Fig 2

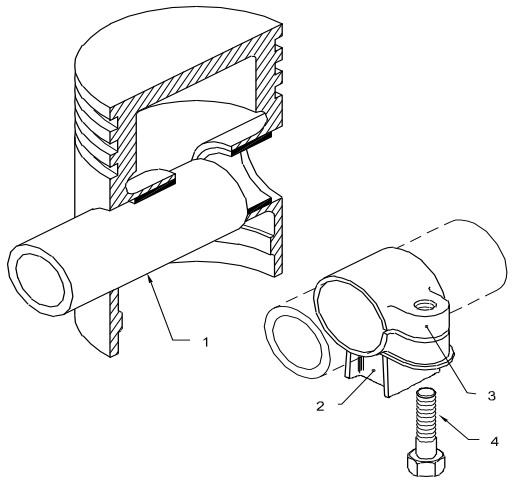
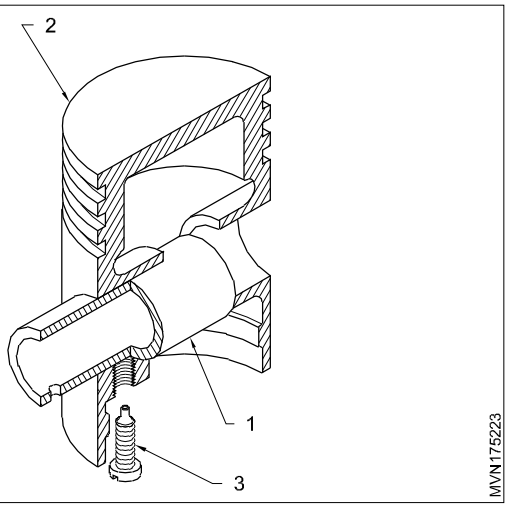


Fig 3



Description and function of crankshaft

Objectives: At the end of this lesson you shall be able to

- **state the function of the crankshaft**
- **state the constructional features of crankshaft**
- **state the material of crankshaft**
- **state the necessity for heat treatment, and the balancing of the crankshaft**
- **state the constructional features of bearing shells**
- **list out material of the bearing shells.**

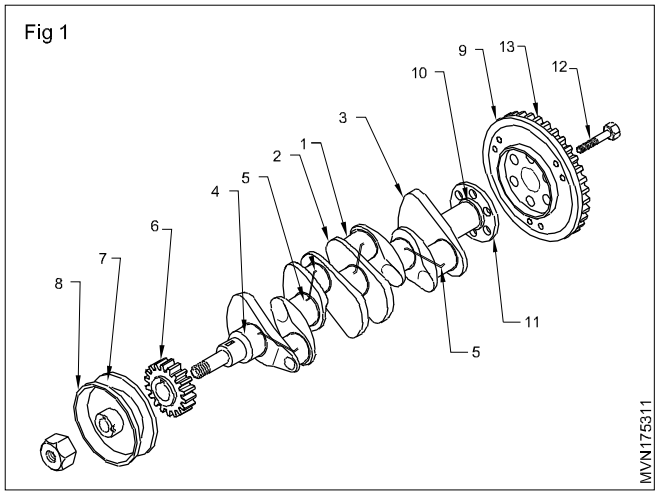
Function of the crankshaft

The crankshaft converts the reciprocating motion of the piston into rotary motion, and transmits the torque to the flywheel.

Construction

A crankshaft consists of a crank pin (1) (Fig 1), webs or crank arm (2) and balancing weights (3) which are provided on the opposite side of the crank arms for balancing the main journals (4). Crankshaft have drilled oil passages (5) through which oil flows from the main bearings to the connecting rod bearings.

Fig 1



The front end of the crankshaft carries the gear or sprocket (6) to drive the cam shaft. A vibration damper (7) and a fan belt pulley (8) are fitted in front. The pulley (8) drives the water pump, engine fan and generator/alternator, through a fan belt.

At the rear end of the crankshaft, a flywheel (9) is fitted. The inertia of the flywheel (9) tends to keep the crankshaft to rotate at a constant speed. Next to the rear end main journal an oil seal (10) is fitted. In some engines, oil return threads are provided which return the lubricating oil to the sump.

Materials

A crankshaft has to withstand the centrifugal force, the impact force by the piston and the connecting rod. It should be light in weight. It is made of the following material.

- Nickel steel
- Chrome, vanadium steel
- Nickel chrome steel
- Nickel chrome molybdenum steel

Heat treatment of the crankshaft

A crankshaft is made of forged and heat-treated alloy steel. It is machined and ground to provide suitable journals for the connecting rods and main bearings. The following methods are used to harden the crankshaft journals.

- Nitriding
- Carburising
- Chrome plating

In the above process the case of the crankshaft journal is hardened. These process give very little depth of hardness. Some manufacturers recommend hardening of the crankshaft journals after regrinding.

