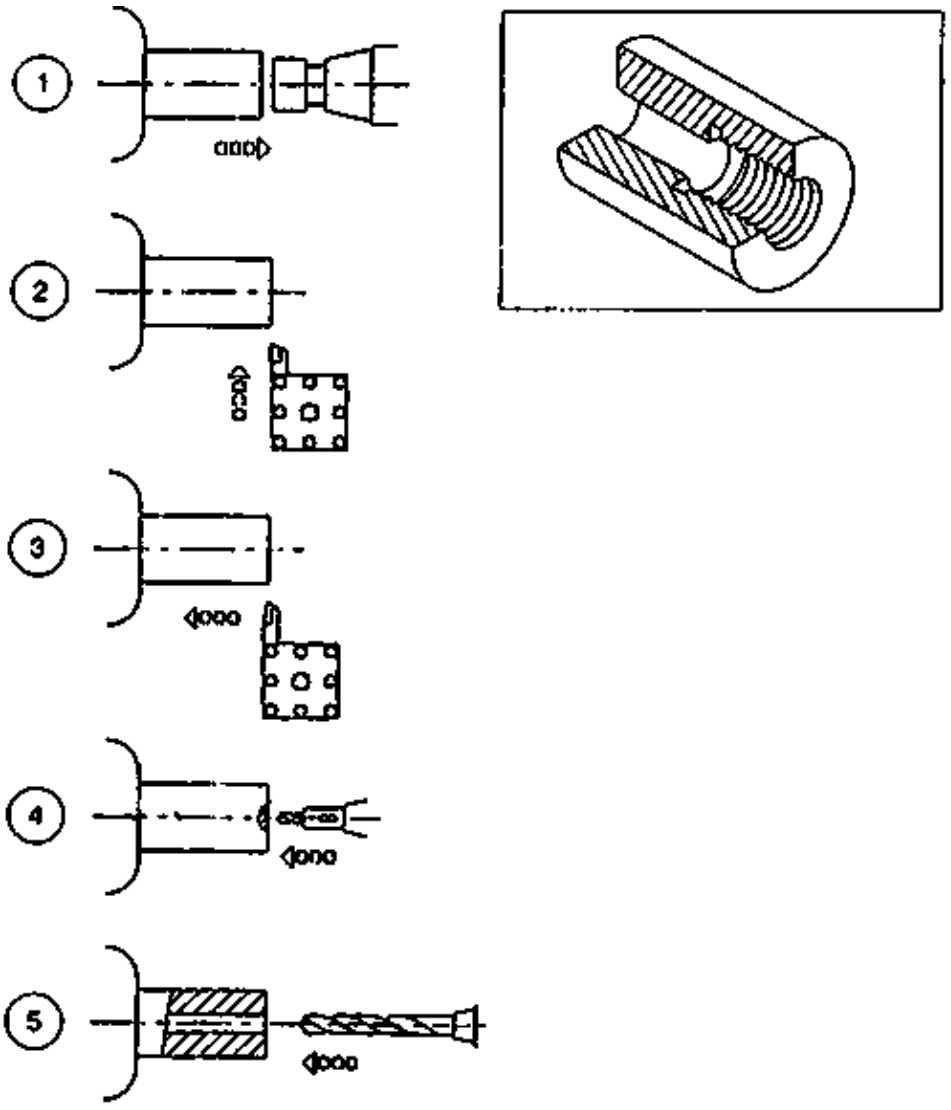
Transparencies
No. TR 01 12 02 09 95
TR 01 12 02 10 95

OPERATIONS ON THE COMPONENT

A Facing
B O.D. Turning
C Drilling
D Boring
E Recessing
F Threading
G Parting–off

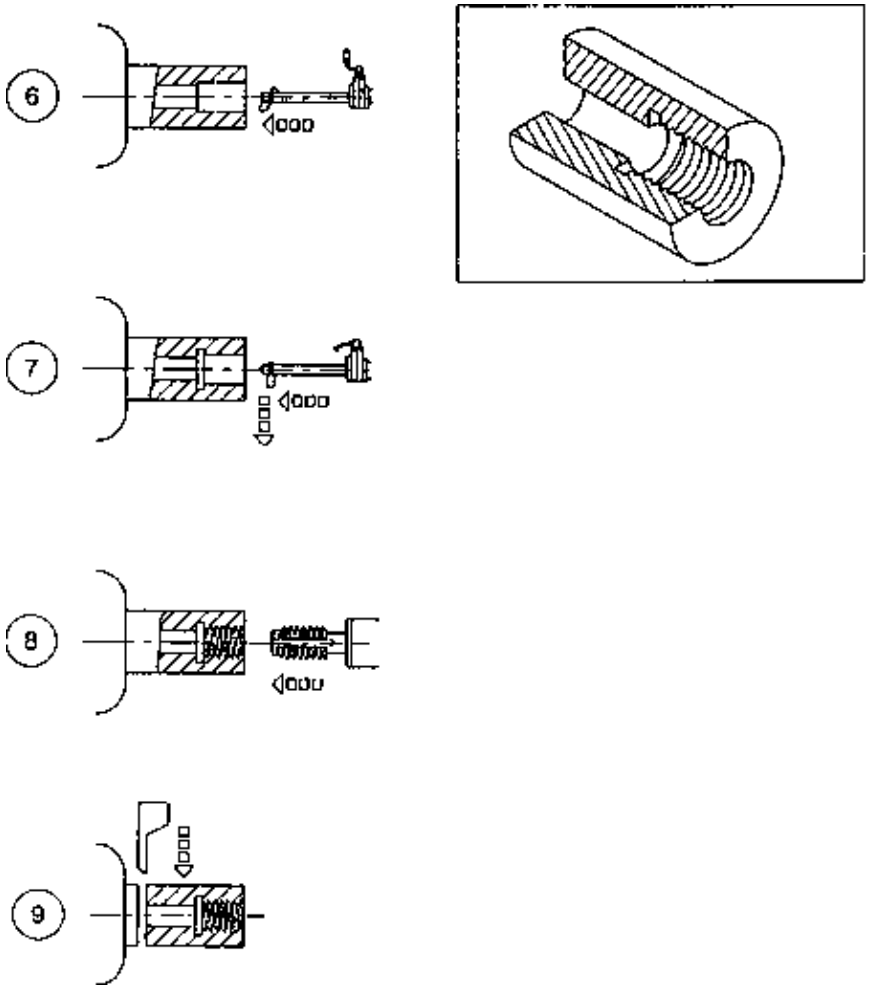
TURRET LATHE (INTERNAL TURNING SEQUENCE)

