Mechanic Motor Vehicle 1st Year – Transparencies

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CENTRAL INSTRUCTIONAL MEDIA INSTITUTE, MADRAS
AN INDO - GERMAN PROJECT

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

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CENTRAL INSTRUCTIONAL MEDIA INSTITUTE
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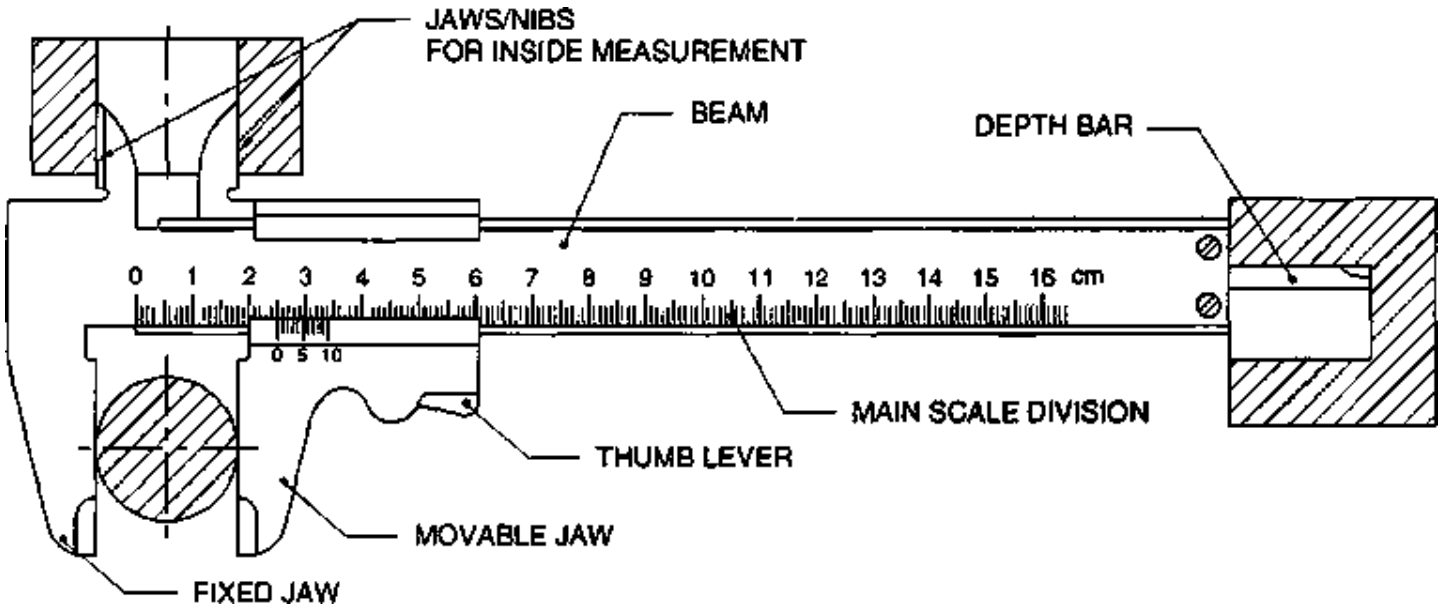
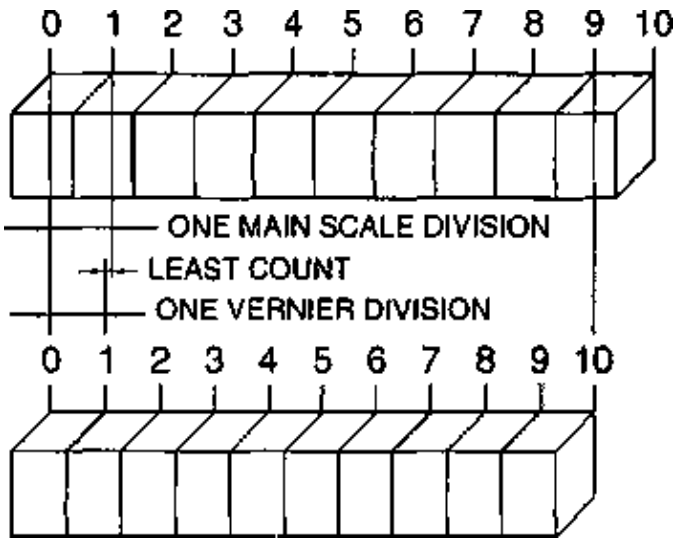
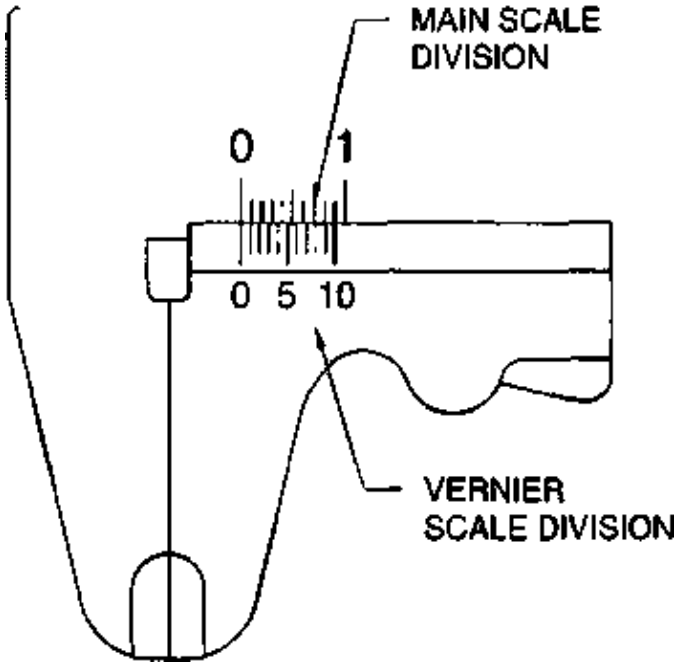
Vernier Caliper parts and principle

