Gear Box

Main points

- Define Gearbox
- Why is manual gearbox ?
- obtaining Speeds in gearbox
- synchronized gear box

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Define Gearbox

A gearbox is a collection of mechanical components that deliver maximum power from an engine by managing a series of gear ratios that in turn operate a transmission. These components include: a gear selector, fork, collar, dog teeth and a gear set.

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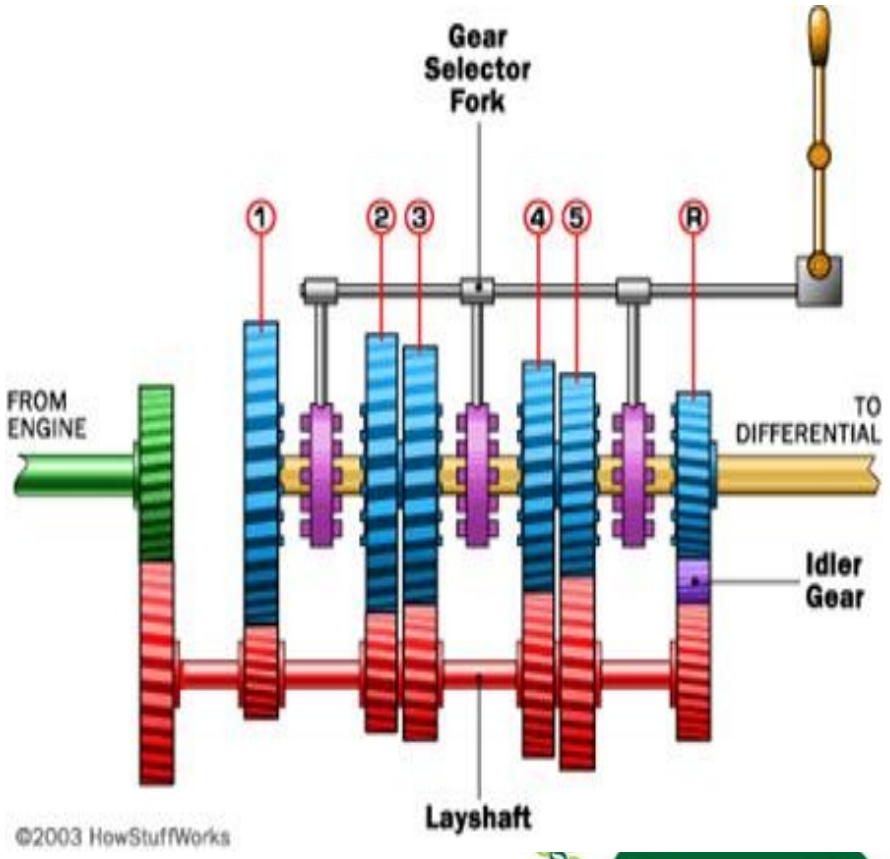
Why is manual gearbox ?

- Manual transmission gearboxes are the simplest types of gearboxes and involve the manual movement of a sliding gear along the gearbox's main shaft using a shifter.



Why is manual gearbox ?

- Although The manual gearbox is rare in modern cars, but is considered superior in sports cars. The ability to select any desired gear at will gives the driver a greater degree of control over the car's behavior than with most other types of gearboxes.
- Manual gearboxes are also the least expensive to purchase and so are considered favorable in economy cars.

Purpose

- Transmissions use different gear ratios to multiply engine torque, helping the car to accelerate quicker at low speeds. Torque multiplication is directly related to the number of teeth on the input gear vs the output gear.
- the gearbox allows the engine to use less fuel while providing more power