Induction hardening

Induction hardening gives more depth of hardness, and, therefore, the crankshaft need not be hardened again and again.

Crankshaft bearings

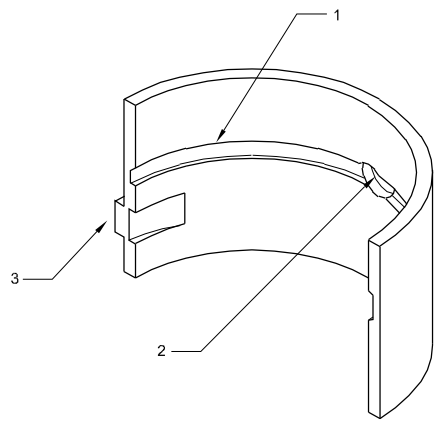
These bearings are made into two halves. These bearings operate at critical loads and high rotational speeds. These bearings run quieter and are easy to replace.

These bearings are also called thin wall bearings. These are made of a thin steel shell base with a thin lining on it.

The lining materials are copper-lead or lead-bronze or tin-lead or soft aluminium alloy. Cadmium alloy with copper or cadmium alloy with silver withstands high pressure. Iridium with copper and lead has excellent wear and corrosion resistance. The lining is plated to a thickness of about five thousandth of an inch.

Half shells are provided with an oil groove (1) (Fig 2, 3 & 4) and oil feed holes (2). The bearing shell also has a locking lip (3) on it to fix it on the lip slot (4) of the bore and cap. In some cases dowel pins (5) are provided in the parent bore which aligns with the hole on the bearing shell and avoids rotation of the shell.

Fig 2



Thrust bearings

This type of bearing (Fig 5) takes care of thrust loads. The bearing shells on the crankshaft, which has thrust faces (1) on it, takes the end thrust of the crankshaft when it is in operation. The thrust faces have oil notches (2) to hold lubricating oil. In some cases separate thrust washers made up of bearing material are also used to take the end thrust.

Fig 3

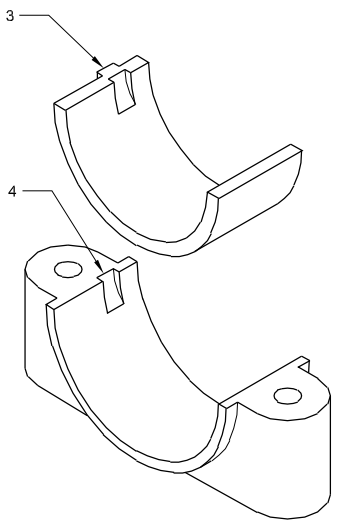


Fig 4

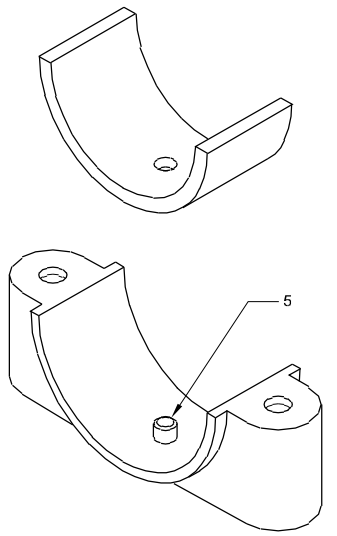
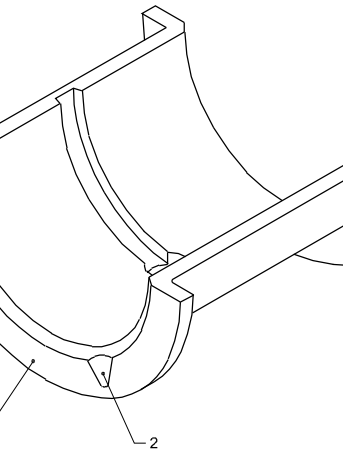


Fig 5



Bearings

Objectives: At the end of this lesson you shall be able to
- **understand the need of bearings**
- **list out the different types of bearings used in vehicle**
- **list out the uses of the different types of bearings**
- **explain the function and application of different types of bearings.**

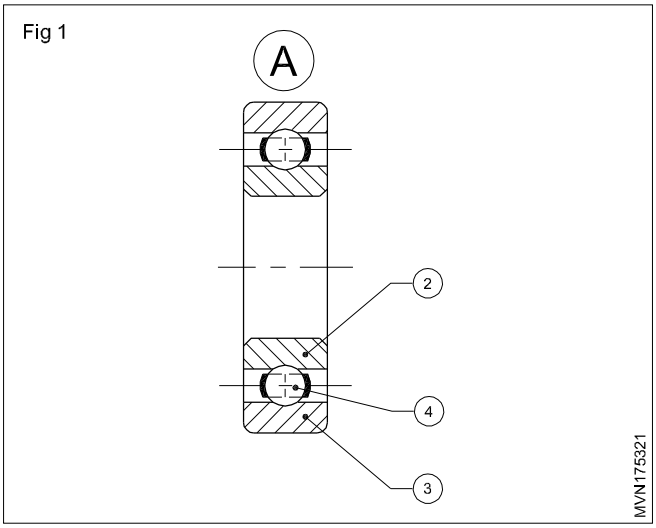
Bearings are used to support the rotating components and to reduce friction between the static and rolling components.