TR 01 02 01 01 95

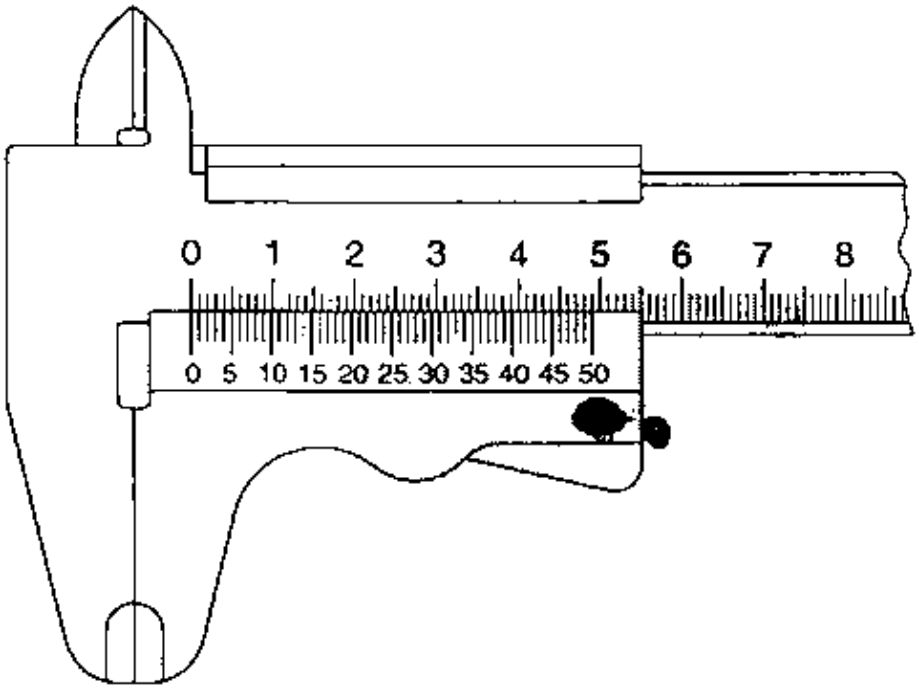






Reading of Vernier Caliper

TR 01 02 01 02 95



49 Main scale divisions are divided into 50 vernier scale divisions

$$\text{VALUE OF 1 VSD} = \frac{49}{50}\,\text{mm}$$

$$\text{LEAST COUNT} = 1\text{MD} - 1\text{VSD}$$

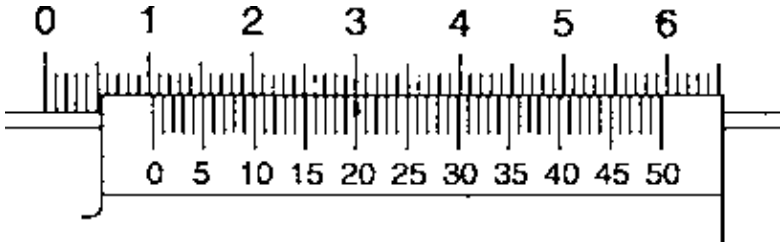
$$= 1 - \frac{49}{50}$$

$$= \frac{1}{50} = 0.02\,\text{mm}$$

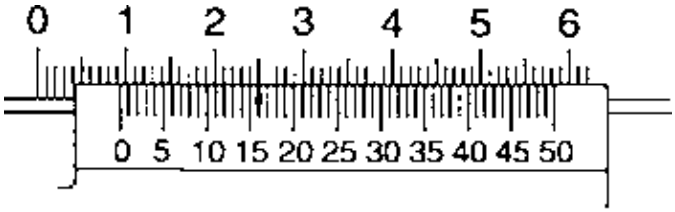
MAIN SCALE READING = 10.00mm

VALUE OF COINCIDING VERNIER DIVISION } = 00.40mm

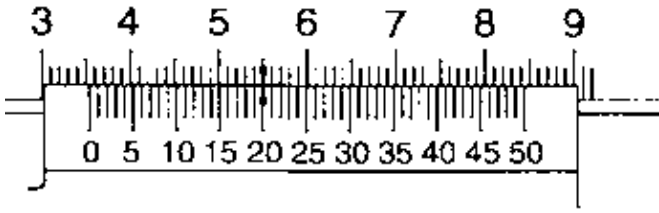
READING = 10.40mm



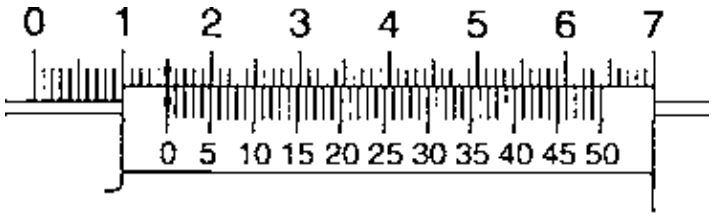
ASSIGNMENTS:–



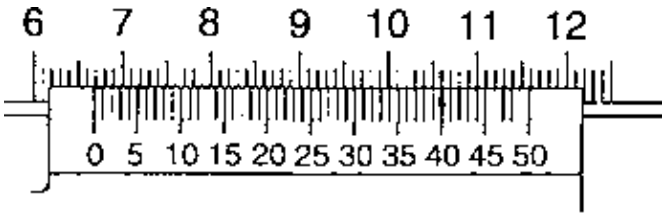
A READING 9.32 mm



B READING 35.40 mm



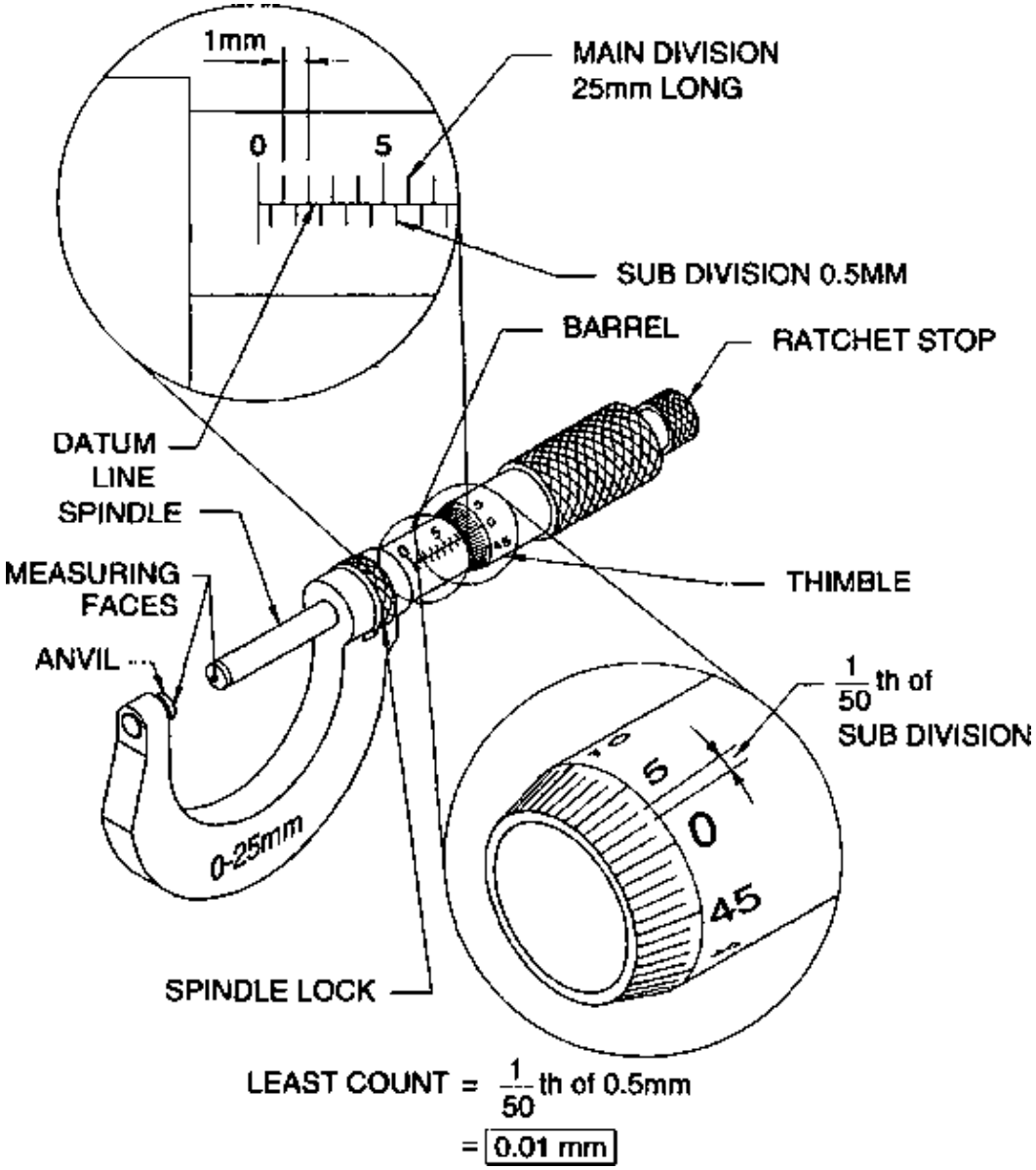
C READING 15.00 mm



D READING 66.80 mm

Micrometer parts and graduations

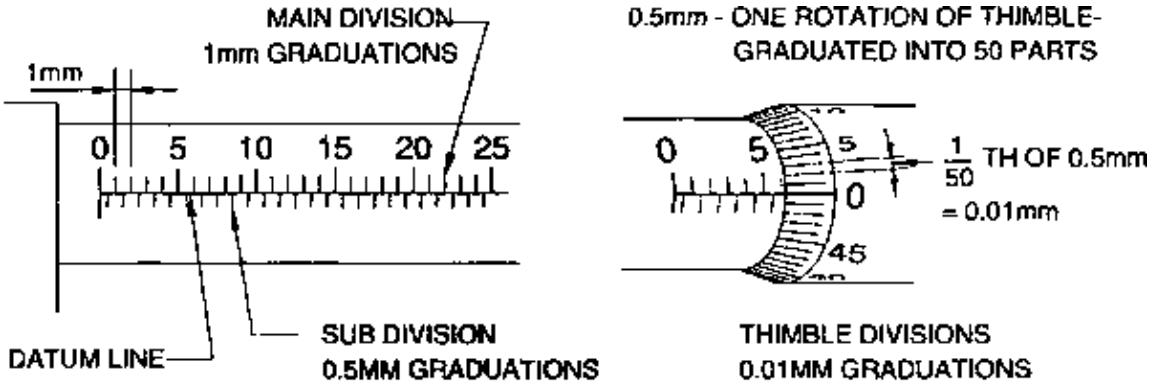
TR 01 02 02 01 95



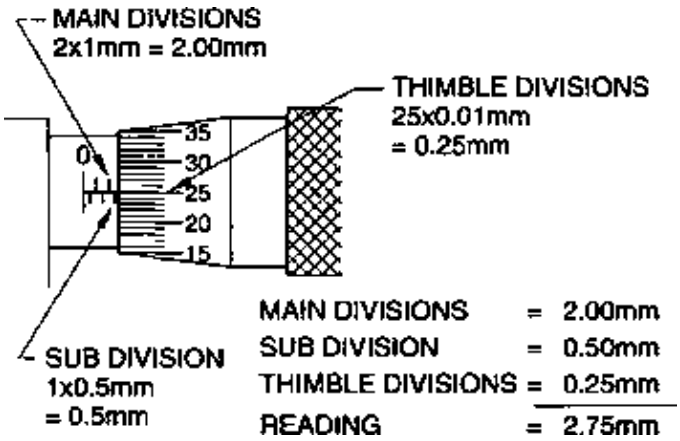
Micrometer reading

TR 01 02 02 02 95

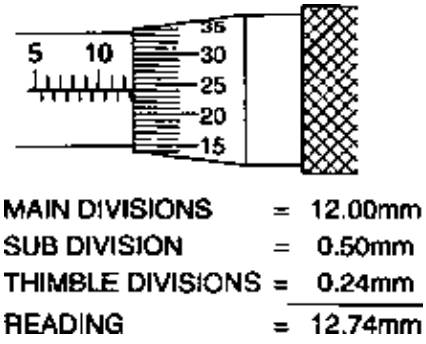
MICROMETER GRADUATIONS



MICROMETER READING



Example



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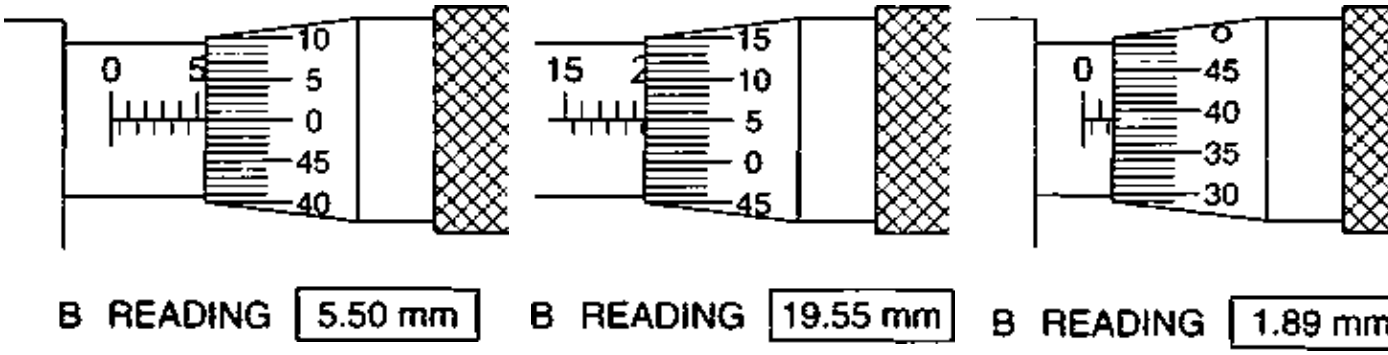
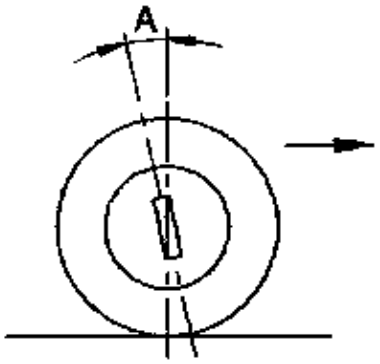
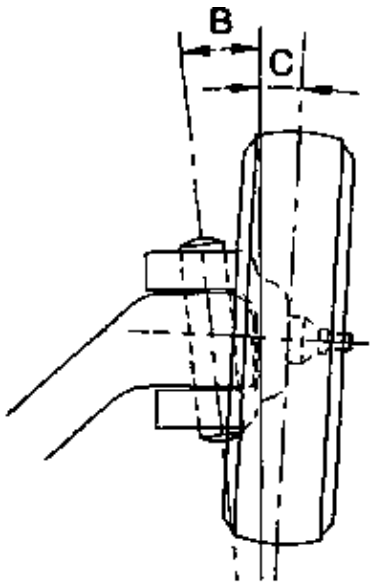