TR 01 12 02 09 95



1. Bar stop
2. Facing
3. O.D. Turning
4. Start drill (spotting)
5. Drilling

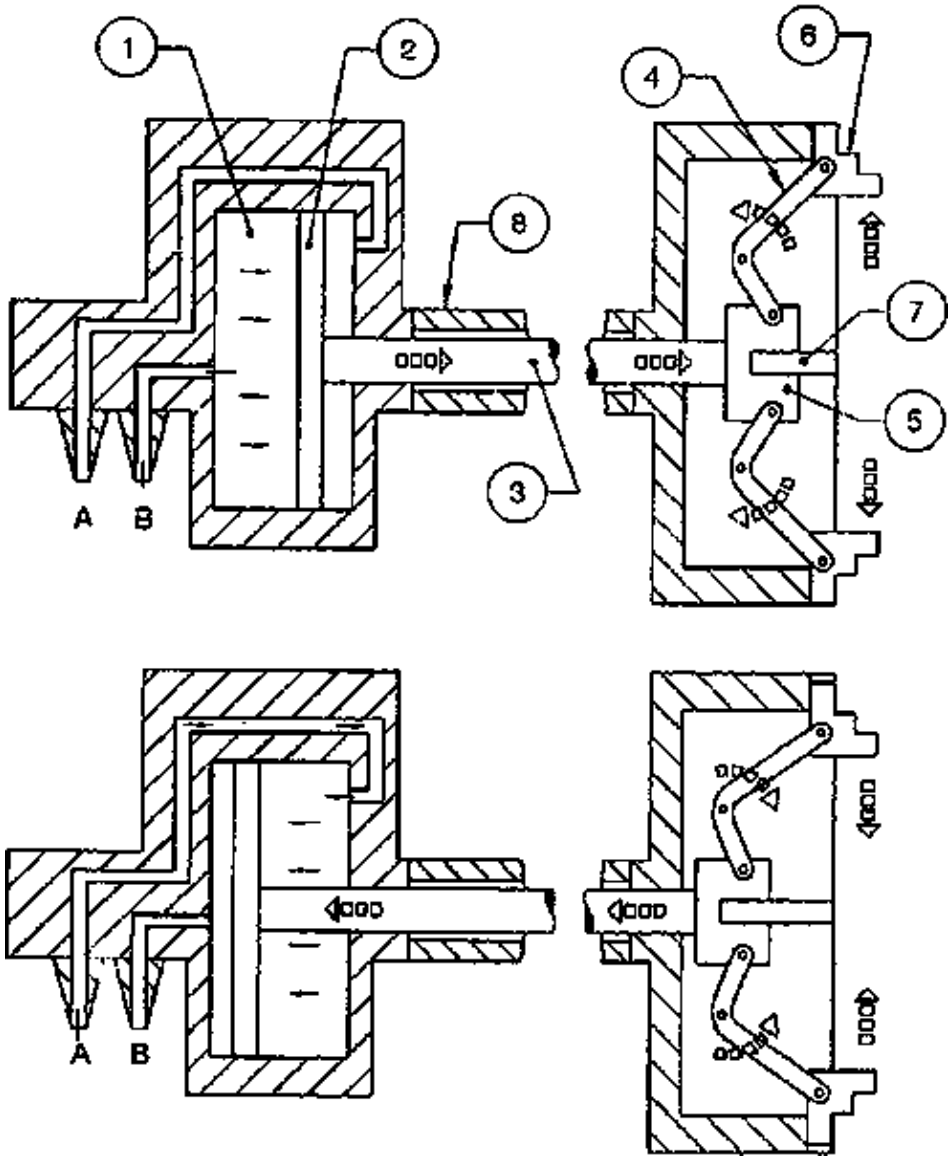
TR 01 12 02 10 95



6. Counter boring
7. Recessing
8. Threading with tap
9. Parting–off

AIR–OPERATED CHUCK (WORKING PRINCIPLE)

TR 01 13 01 03 95

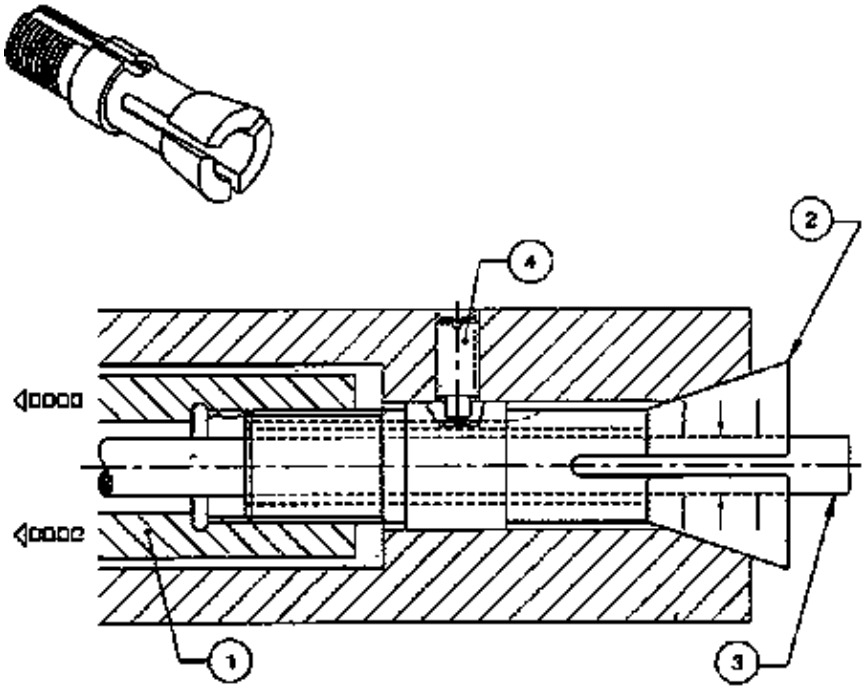


Air operated chuck is used in mass production work because of its fast and effective gripping capacity. The mechanism consists of an air cylinder mounted at the rear end of the head stock spindle and rotates with it. Pressure is transmitted to the cylinder by operating a valve with a lever. When the air pressure enters the cylinder (1) through the pipe B, the piston (2) moves forward alognwith the piston rod (3) attached. The links (4) keyed to the sliding unit (5) are moved and the jaws (6) gets opened and the job held in the chuck is released.