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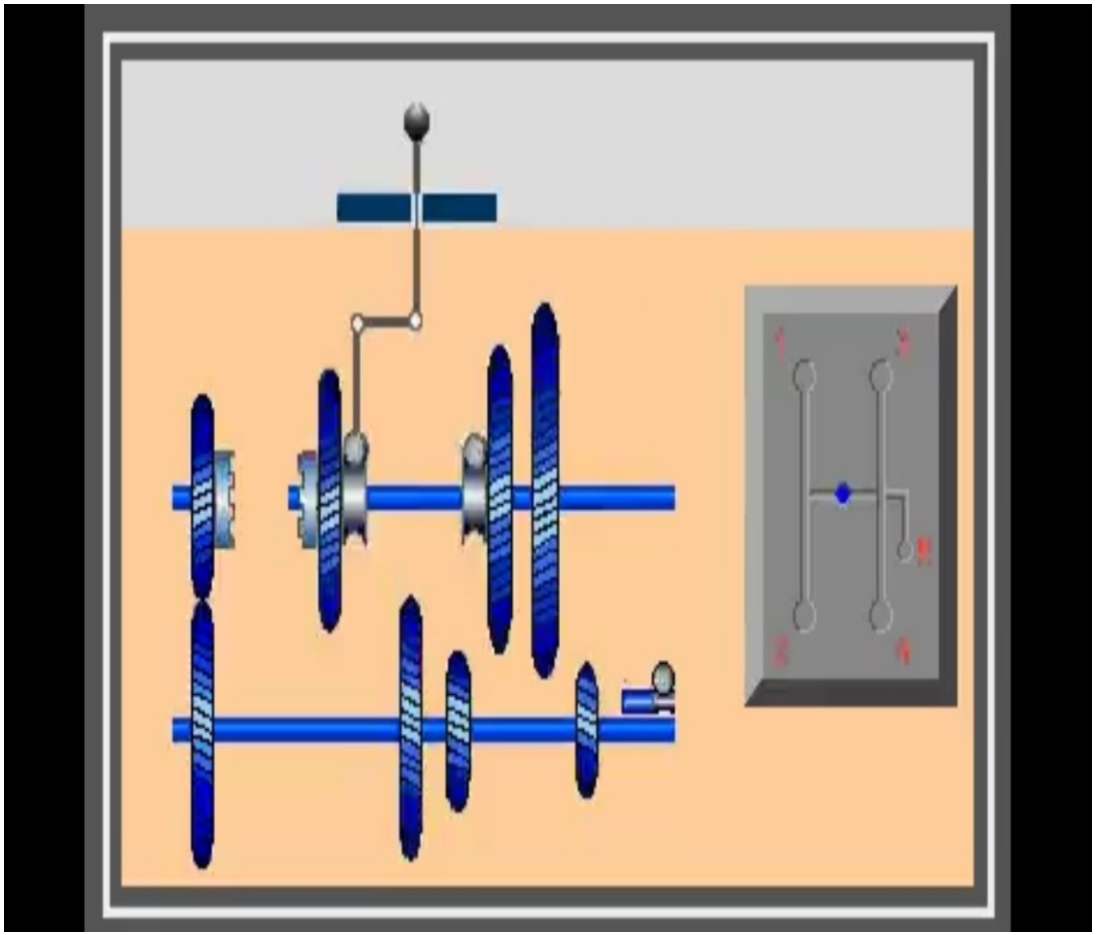