Wheel alignment

TR 10 09 04 01 95



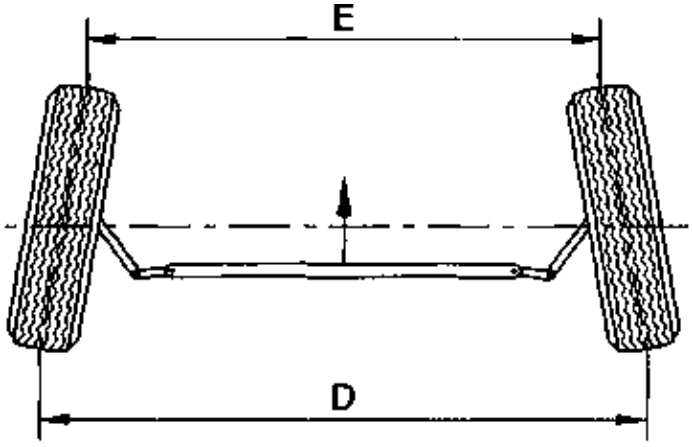
A = Caster angle



B King pin inclination

C Camber angle

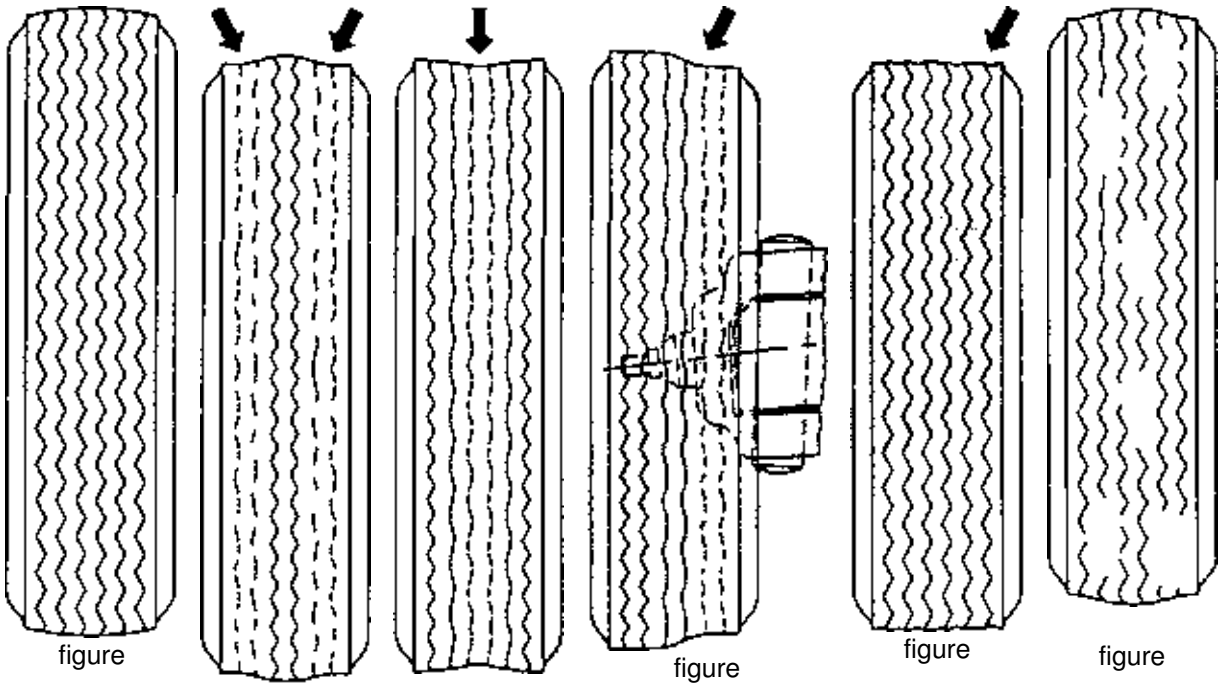
B+C= Included angle



D-E = Toe-in

Tyre wear Patterns and causes

TR 10 09 03 01 95



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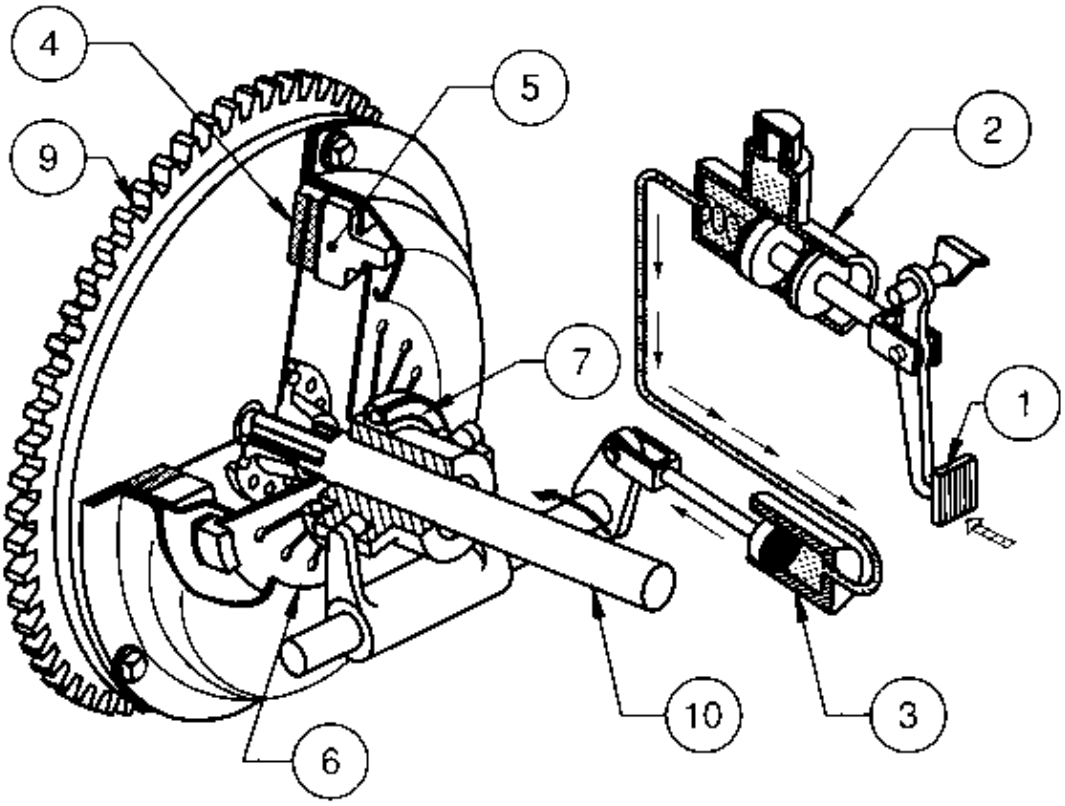
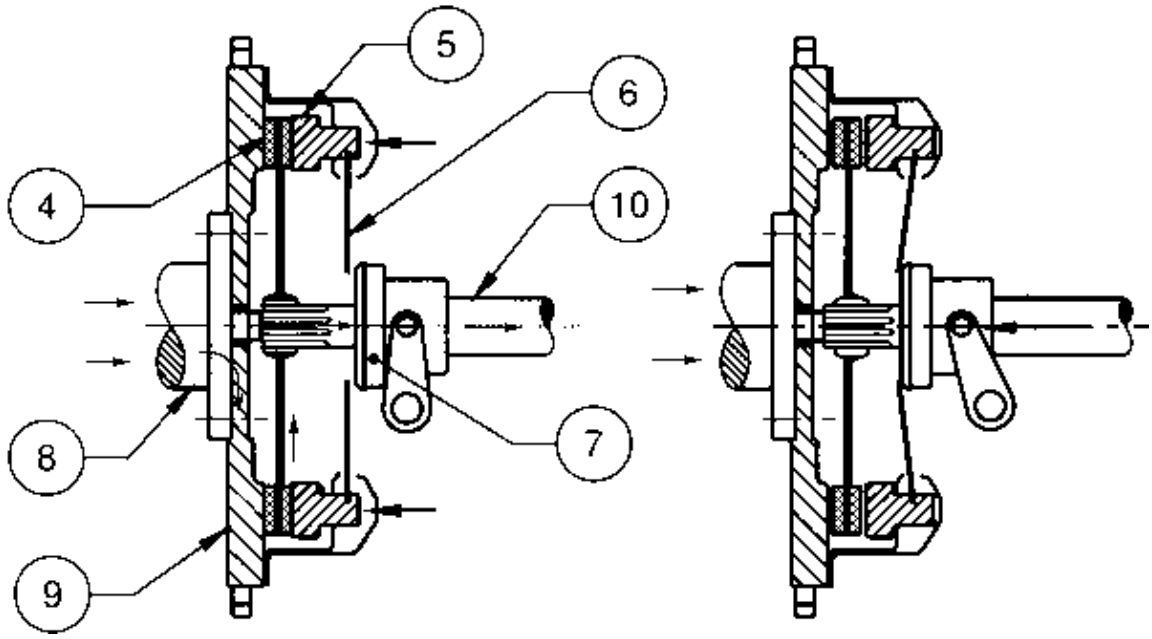
WEAR PATTERN	IDEAL	At shoulders	At center	On one side	Feathered edge	Bald spots
CAUSE	PERFECT CONDITION	Under inflation	Over inflation	Excessive camber	Incorrect toe	Unbalanced wheel

Clutch actuation (Hydraulic)

TR 10 02 06 01 95



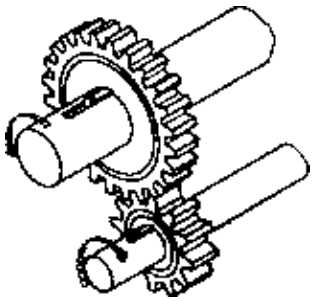


Action: The diaphragm spring **(6)** pushes the pressure plate **(5)** against the clutch plate **(4)**. Power flows from crankshaft **(8)** ' flywheel **(9)** ' pressure plate **(5)** ' clutch plate **(4)** ' and to primary shaft **(10)**

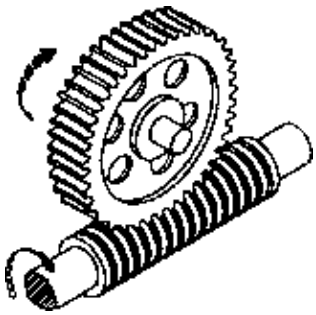
Action: The downward movement of the clutch pedal **(1)** pumps fluid from the master cylinder **(2)** to the slave cylinder **(3)** and pushes the release bearing **(7)** and the diaphragm **(6)** inwards. The pressure plate **(5)** and the clutch plate **(4)** move away from the flywheel **(9)**. No power flows from the crankshaft **(8)** to the primary shaft **(10)**

Types of gears

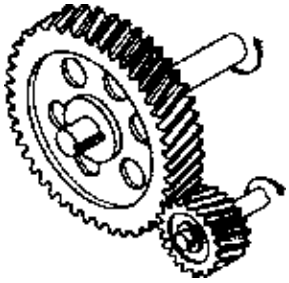
TR 10 03 07 01 95



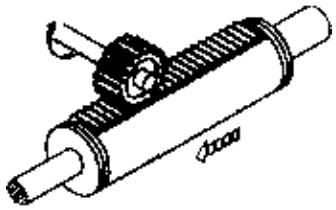
Spur Gears
Teeth are straight and parallel
Only one tooth is in contact at a time.
There is no axial thrust
APPLICATION – Gear box



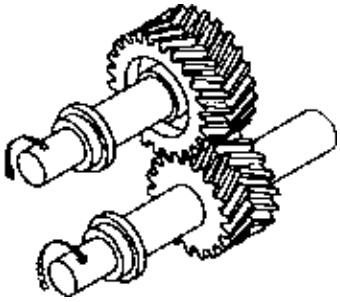
Worm Gears
Teeth are at an angle and curved
More teeth are in contact at a time
There is axial thrust
APPLICATION – Gear box.



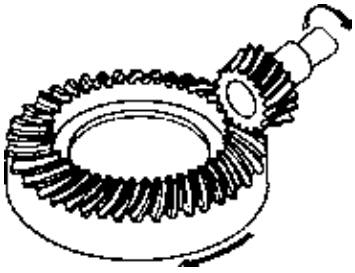
Helical gears
Teeth are at an angle
More teeth are in contact at a time
There is axial thrust
APPLICATION – Gear box.



Rack and Pinion
Teeth are parallel
Only one tooth is in contact at a time
There is no axial trust.
Converts rotary motion into linear motion.
APPLICATION – Steering



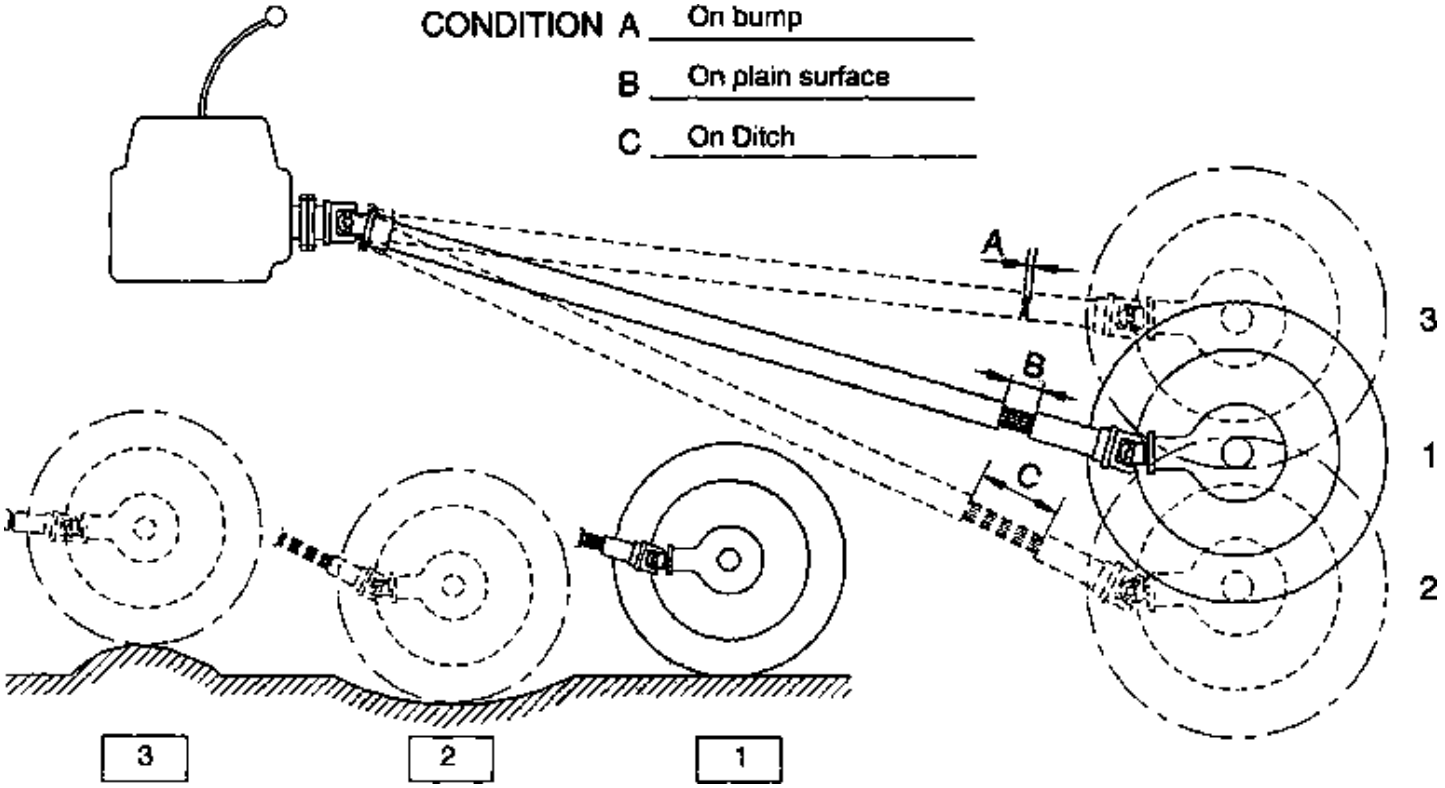
Herring Bone Gears
Teeth are straight at an angle
More teeth are in contact at a time
Axial thrust is neutralized
APPLICATION – Gear box



Spiral Bevel Gears
Teeth are curved
More teeth are in contact at a time
Produces axial thrust
Transmits torque at 90°
APPLICATION – Final drive differential