When the air pressure enters the cylinder through the pipe A, the piston (2) moves backward. The links (4) are moved, the jaws (6) gets closed and the job is gripped in the chuck.

COLLET – DRAW–IN–TYPE (WORKING PRINCIPLE)

TR 01 13 01 04 95

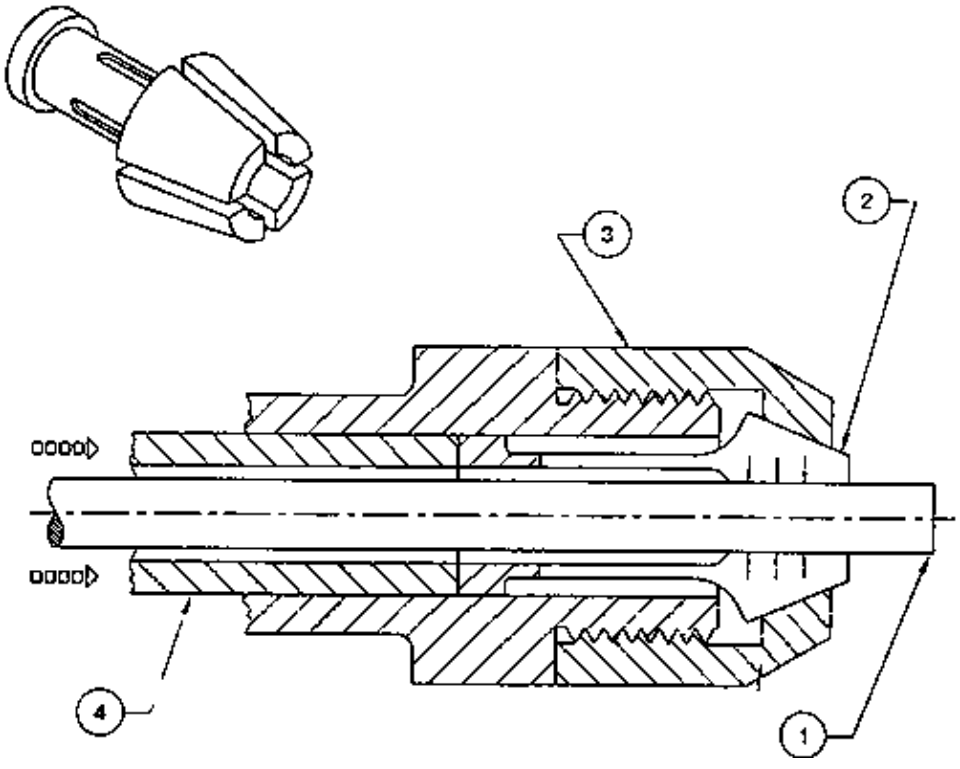


By rotating the draw tube (1) the collet (2) is pulled back as the draw tube and the collet have matching threads. Due to this the split end of the collet comes closer and grips the bar (3). The guide pin (4) guides the collet to move straight without rotation.

The machining length of the bar can not be set accurately, as the collet while closing, will draw the bar slightly inward, necessary allowance should be provided to over come this.

COLLET – PUSH OUT TYPE (WORKING PRINCIPLE)

TR 01 13 01 05 95

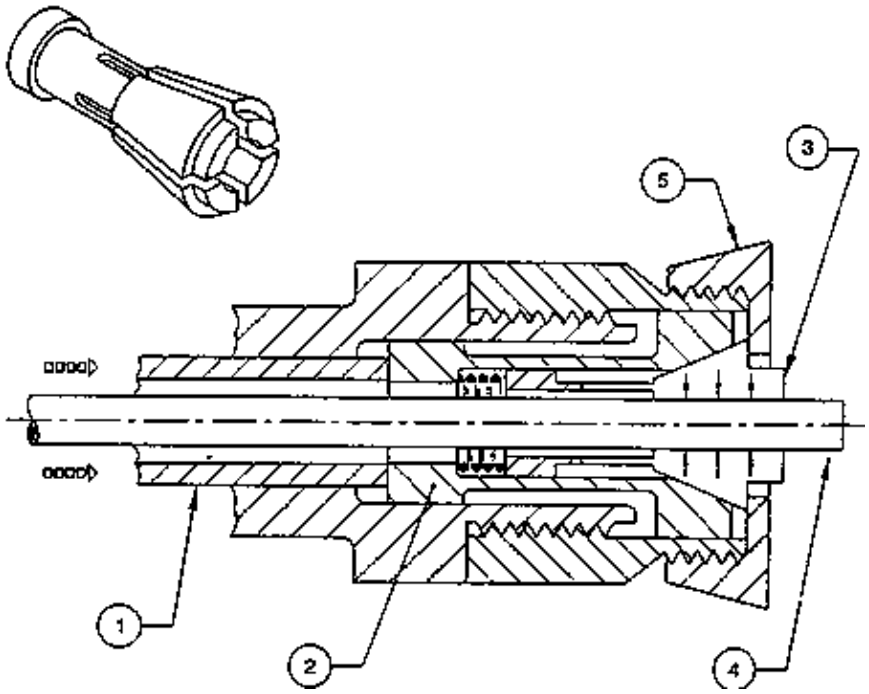


To grip the bar (1), the tapered portion of the collet (2) is pushed into the mating taper of the hood (3) with the help of push tube (4). During this process, there is a tendency for the bar (1) to be pushed slightly outward. If

the bar is fed against a bar stop fitted on the turret head, it will ensure accurate setting of the length for machining.