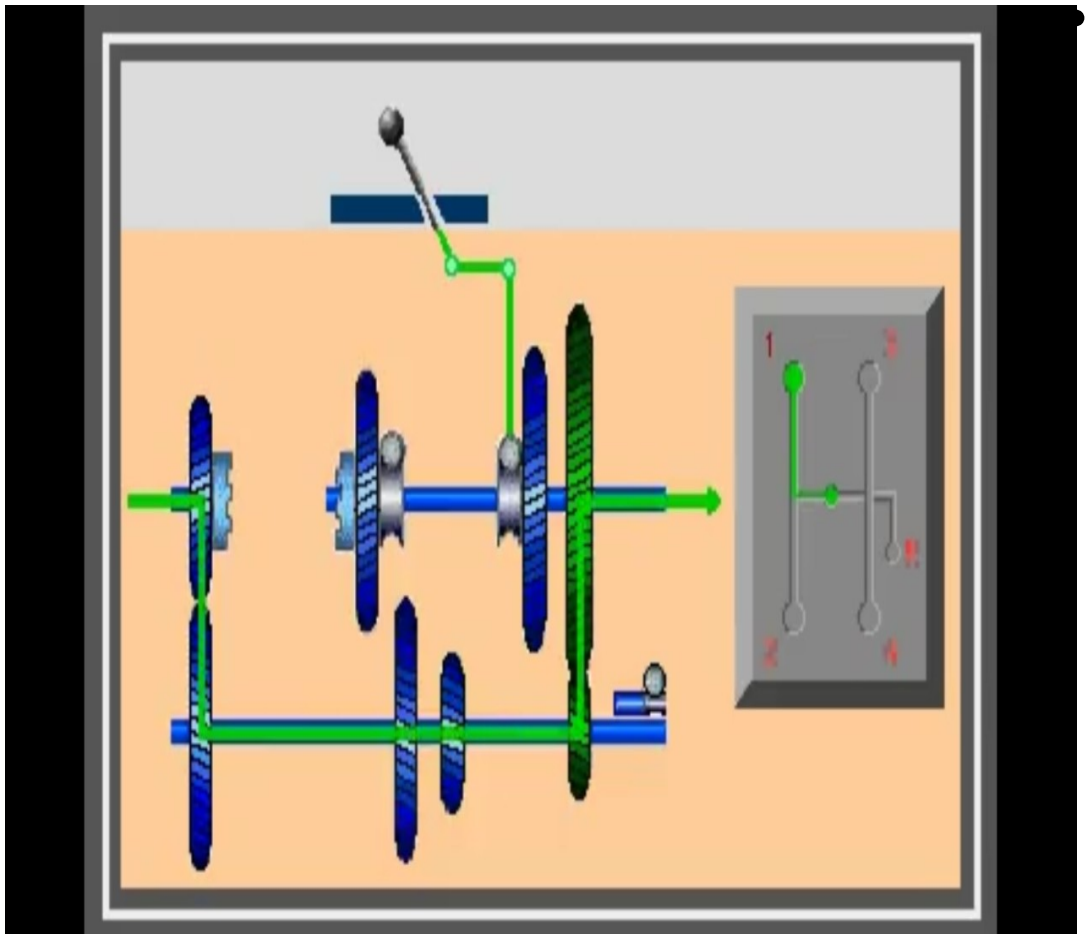
Neutral Position