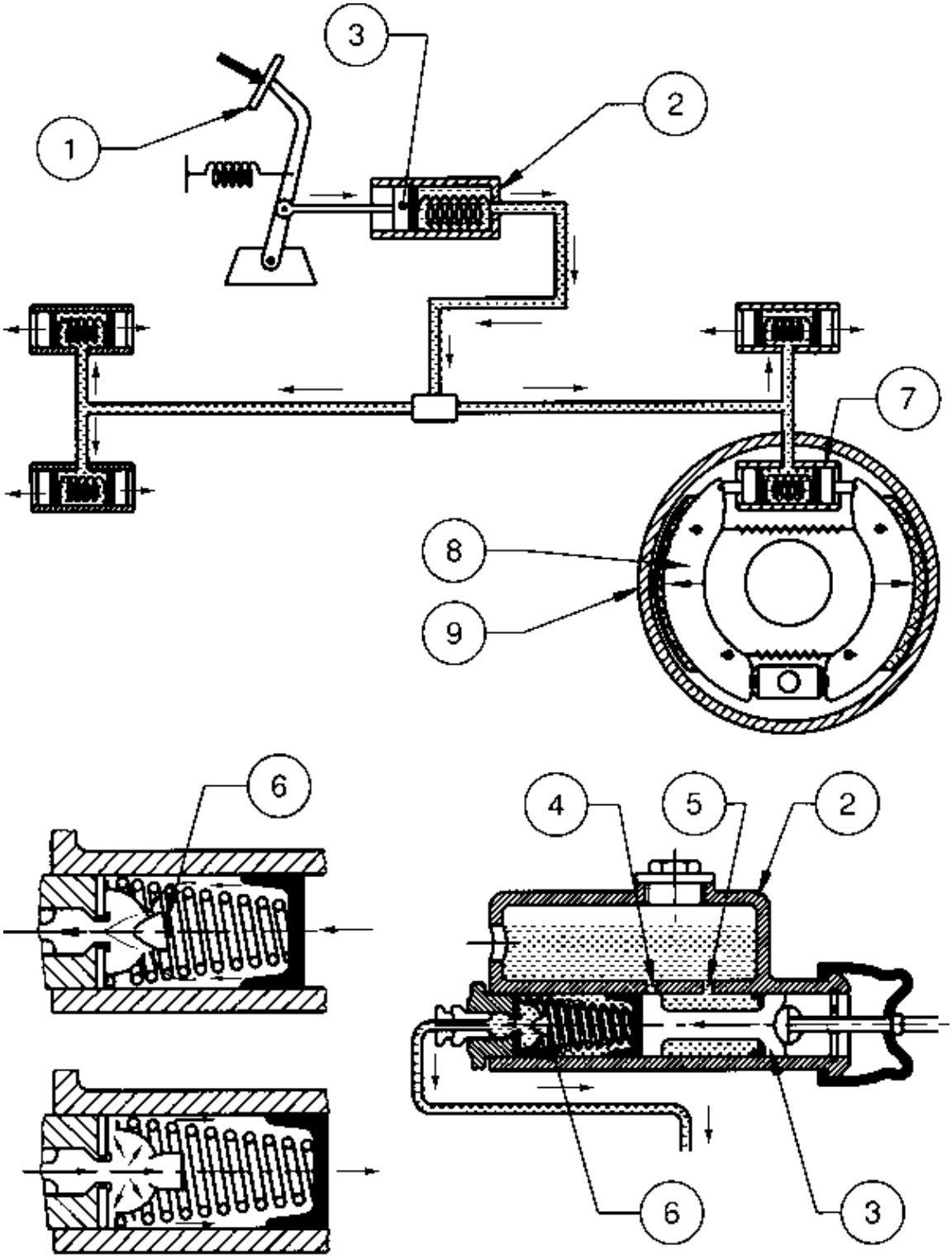
Function of Universal joint and slip joint

TR 10 05 02 01 95



Hydraulic brakes

TR 10 11 02 01 95



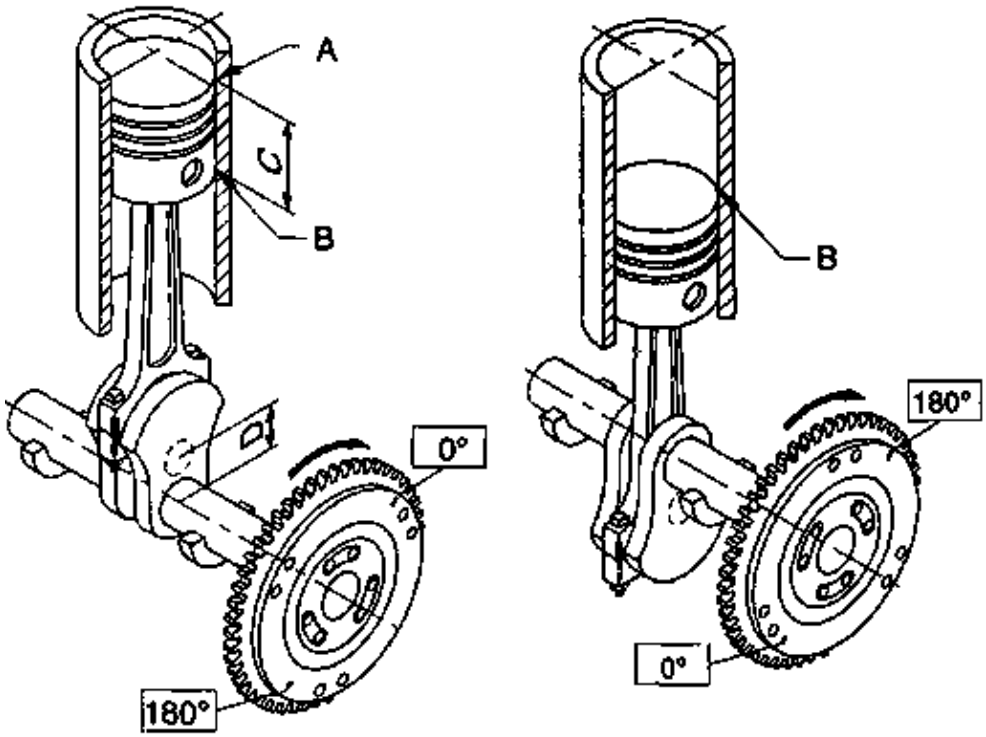
When the brake pedal **(1)** is pressed, the push rod forces the piston **(3)** of the Master Cylinder **(2)** forward against the spring tension. The primary cup covers compensating port **(4)**. The pressurised fluid is supplied to the wheel cylinders **(7)** through the non return check valve **(6)**. The wheel cylinder piston pushes the brake shoes **(8)** towards the brake drum **(9)** and stops the rotation of the brake drum.

When the brake pedal **(1)** is released, the pedal comes to its original position with the help of the pedal return spring and shoes by the retracting springs. Wheel cylinder pistons are pushed inside and the fluid is sent back to master cylinder **(2)** by lifting the check valve **(6)** from its seat through the compensating port **(4)** and the transfer port **(5)**.

Relationship between piston and flywheel movement

TR 10 01 01 01 95

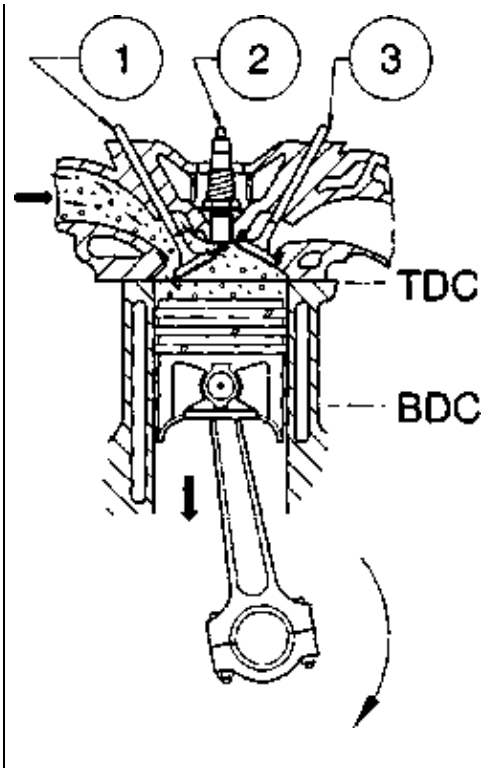
A Top Dead center (T.D.C)
B Bottom Dead Center (B.D.C.)
C Stroke length
D Crank throw

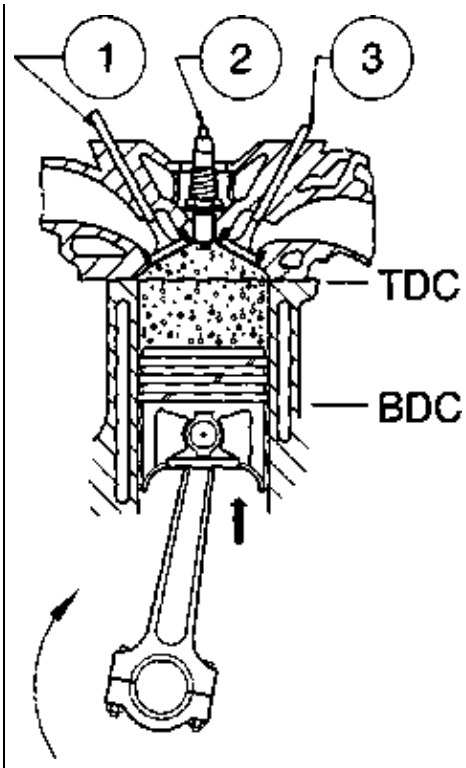


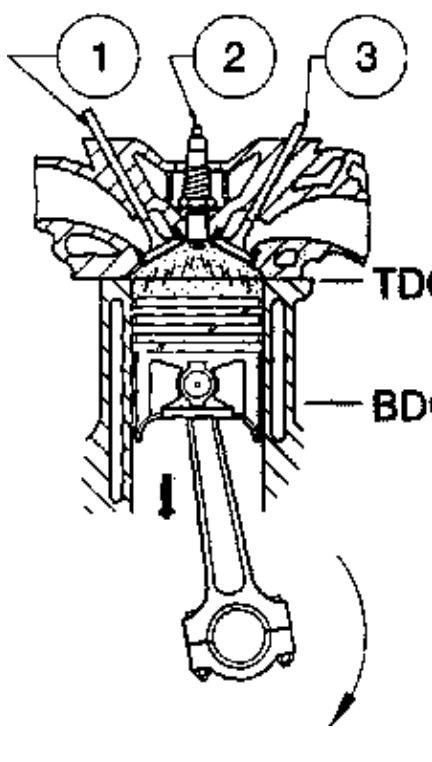
Dx2 = Stroke length

Four Stroke cycle operation (petrol)

TR 10 01 01 02 95



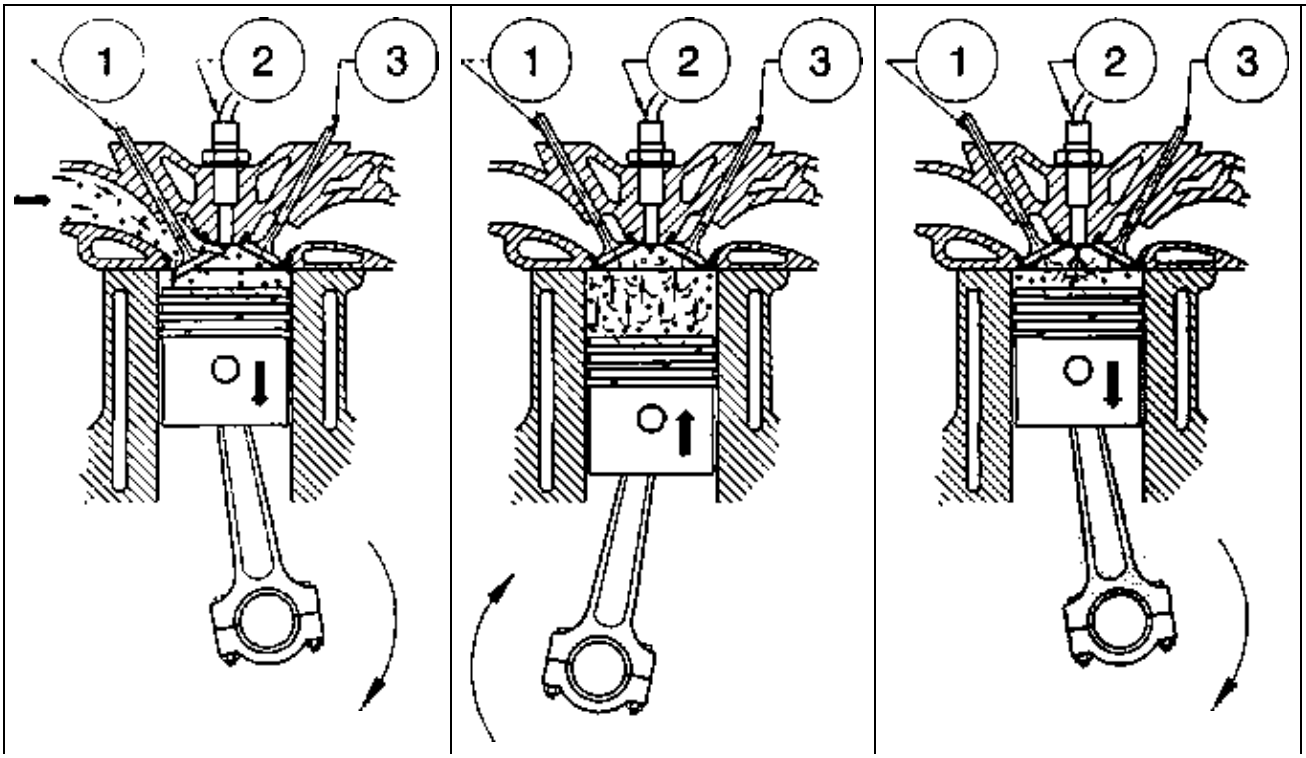


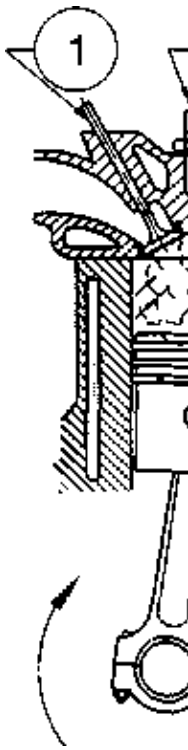


A – Suction Stroke	B – Compression Stroke	C – Power Stroke
Action: Inlet valve **(1)** opens and air fuel mixture enters inside the cylinder.	**Action**: Inlet valve **(1)** and exhaust valve **(3)** are closed. Air fuel mixture is compressed.	**Action**: Valves **(1)** and **(3)** are closed. Spark from the spark plug **(2)** ignites the mixture. Piston is forced down by the burnt gases.