COLLET – DEAD LENGTH TYPE (WORKING PRINCIPLE)

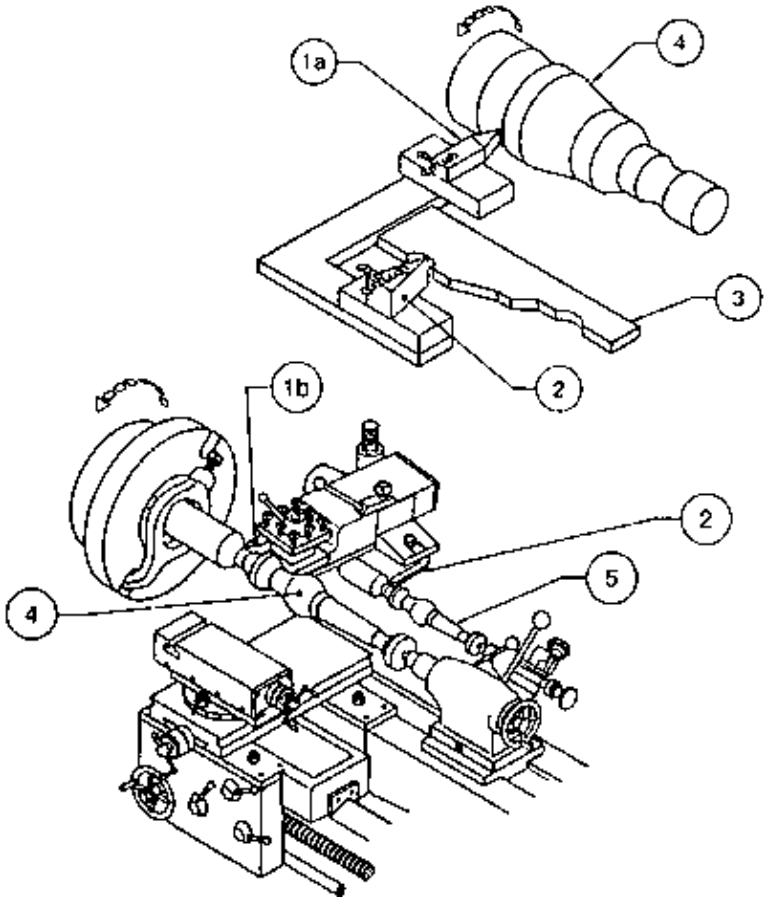
TR 01 13 01 06 95



This collet can accurately position the bar to the required length. When the push tube (1) pushes the sliding sleeve (2) forward towards the taper portion of the collet (3), the split end comes closer and grips the bar (4). The shoulder stop of the hood (5) will not allow any end movement for the collet (3) as well as the bar (4).

COPY TURNING ATTACHMENT (WORKING PRINCIPLE)

TR 01 13 01 03 95



PRINCIPLE

The copying attachment is functioning with the help of hydraulic system. The cutting tool (1 a) and the stylus (2) are connected to an angle shaped piece which is linked to a hydraulic system. The movement of the stylus is guided by the profile of a template(3).

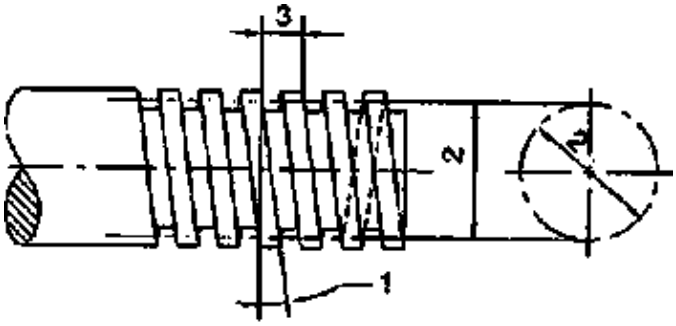
FUNCTION

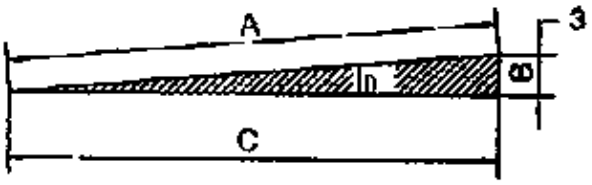
On the lathe the job (4) is held between centres. A master piece (5) of the job to be produced is held separately parallel to the job axis. The cutting tool (1 b) is held up−side down in the rear tool post which is linked to a stylus (2).

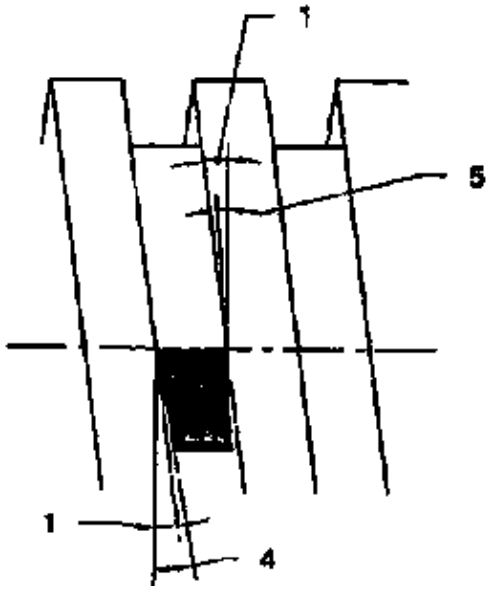
When the automatic feed is engaged, the stylus (2) moves from tail stock to head stock with a forward pressure. The movement of the stylus (2) is guided by the profile of the master piece (5).

LEADING AND FOLLOWING ANGLES (SQUARE THREADING TOOL)

TR 01 14 02 01 95







When a square tool which is similar to a parting–off tool is used for cutting a square thread, the bottom of the tool (side) will rub against the side of the thread. This is because, when a thread is cut, an inclined groove is formed on the circumference of the round rod. This inclined (side) portion will rub against the bottom of the tool. This inclination to the perpendicular line is called the helix angle of the thread.

To calculate the helix angle (1), a right angled triangle is formed with circumference of pitch diameter (2) as adjacent side and the lead of the thread (3) as opposite side for the triangle. By applying the formula,

$$\text{Tan}\theta = \frac{\text{Oppositeside}}{\text{Adjacentside}}$$, we get the helix angle of the square thread.