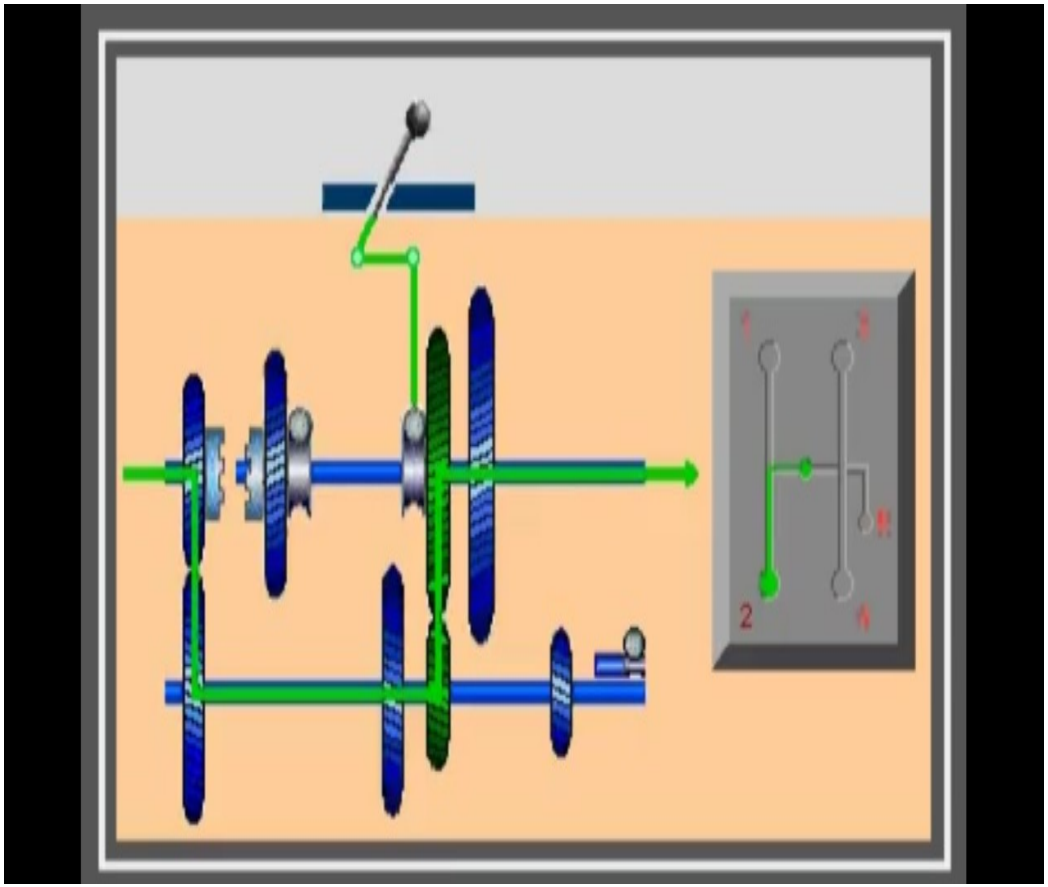
- In this case the movable gear stick position isn't Dovetailed with the layshaft and the output torque from the gearbox is zero.