Four Stroke cycle operation (Diesel)

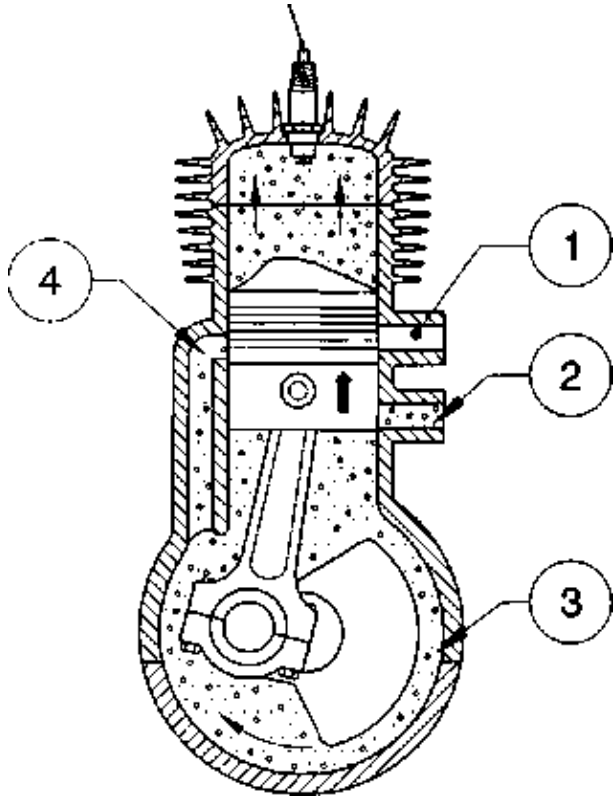
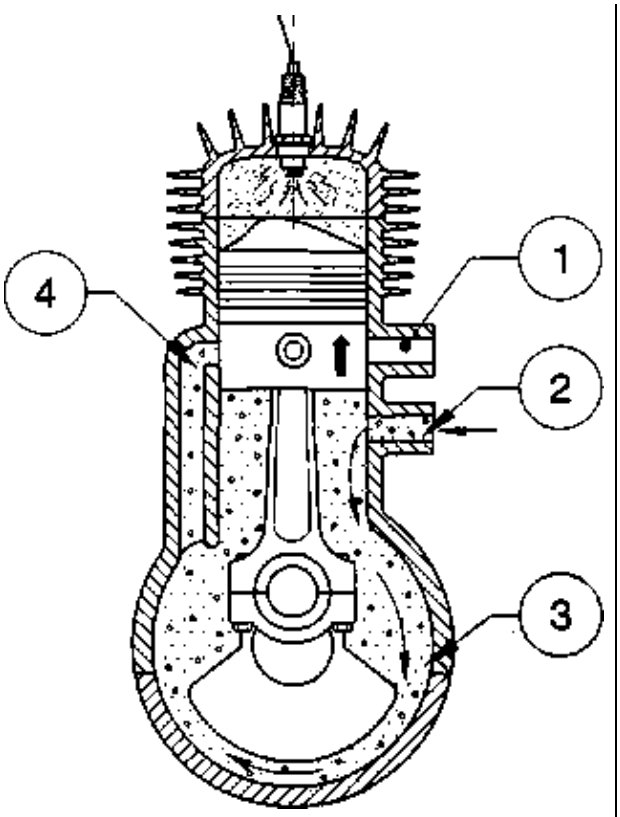
TR 10 01 01 03 95



			
A – Suction Stroke	**B – Compression Stroke**	**C – Power Stroke**	**D – Exhaust St**
Action: Inlet valve **(1)** opens and only air enters inside the cylinder.	**Action**: Inlet valve **(1)** and exhaust valve **(3)** are closed. Air is compressed.	**Action**: Valves **(1)** & **(3)** are closed and Injector **(2)** sprays diesel. Diesel is ignited by hot compressed air. Piston is forced down by burnt gases.	**Action**: Exhaust valve **(** gases are force cylinder.

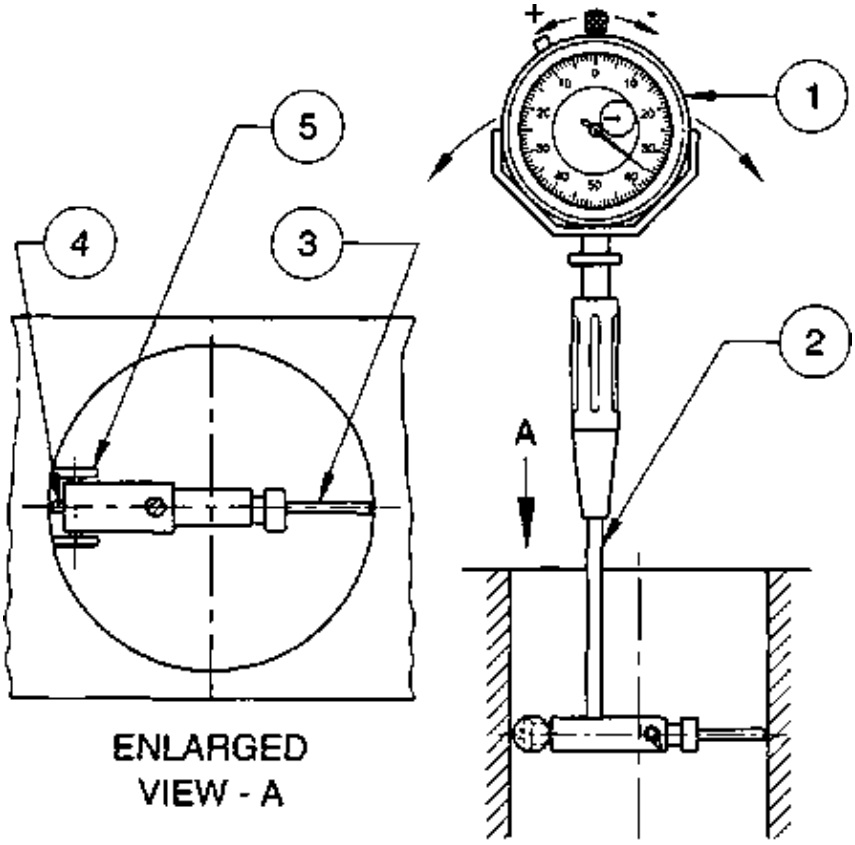
Two stroke cycle operation (Petrol)

TR 10 01 01 04 95

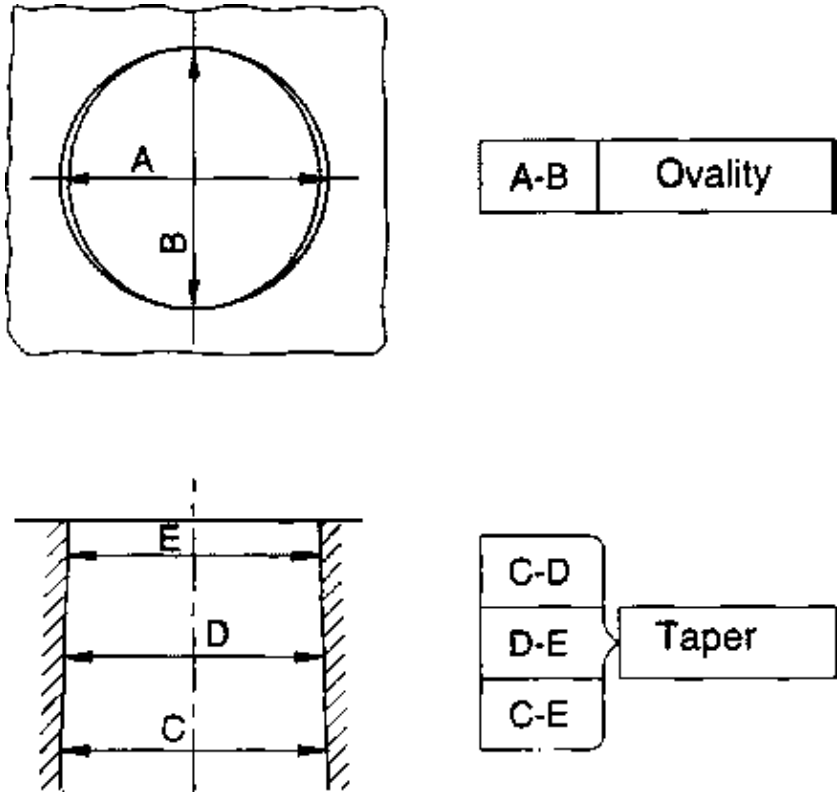
		
A – Begining of Compression Stroke	**B – Suction and Compression Stroke**	**C – Power**
Action: All the ports **1**,**2** & **4** are closed. Air fuel mixture is compressed above the piston.	**Action**: Inlet port **(2)** opens and the charge goes inside crank case **(3)**. Charge above the piston is compressed and ignited.	**Action**: Piston is fo port **(1)** ope the charge

Bore dial gauge–checking ovality and taper

TR 10 01 08 01 95

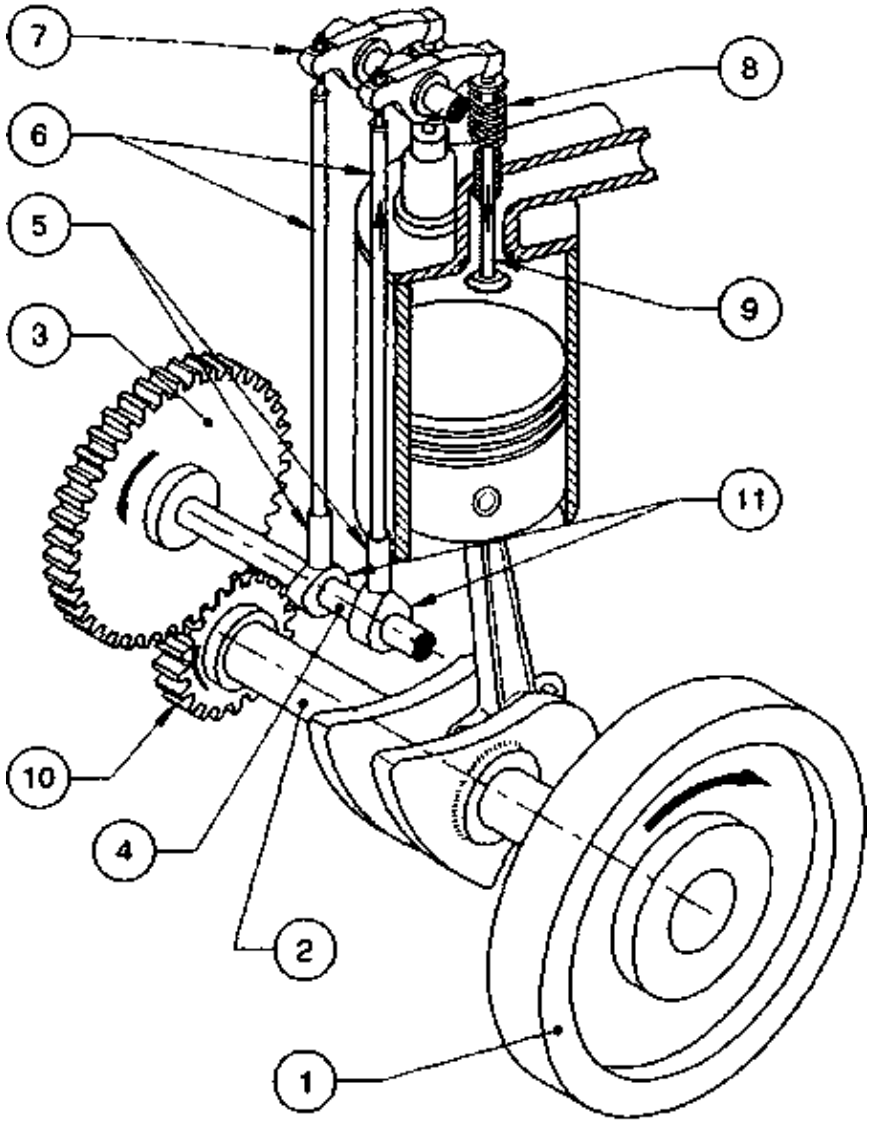


1. Dial
2. Stem
3. Extension Rod
4. Plunger
5. Guide shoe



Overhead valve operating mechanism

TR 10 01 01 05 95



Crankshaft Gear **(10)**	21 teeth
Camshaft Gear **(3)**	42 teeth

The flywheel **(1)** rotates in clock−wise direction.

The crankshaft **(2)** and the gear **(10)** also rotate in clockwise direction.