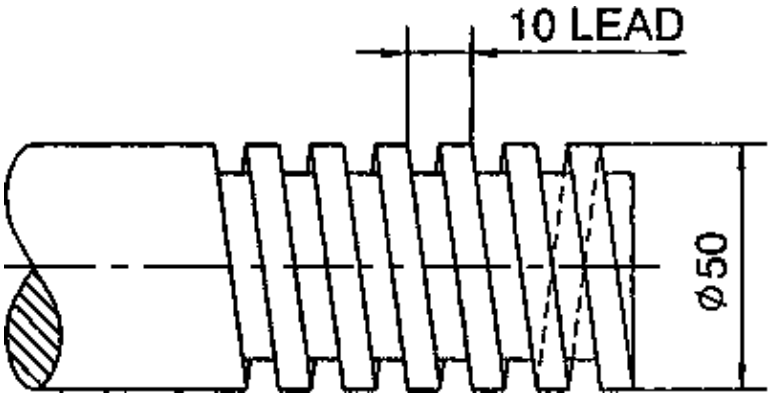
The leading angle (4) and the following angle (5) of the square threading tool can be arrived at as follows:–

Leading angle = Helix angle + 1° 30’

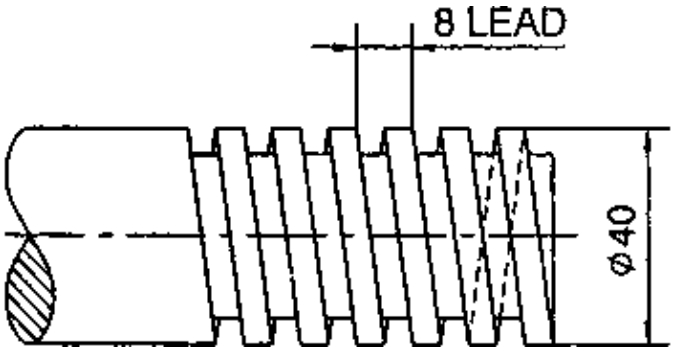
Following angle = Helix angle – 1° 30’

LEADING AND FOLLOWING ANGLES (ASSIGNMENT)

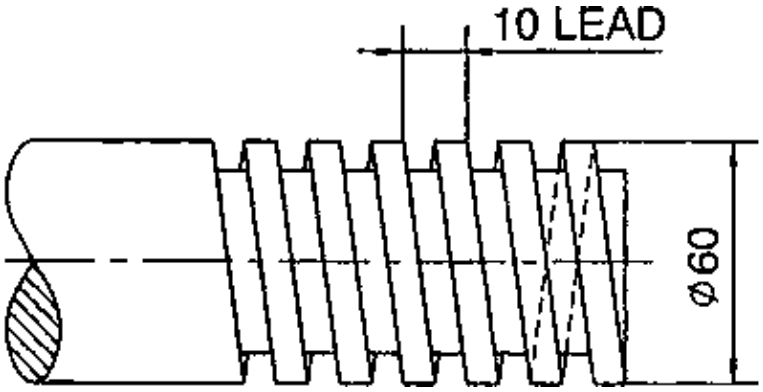
TR 01 14 02 02 95



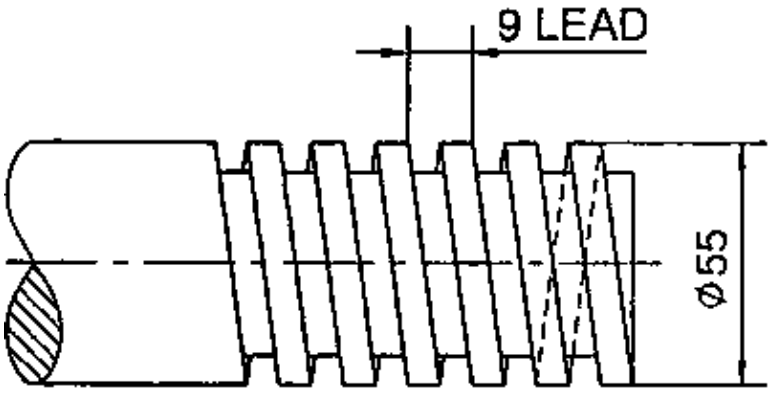
Helix angle = 4°2'
Leading angle = 4°2' + 1°30' = 5°32'
Following angle = 4°2'–1°30' = 2°32'



Helix angle = 4°2'
Leading angle = 4°2' + 1°30' = 5°32'
Following angle = 4°2'–1°30' = 2°32'



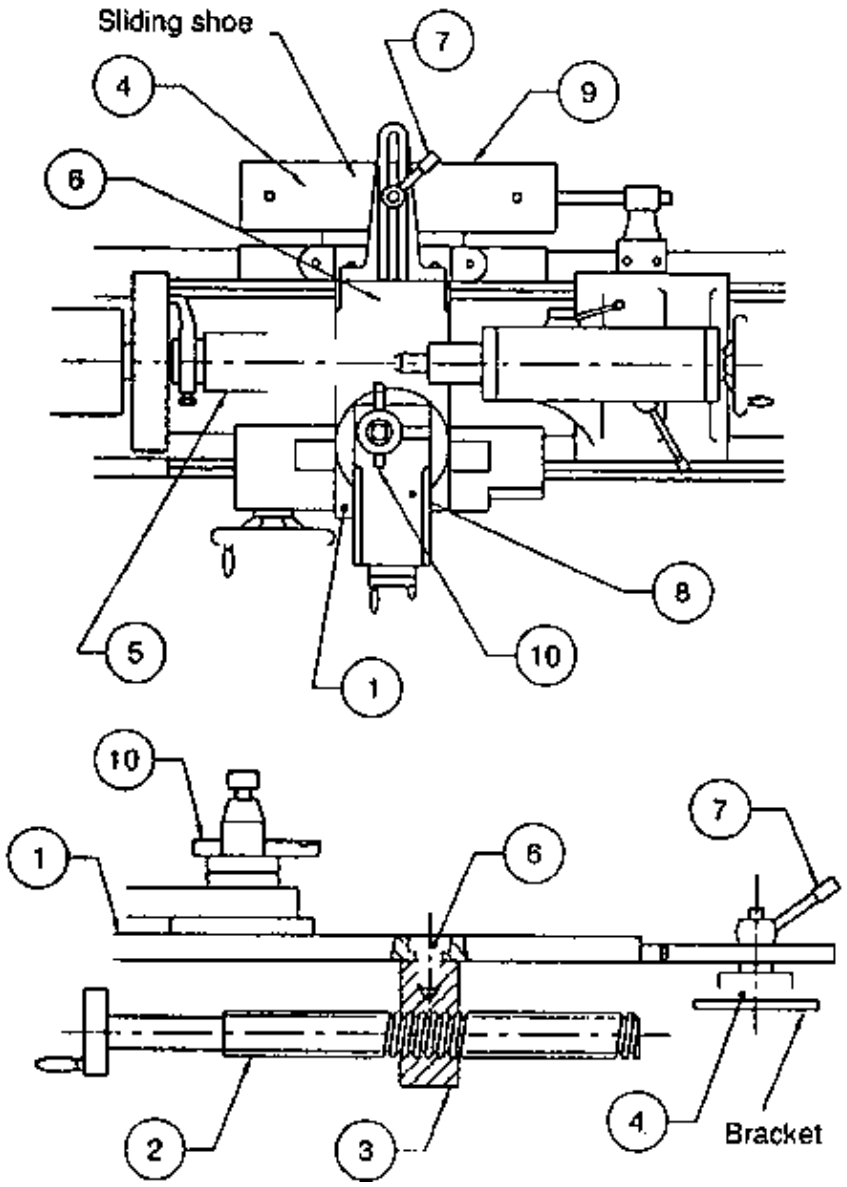
Helix angle = 3°18'
Leading angle = 3°18' + 1°30' = 4°48'
Following angle = 3° 18'–1°30' = 1 °48'