First speed



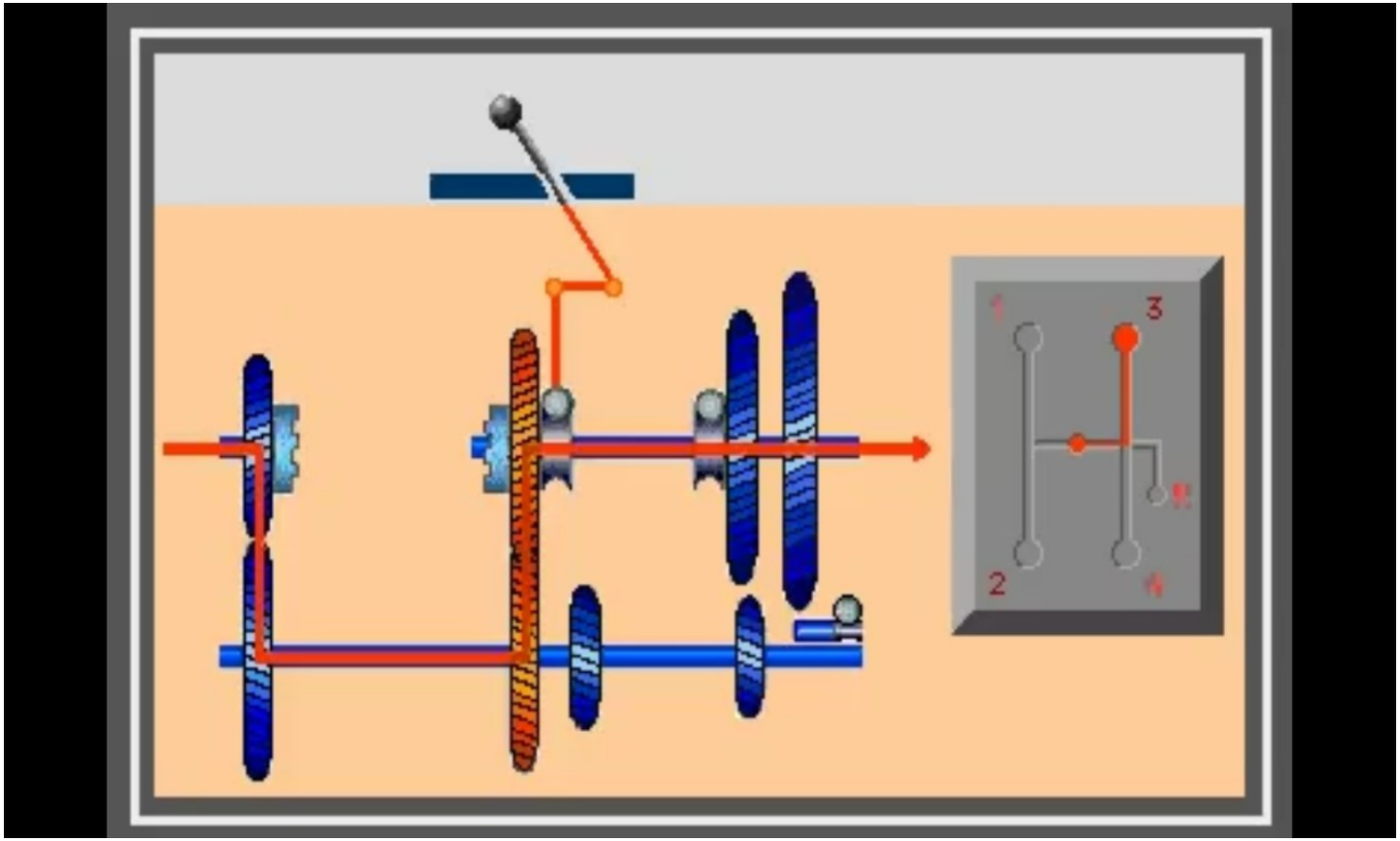
In this case the movable gear stick position at which the main shaft where the first gear(the biggest diameter) it is dovetailed with the smallest one the lay shaft and this is to get the biggest gear ratio and maximize the output torque resulting in minimize the output speed.