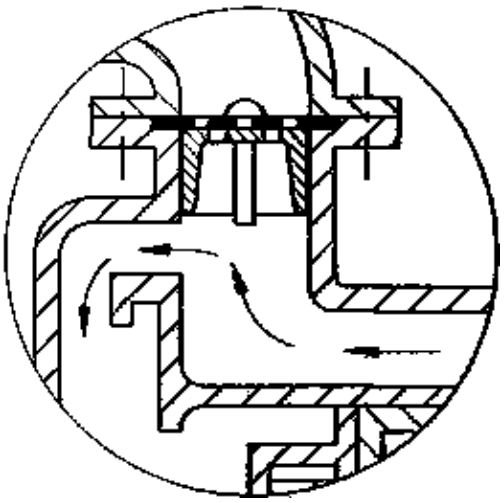
The camshaft gear **(3)** and the camshaft **(4)** rotate in the anti−clockwise direction at half of the crankshaft speed.

The eccentricity of the cam lobe **(11)** pushes the tappet **(5)** and the push rod **(6)** in upward direction. The push rod **(6)** pushes the rocker lever **(7)**.

The rocker lever **(7)** swivels and the valve **(9)** is opened against the pressure of the spring **(8)**.

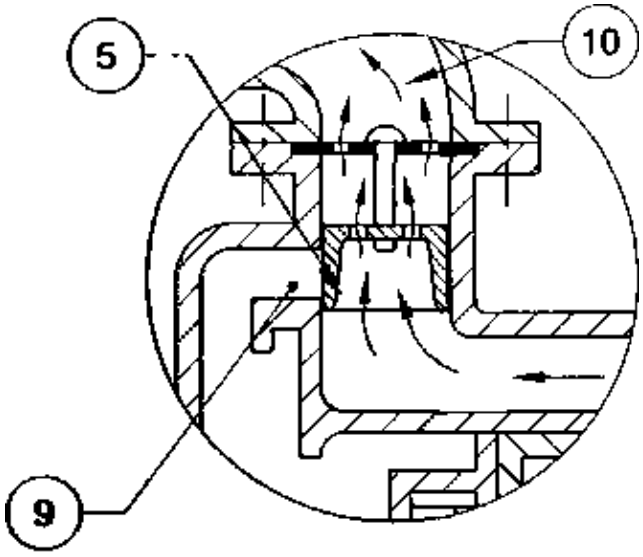
Cooling system

TR 10 01 07 01 95



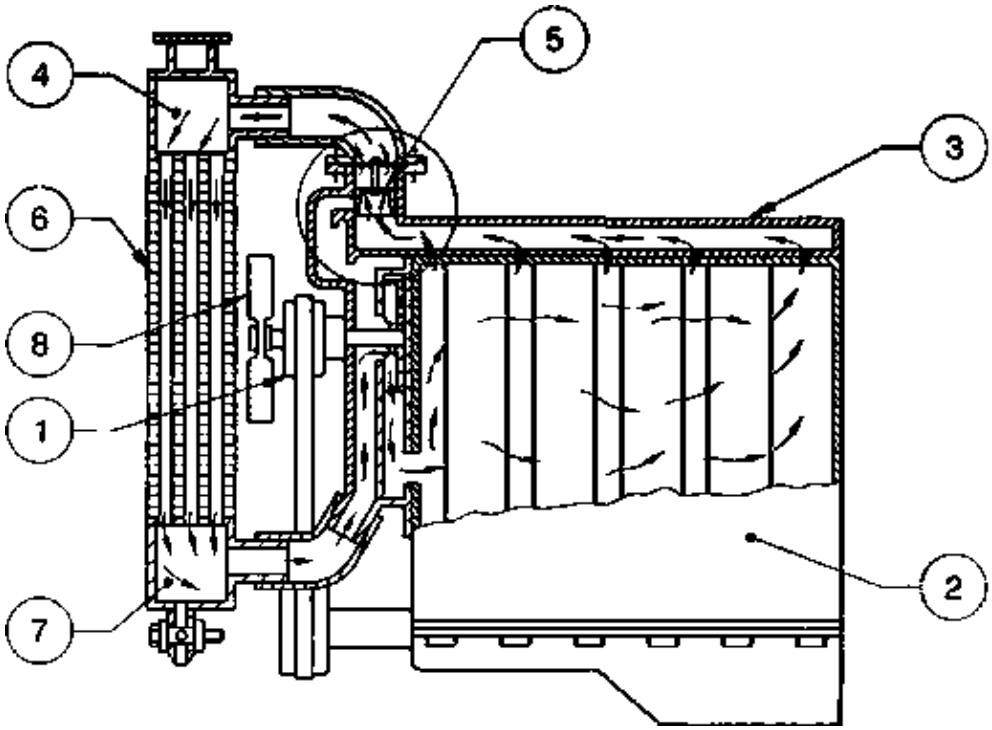
Engine cold

When the thermostat **(5)** is closed the by−pass port **(9)** opens and water circulates in the engine itself and warms up quickly.



Engine hot

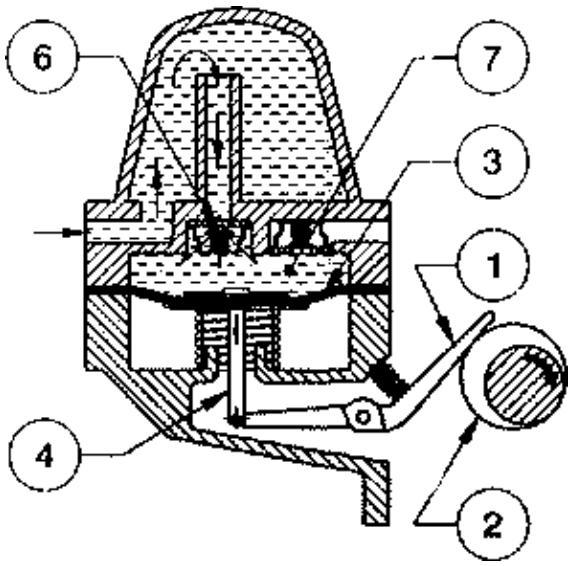
When the thermostat **(5)** is opened, the by−pass port **(9)** closes. Water is circulated to the radiator through outlet **(10)**



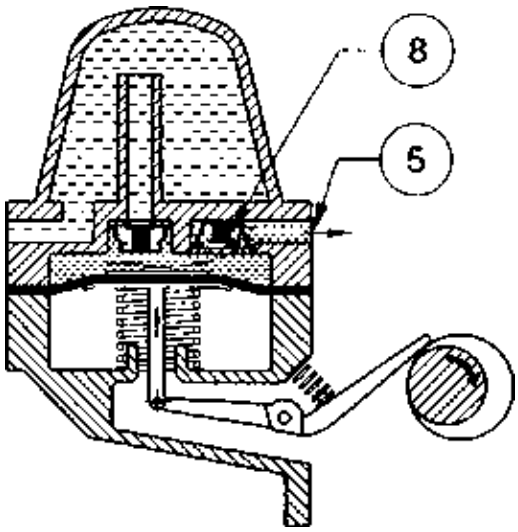
Water flows from pump **(1)** ' Engine block **(2)** ' Cylinder head **(3)** ' radiator uppertank **(4)** through thermostat **(5)** ' Radiator core **(6)** ' Lower tank **(7)** ' and to water pump **(1)**. Air passes through the radiator cores with the help of a fan **(8)**

Fuel pump operation

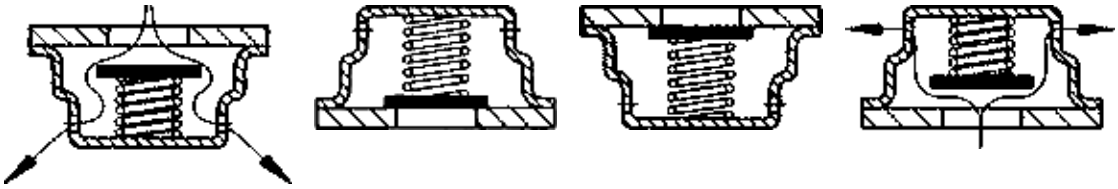
TR 10 01 02 01 95



Suction



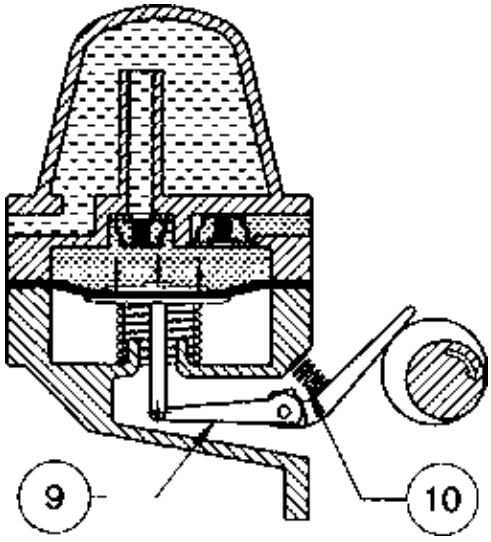
Delivery



DETAILS: 6 8 6 8

When the rocker arm **(1)** is actuated by a cam lobe **(2)**, diaphragm **(3)** is pulled down. The inlet valve **(6)** opens and the fuel is sucked in chamber **(7).**

When the diaphragm is pushed up by the spindle **(4)**, the outlet valve **(8)** opens and the fuel is sent to carburetor via outlet **(5).**

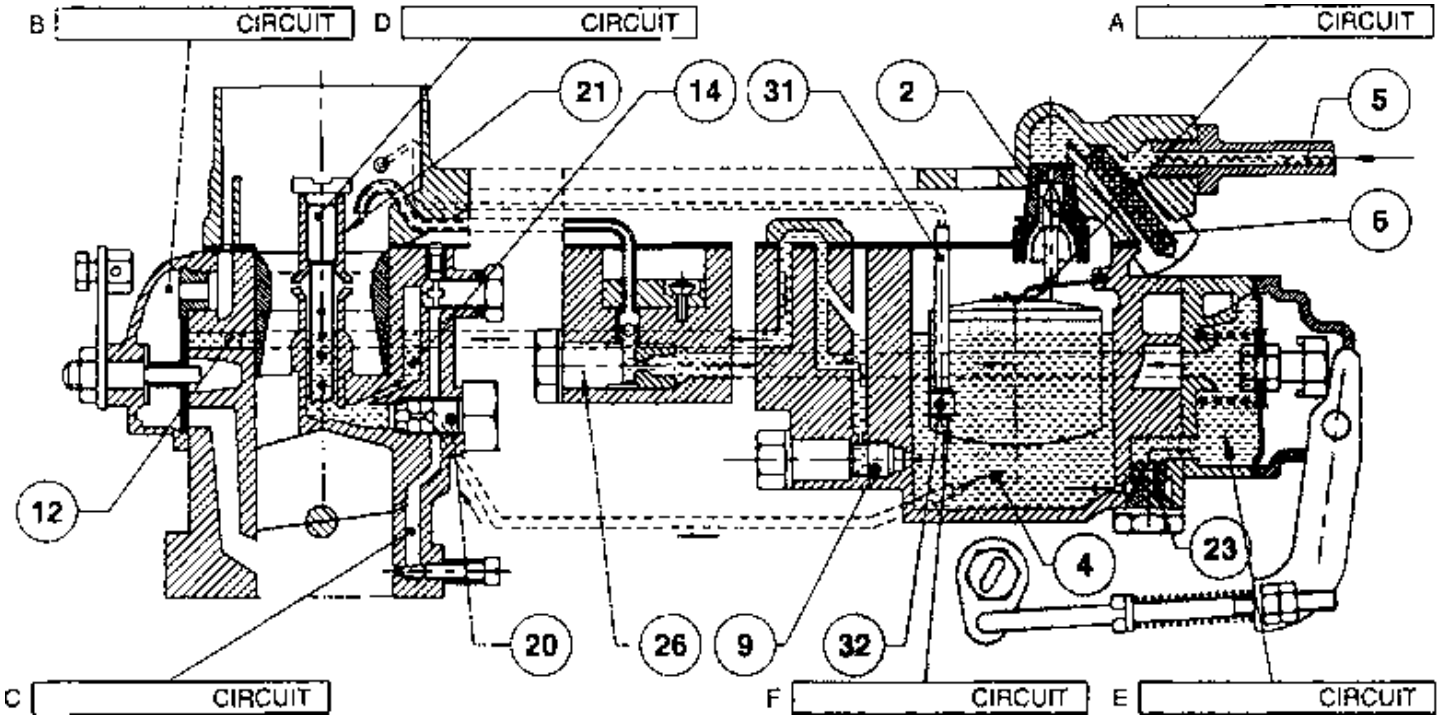


Idling

When the float chamber is full, back pressure keeps the diaphragm **(3)** down and the connecting link **(9)** does not move, only the rocker arm **(1)** moves. The spring **(10)** reduces the rattling noise.