Helix angle = 3°15'
Leading angle = 3°15' + 1°30' = 4°45'
Following angle = 3°15' – 1°30' = 1°45'

TAPER TURNING ATTACHMENT – YOKE TYPE (PRINCIPLE)

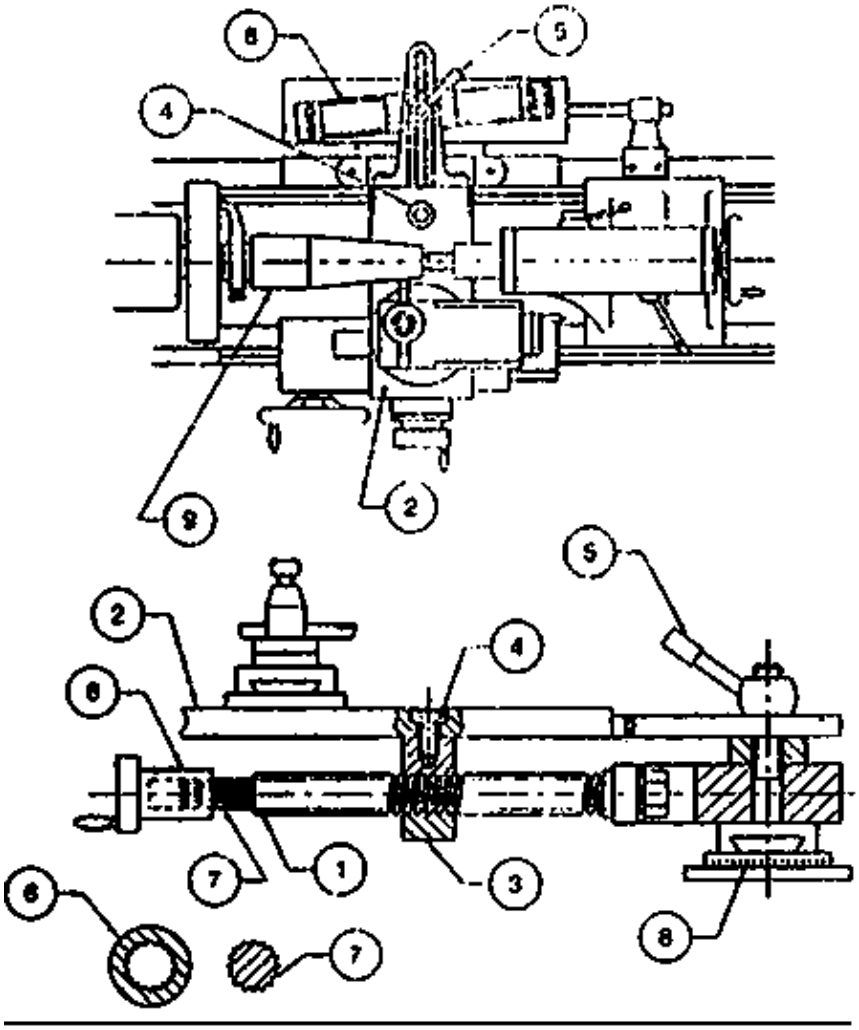
TR 01 15 03 04 95



In the normal working condition the cross slide (1) is moved forward and backward with the rotation of a screw rod (2) which is linked to a box nut (3). The guide bar (4) is set to an angle equal to the angle of taper on job (5). The taper attachment is centrally located to cover the length of taper on job. The screw (6) is removed to de–link the box nut. The cross–slide is linked to the taper attachment by tightening the binding screw handle (7). When the machine is started with automatic feed on, the tool (10) will move in an inclined direction equal to the angle set on guide bar (4). The compound rest (8) is tilted perpendicular to the job axis to give depth of cut.