The following types of bearings are used in automobiles.
- Shell bearing
- Bush bearing
- Ball bearing
- Roller bearing
- Needle roller bearing
- Taper roller bearing

Bush bearings are made of copper-lead, tin-aluminium, tin-copper and used in the small end of the connecting rod, camshaft, oil pump drive shaft etc.

Ball bearings (A) (Fig 1) reduce friction between rotating parts to a minimum, and can take radial as well as axial load.

Fig 1



Ball bearings consist of an inner race (2), outer race (3) and balls (4). These bearings are used in the gearbox.

Roller bearings (B) also consist of an inner race (5), outer race (6) and rollers (7). (Fig 2) These bearings can take heavy radial load but no axial load and are used in the final drive, flywheel, water pump etc.

Needle roller bearings (C) (Fig 3) are similar to roller bearings except that the ratio between the length of the needle roller (8) and the diameter of the roller is much more than that of a roller bearing.

Taper roller bearings (D) (Fig 4) have taper rollers (9) instead of plain rollers. In automobiles, these bearings are generally used in pairs and these can take axial and radial loads. These bearings are used in the differential assembly, wheel hubs etc.

Fig 2

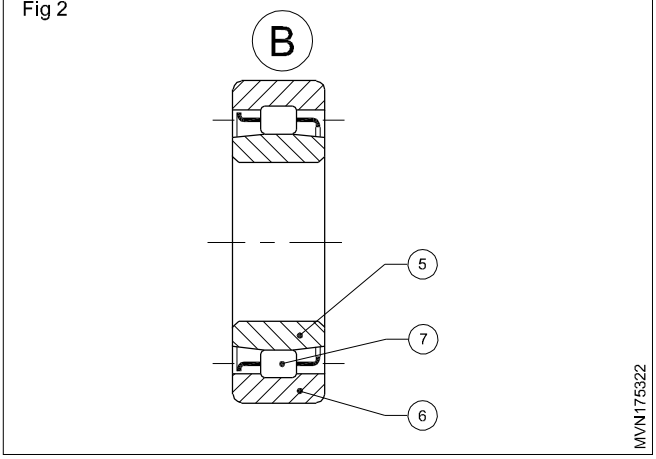


Fig 3

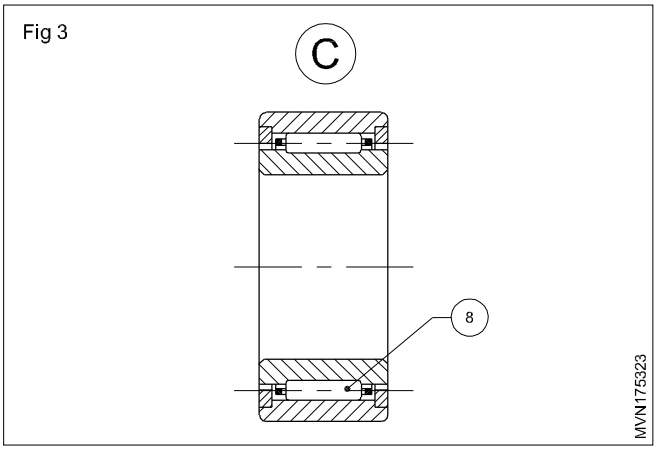
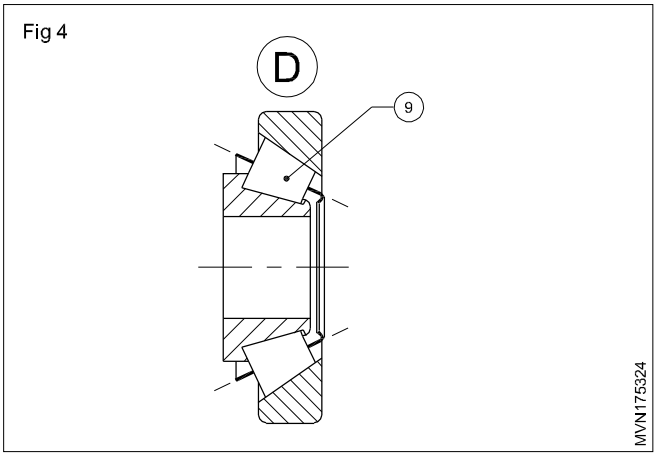


Fig 4



Details of engine bearings

Engine bearings

These are also called "Shell bearings or sliding function bearings or precision insert bearings. These are largely used for free rotation of crankshaft, connecting rods and camshaft. They provide low frictional areas for these shafts to rotate smoothly under different speeds and loads.