Carburettor Function

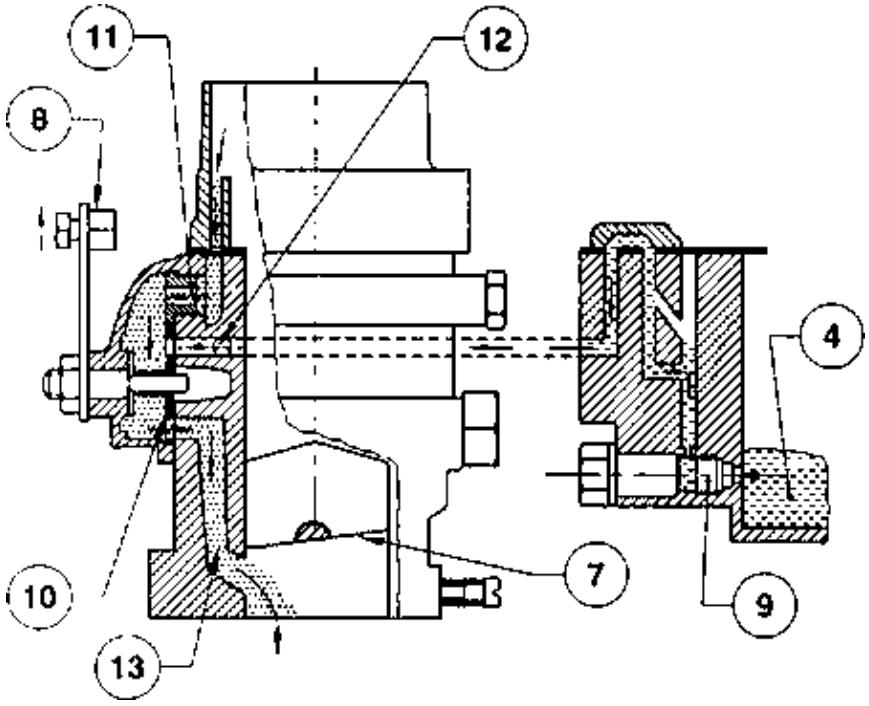
TR 10 01 02 02 95



A	**Float circuit:**	When the needle valve **(2)** opens, fuel flows to the float chamber **(4)** through the inlet **(5)** and filter **(6)**.
B	**Starting circuit:**	Petrol is drawn from the float chamber **(4)** through the starter jet **(9)** to the passage **(12)**.
C	**Idling circuit:**	Petrol is drawn to the well **(14)** from the float chamber **(4)** through the main jet **(20)**
D	**Main circuit:**	Petrol is drawn from the float chamber **(4)** to the emulsion tube **(21)** through the main jet **(20)**
E	**Pump circuit:**	Petrol is drawn from the float chamber **(4)** to the pump chamber through the pump inlet valve **(23)** and to the pump jet **(26)**
F	**Econostat circuit**:	Petrol is drawn from the float chamber **(4)** to the econostat tube **(31)** through the jet **(32)**

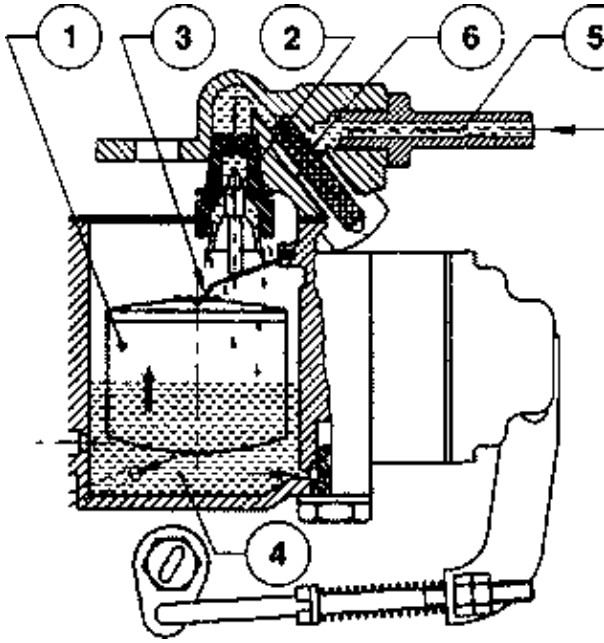
Float and starting circuit

TR 10 01 02 03 95



B Starting circuit

When the dash board knob is pulled out, the starter valve lever **(8)** rotates the starter disc valve **(10)** and opens the fuel passage **(12)**. Petrol is drawn from the float chamber **(4)** through the starter jet **(9)** to the fuel passage **(12)**. Air is drawn from the air jet **(11)**. Air fuel mixture passes through the passage **(13)** below the throttle **(7).**

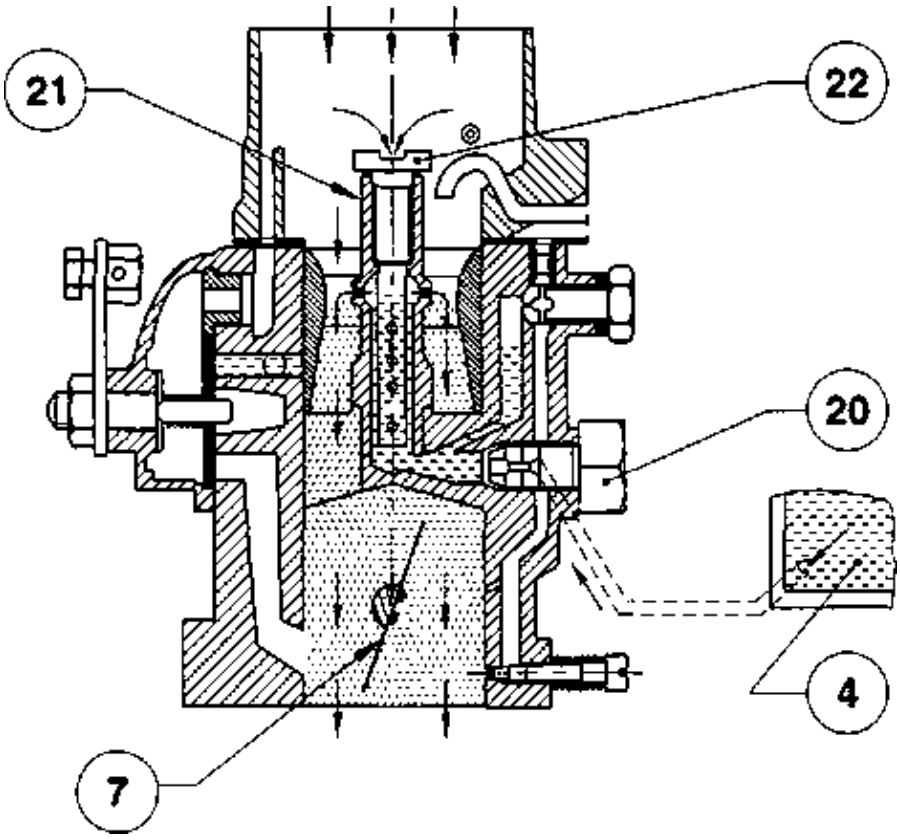


A Float circuit

When the fuel flows to various circuits, fuel level in the float chamber **(4)** drops. The float **(1)** move dow and the needle valve **(2)** opens. Fuel flows through the inlet **(5)** and the filter **(6)** to the float chamber **(4** When the fuel level rises in the float chamber **(4)** th float **(1)** moves up and closes the needle valve **(2)** by the toggle **(3)**.

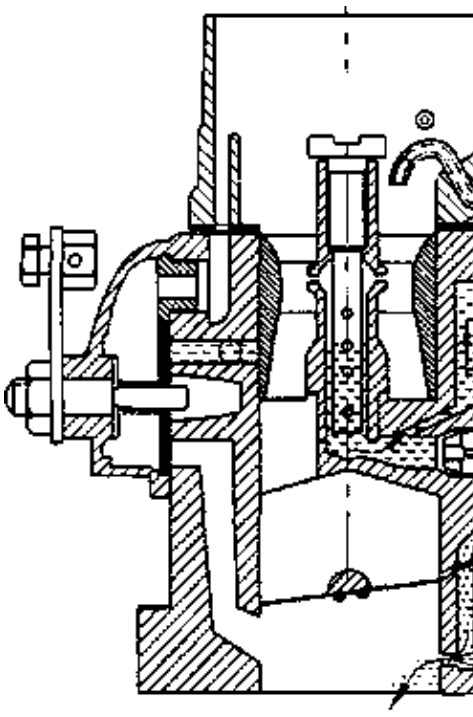
Idling and main circuit

TR 10 01 02 04 95



D Main circuit

On further wide opening of the throttle valve **(7)**, air velocity increases across the narrow passage and creates more vacuum. Petrol is drawn from the float chamber **(4)** through the main jet **(20)** to the emulsion tube **(21)**. Vacuum draws petrol through the emulsion tube orifices and air through choke tube and the air correction jet **(22).**

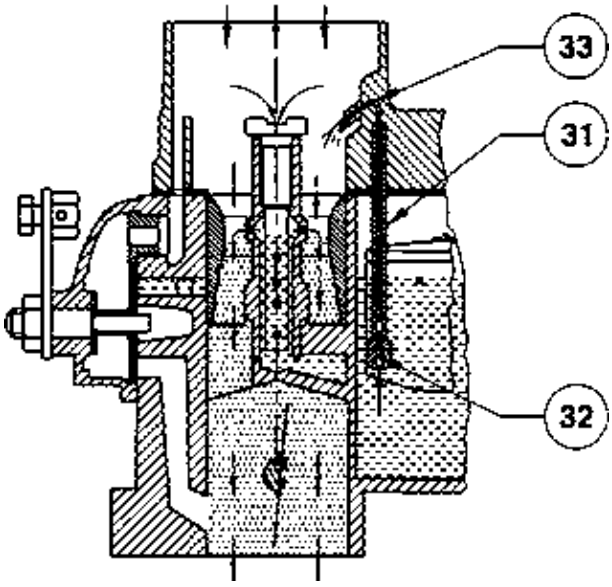


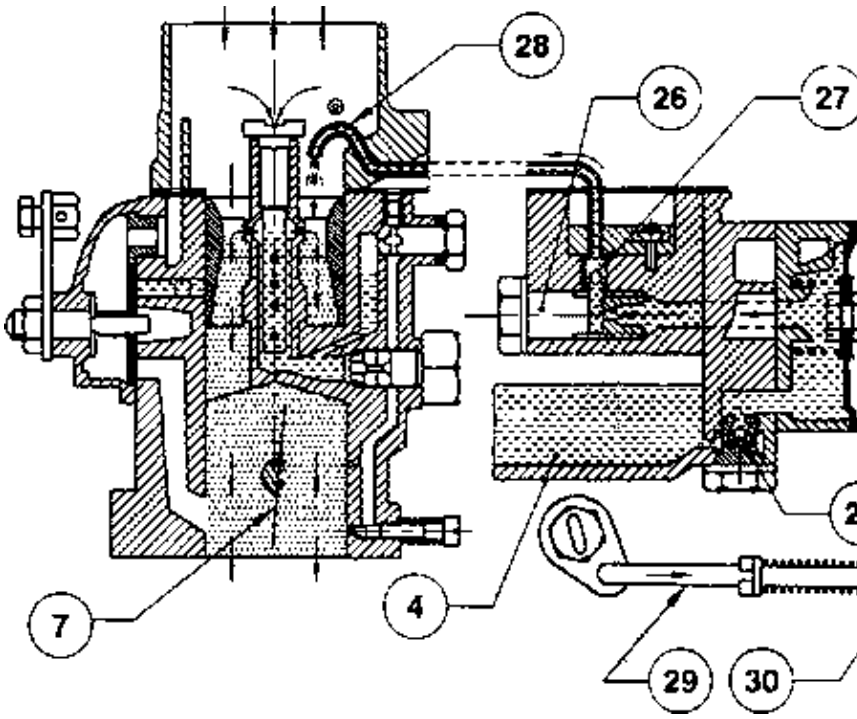
C Idling cir

When the throttle valve **(7)** is closed, the petrol to flow from the well **(14)** to the pi air bleeder **(16)**. Both air and fuel mixtur to run the engine at idling speed. Volum the screw **(19)**. When the throttle **(7)** is c orifice **(18)** discharges extra mixture req

Pump and Econostat circuit

TR 10 01 02 05 95





F Econostat circuit

Under full load and full throttle opening at cruising speed, petrol is sucked from the float chamber **(4)** to the econostat tube **(31)** through the jet **(32)** and injected by an injector **(33)** which provides maximum fuel economy.