Second speed

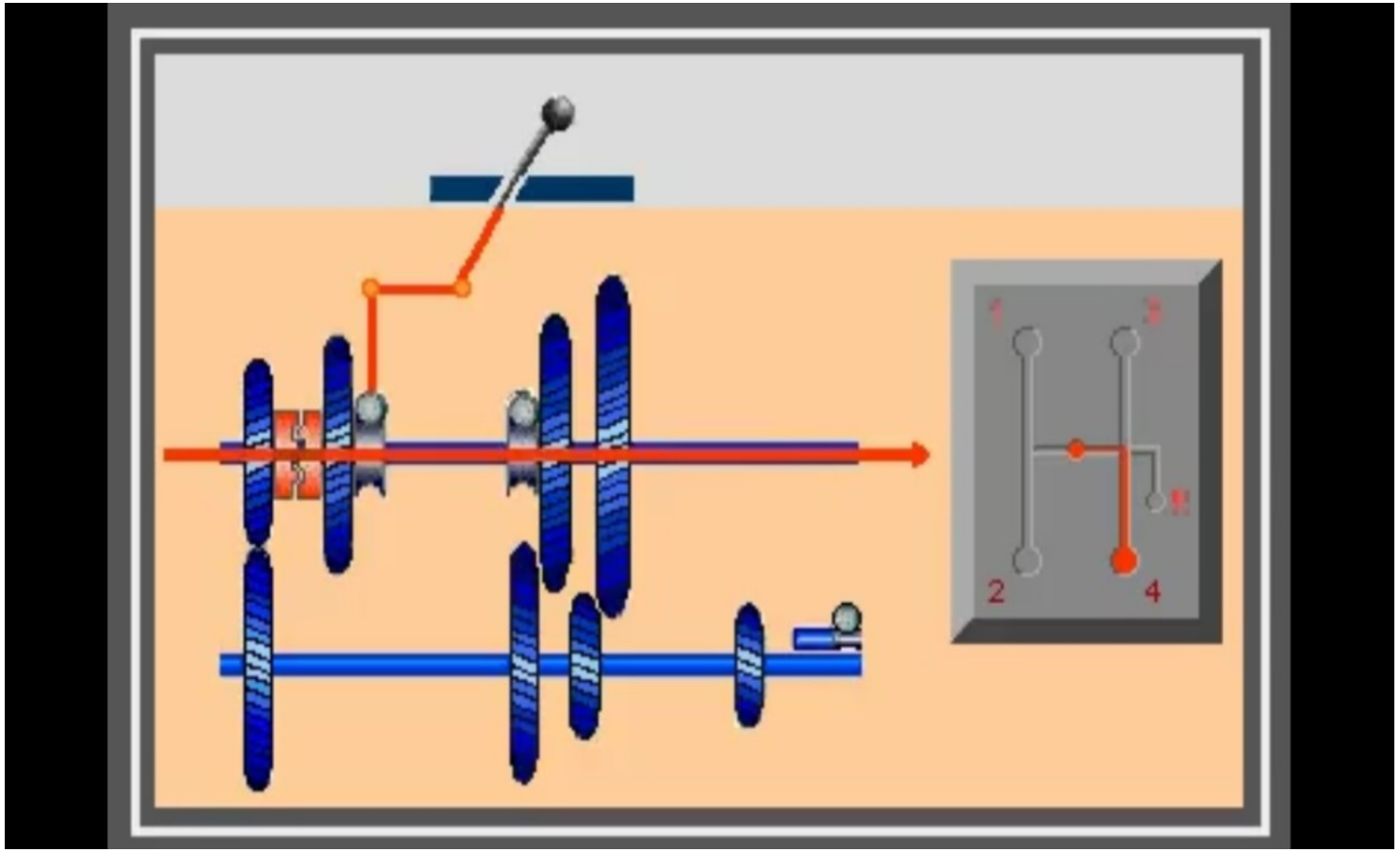


- In this case the second gear (smaller than the first one) is dovetailed with a gear on the lay shaft (biger than which used in the first speed) to obtain a gear ratio less than the first one which mean less torque and higher speed