TAPER TURNING ATTACHMENT – TELESCOPIC TYPE

TR 01 15 03 05 95

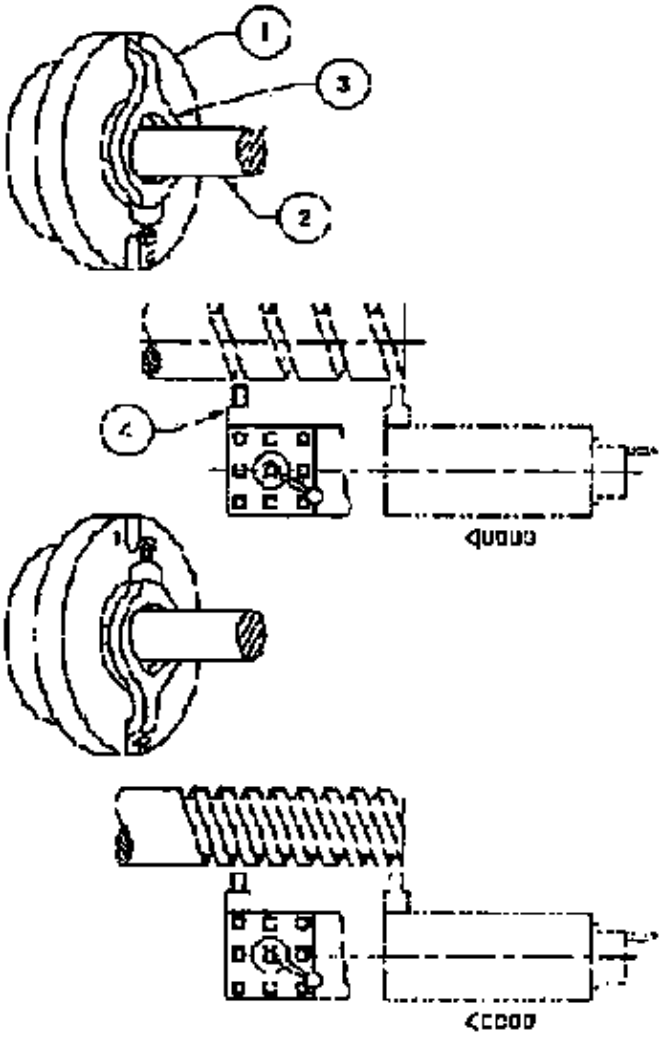


The screw rod (1) is linked to cross slide (2) through a box nut (3) and screw (4). One end of the cross slide is connected to the taper attachment with a binding screw (5) and the other end the cross slide handle is assembled with a spline (6 & 7 – hole and shaft). The guide bar (8) is set to an angle equal to the angle of taper on job (9). The taper attachment is centrally located to cover the length of taper on job.

After locking the cross slide to the taper attachment, the machine is switched on to give automatic feed. The tool will move in an inclined direction equal to the angle set on guide bar (8). In this case, there is no need to remove the screw (4) and de–link the box nut, because, for the movement of the cross slide screw rod and handle are assembled with a spline construction (6 & 7) one end of the screw rod is connected to the guide bar assembly. Depth of cut can be given by the cross slide.

DOUBLE START THREAD (CATCH PLATE METHOD)

TR 01 15 04 01 95



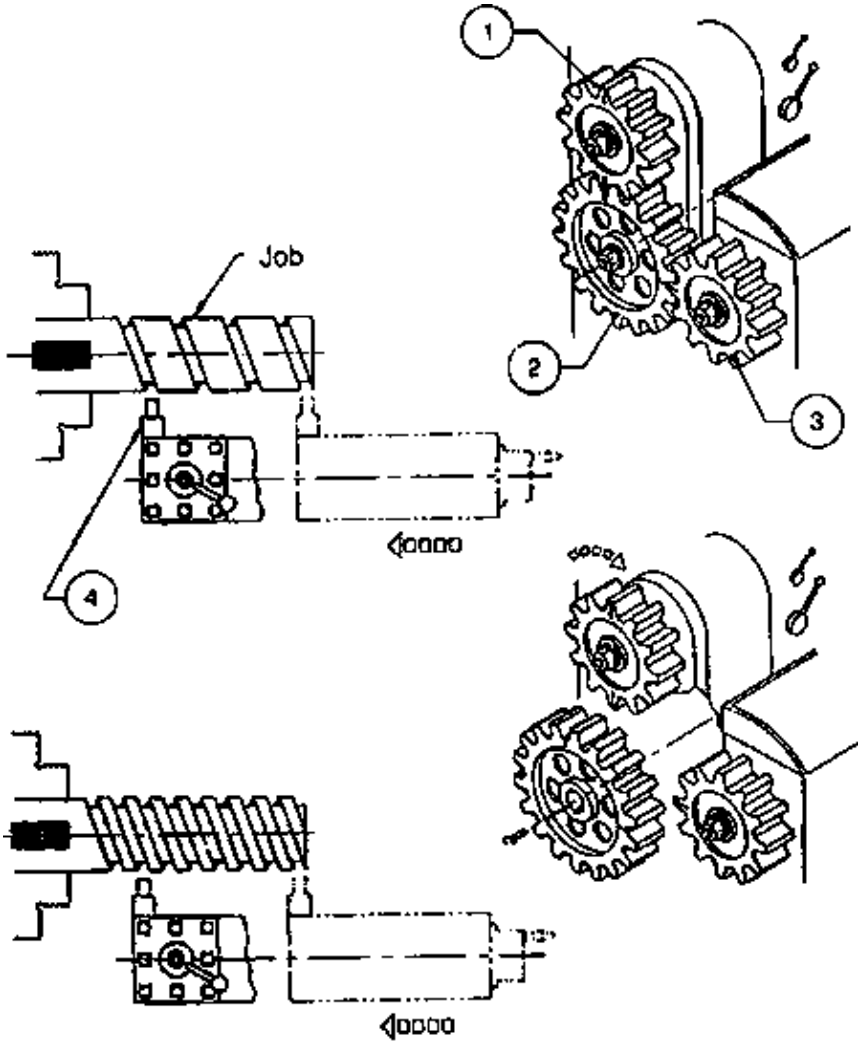
A catch plate (1) with two slots in the opposite sides (180° apart) is mounted on the lathe. Job (2) is held between centres accommodating the tail of the carrier (3) in slot No.1. Calculate the lead of the thread and cut the 1st start to the required depth.

Stop the machine and remove the job along with the dog carrier. Re−set the job accommodating the tail of the carrier in slot No.2. Now, the tool will come exactly in the middle of the two grooves. Cut the 2nd start of the thread.

Note: The two slots formed on the catch plate in the opposite sides (180° apart) are marked as 1 and 2.

DOUBLE START THREAD (DIVIDING THE GEAR METHOD)