E Pump circuit

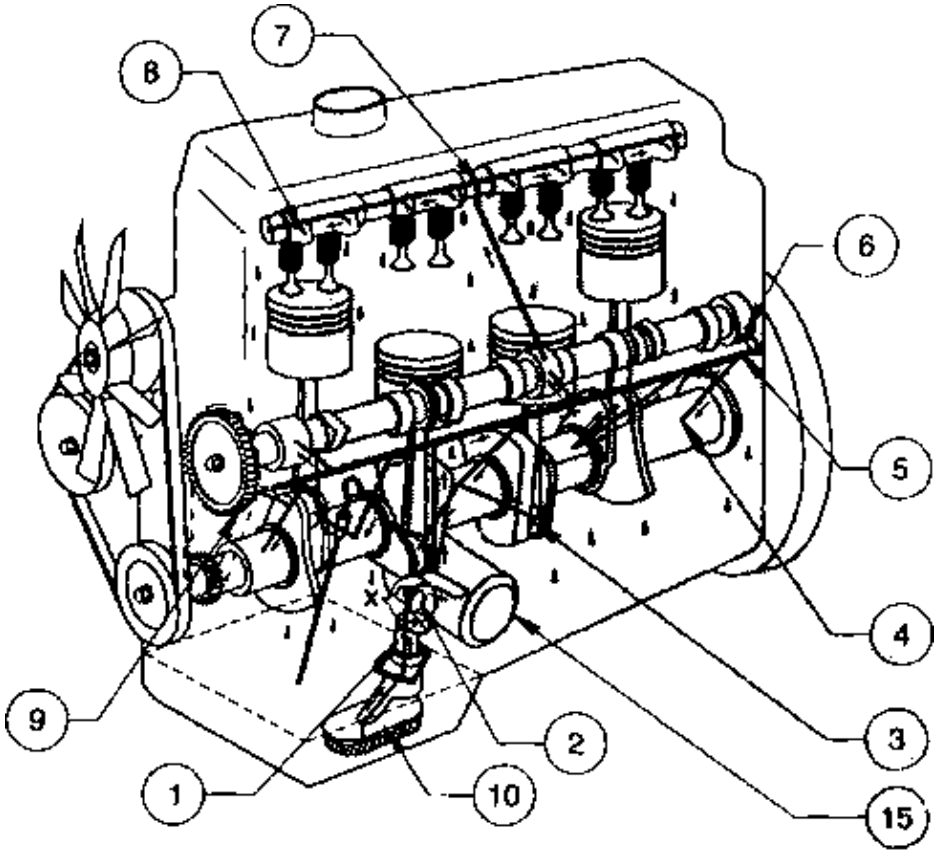
When the throttle **(7)** is closed, the diaphragm **(25)** is pushed back. Petro from the float chamber **(4)** to the pump chamber through the non return i valve **(23)**.
Due to sudden wide opening of the throttle **(7)**, the lever **(24)** pushes the **(25)** forward. Petrol passes through the pump jet **(26)** and opens the non outlet ball valve **(27)**. The petrol is injected to the choke tube by the injec **(28)**. This action supplies extra amount of fuel required for avoiding flat s spring loaded rod **(29)** is adjusted by a nut **(30)** for effective travel of the

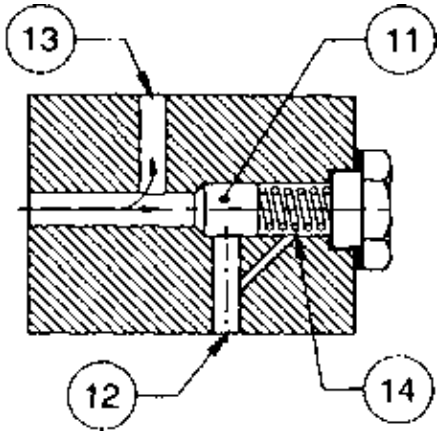
Lubrication system (Engine oil circulation)

TR 10 01 06 01 95

Oil circulation

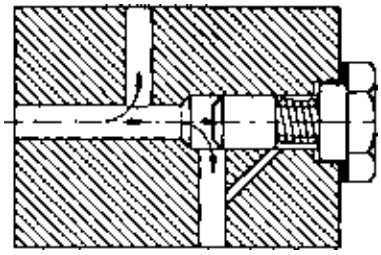
Oil flows from stainer **(10)** ' Oil pump **(1)** ' Filter **(15)** ' Oil gallery **(5)** ' Main bearings **(4)** ' Connecting rod bearings **(3)** ' and finally to sump.
From main gallery **(5)** to ' Camshaft bearings **(6)** ' rocker shaft **(7)** ' rocker arms **(8)** ' and to sump.
From main gallery to timing gear/chain **(9)** ' and to sump.
Excess pressure from pump **(1)** is relieved by the oil pressure relief valve **(2)**





Detail X–A: oil under normal pressure

Relief valve plunger **(11)** closes the by–pass port **(12)** and oil passes through outlet port **(13)** and to the oil filter **(15)**

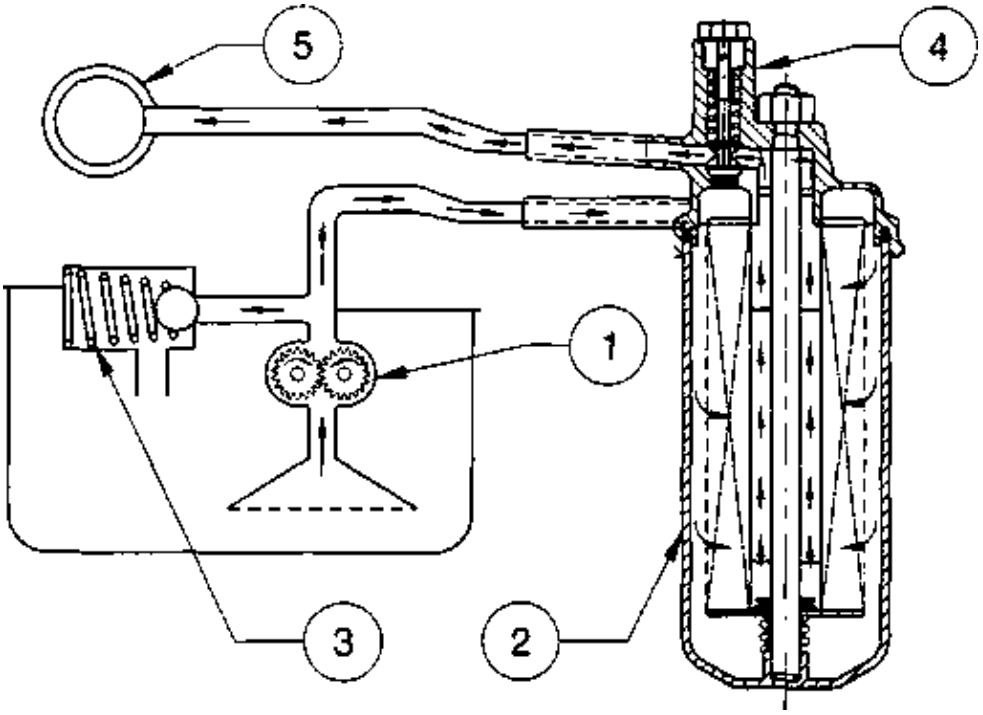


Detail X–B – Oil pressure more than specified limit

The relief valve plunger **(11)** moves against the spring pressure **(14)** and opens the by–pass port **(12)**. Excess of pressurised oil escapes through by–pass port **(12)** and to the oil sump.

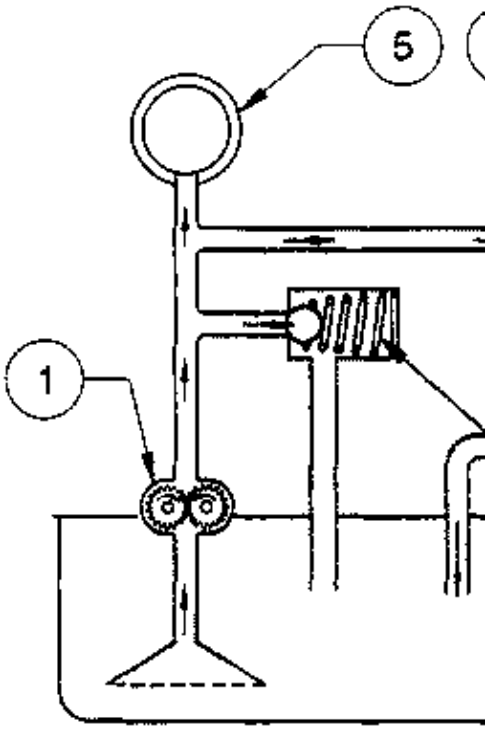
Lubrication system (full flow and by pass flow oil filter)

TR 10 01 06 02 95



Type – Full flow oil filter

Function: From the oil pump **(1)** all the oil passes through the filter **(2)** to the main oil gallery **(5)**. By pass valve **(4)** provided in the filter allows oil to reach main oil gallery directly when the filter is chocked. Excess oil pressure is relieved by oil pressure relief valve **(3).**

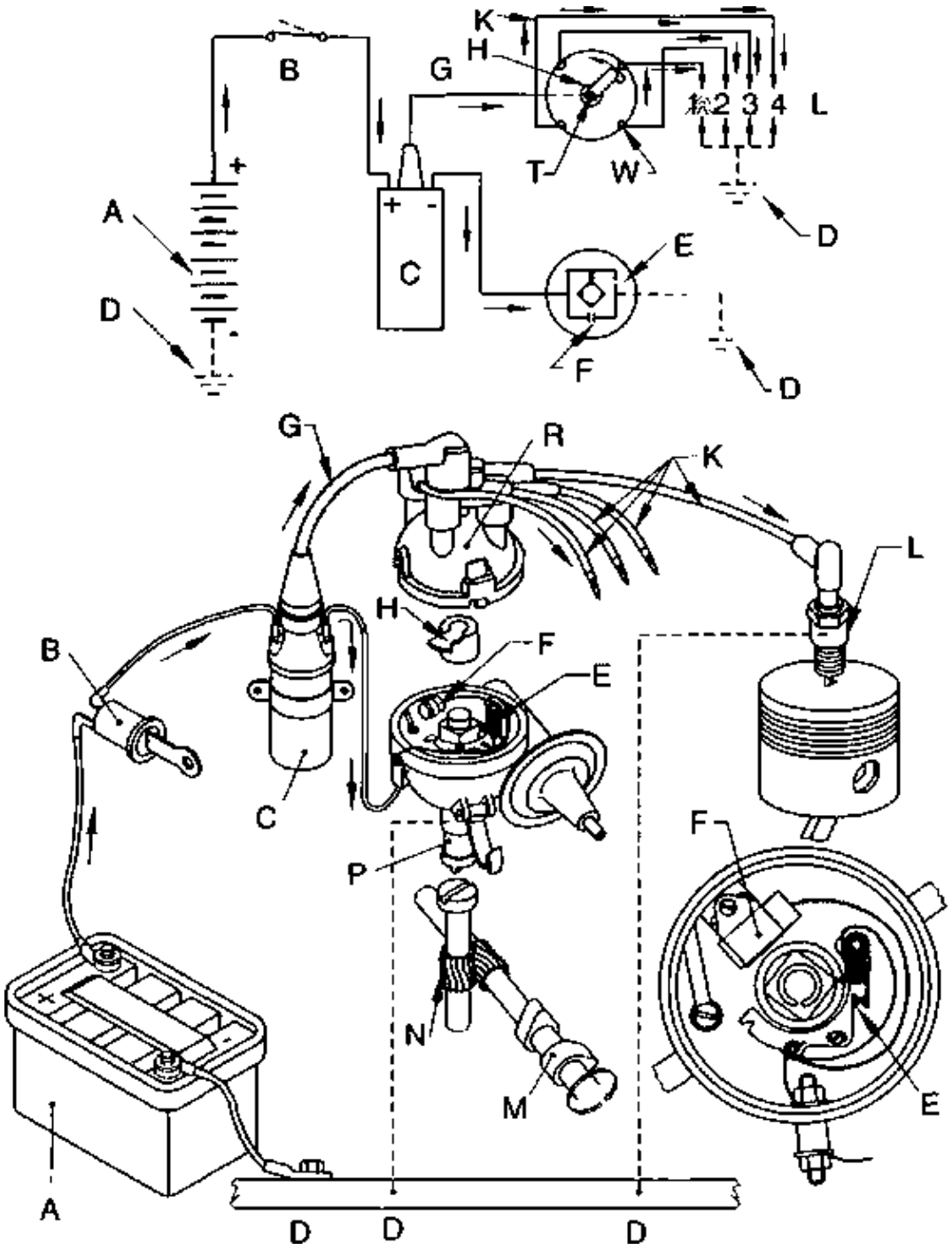


Type – By pass flow oil filter

Function: From the oil pump **(1)** only par goes to the oil sump **(6)**. The remaining o gallery **(5)**. Excess oil pressure is relieved

Ignition system

TR 10 10 04 01 95



FIRING ORDER: 1–3–4–2

Function: Current flows from battery **(A)** ' Ignition switch **(B)** ' the primary windings of the Ignition coil **(C)** ' CB points **(E)** ' earth **(D)**. Condenser **(F)** is fitted parallel to CB points **(E)**. High tension current from coil **(C)** ' High tension wire **(G)** ' Carbon rod **(T)** at the centre of the distributtor cap **(R)** ' rotor **(H)** ' distributor cap segments **(W)** ' HT wires **(K)** ' spark plug **(L)**. The battery **(A)** the distributor **(P)** and the spark plug **(L)** are earthed at points **(D)** on the vehicle frame. Distributor **(P)** gets drive from the engine camshaft **(M)** through the screw gear **(N)** and rotates at half of the engine speed.