TR 01 15 04 02 95



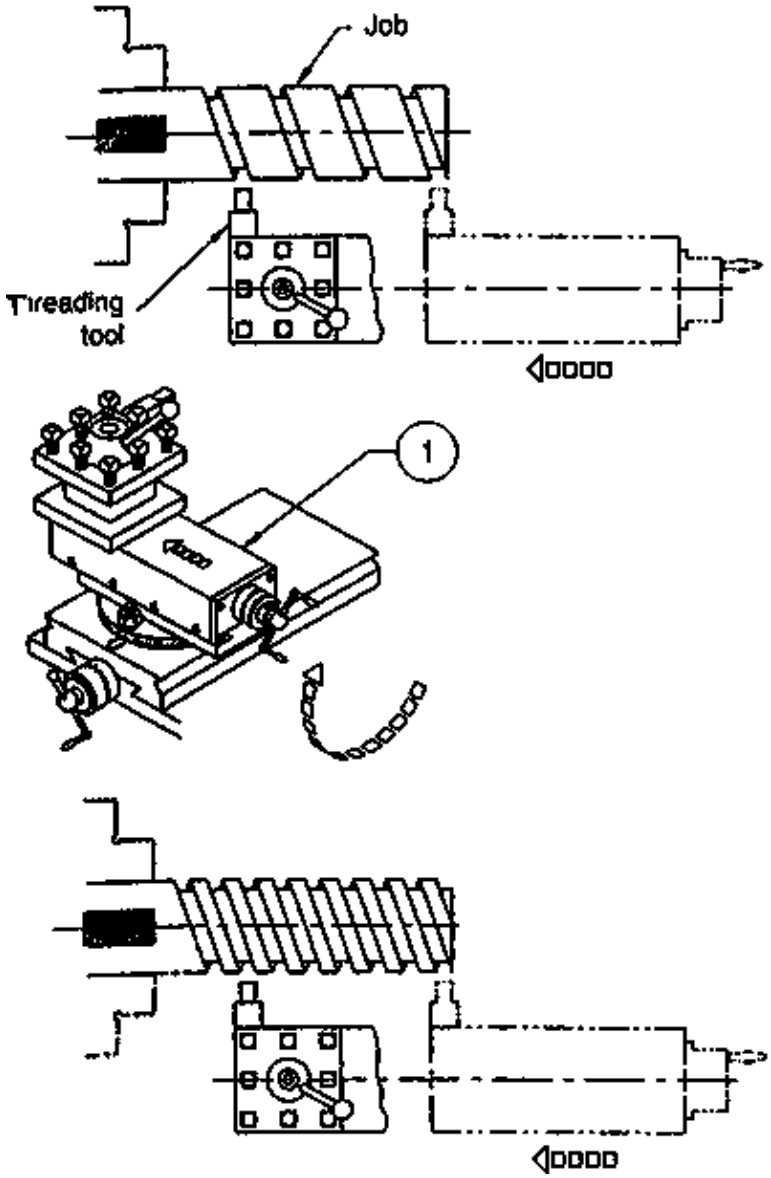
The gear train should be such that the gear teeth in the driver gear (1) must be divisible by two. Calculate the lead of the thread and cut the 1st start to the required depth. Then stop the lathe. Open the rear guard. Mark the driver gear (1) teeth into two so that there are equal number of teeth on either sides. One at the bottom where driver gear (1) meshes with intermediate gear (2). The other is exactly on the opposite side.

Make another chalk mark between two gears where intermediate gear (2) and lead screw gear (driven) (3) meshes.

Remove the intermediate gear (2) and rotate the driver gear (1) exactly half turn. While doing this the job also rotates half turn. Re−fix the intermediate gear so that the chalk marks matches. Now, the tool (4) will come exactly in the middle of the two grooves of the 1st thread.

DOUBLE START THREAD (GRADUATED COLLAR METHOD)

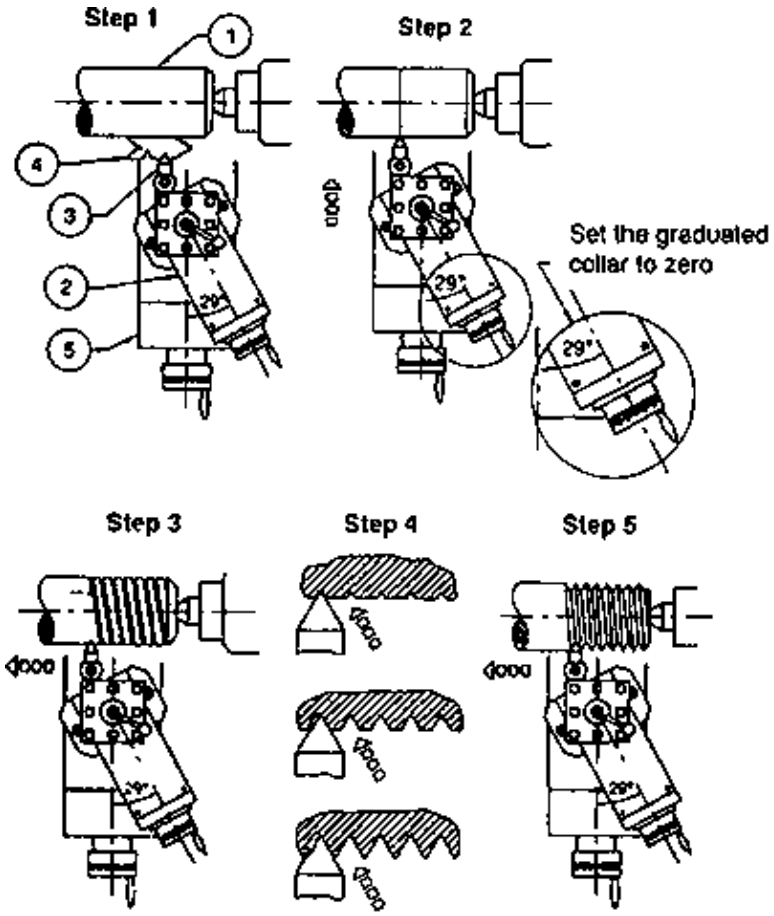
TR 01 15 04 03 95



Calculate the lead of the thread. Arrange gear train and cut the 1st start of the thread to the required depth. Stop the machine and move the compound slide (1) forward to the half the lead of the thread. For this, use graduated collar of the compound rest. Now, the tool will come exactly in the middle of the two grooves of the 1st thread. Cut the 2nd start.

THREAD CUTTING BY HALF ANGLE METHOD (PRINCIPLE)

TR 01 15 04 04 95



Step 1: Turn the job (1) to the required diameter before thread cutting operation is started. Tilt the compound rest (2) to 29° perpendicular to the job axis. The cutting tool (3) Is set perpendicular to the job axis with the help of centre gauge (4).

Step 2: Start the machine. Using cross−slide (5), bring the tool very close to the job and touch lightly. Set the graduated collar of the compound rest to zero.

Step 3: Take the tool to the starting point and give a light threading cut. Depth of cut is given by compound rest (2).

Step 4: Take number of cuts using compound rest to form the thread.

Step 5: Give the final cut and complete the thread formation.