Third speed:-

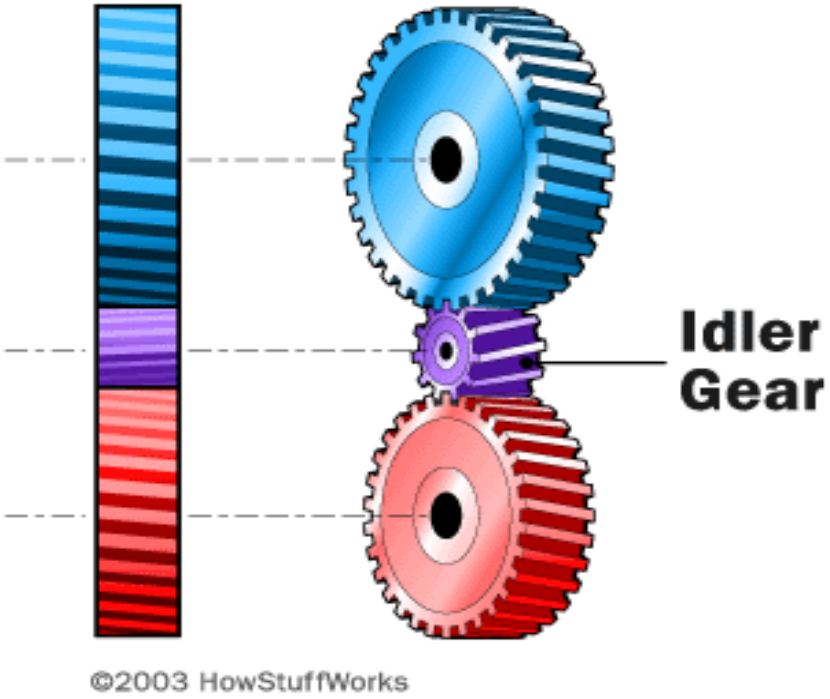


Forth speed:-

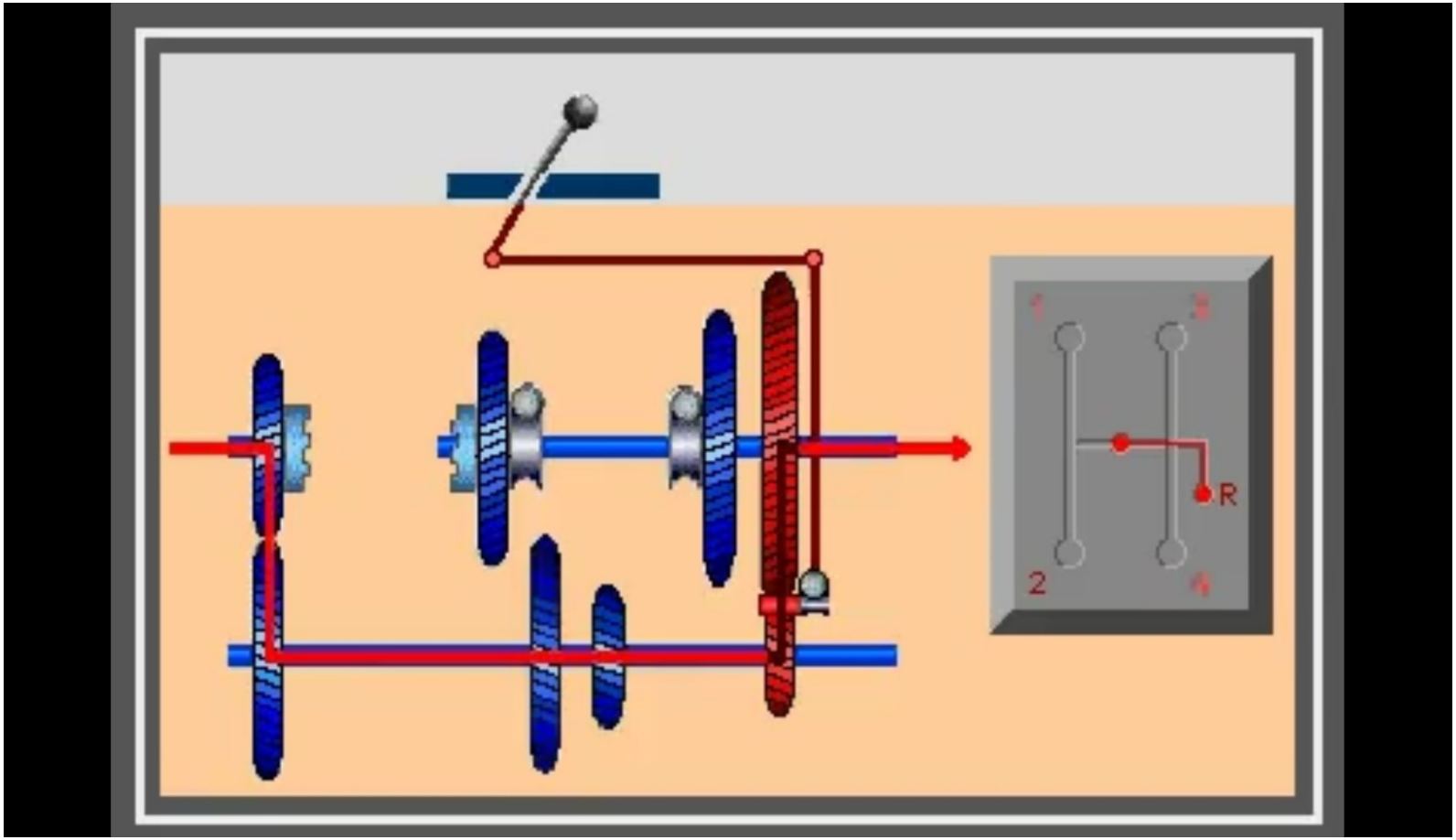


The reverse speed:-

- In this case a idler gear is used intermediate between the first gear and the one on the lay shaft to guarantee that the motion in the reverse direction



The Reverse speed:-



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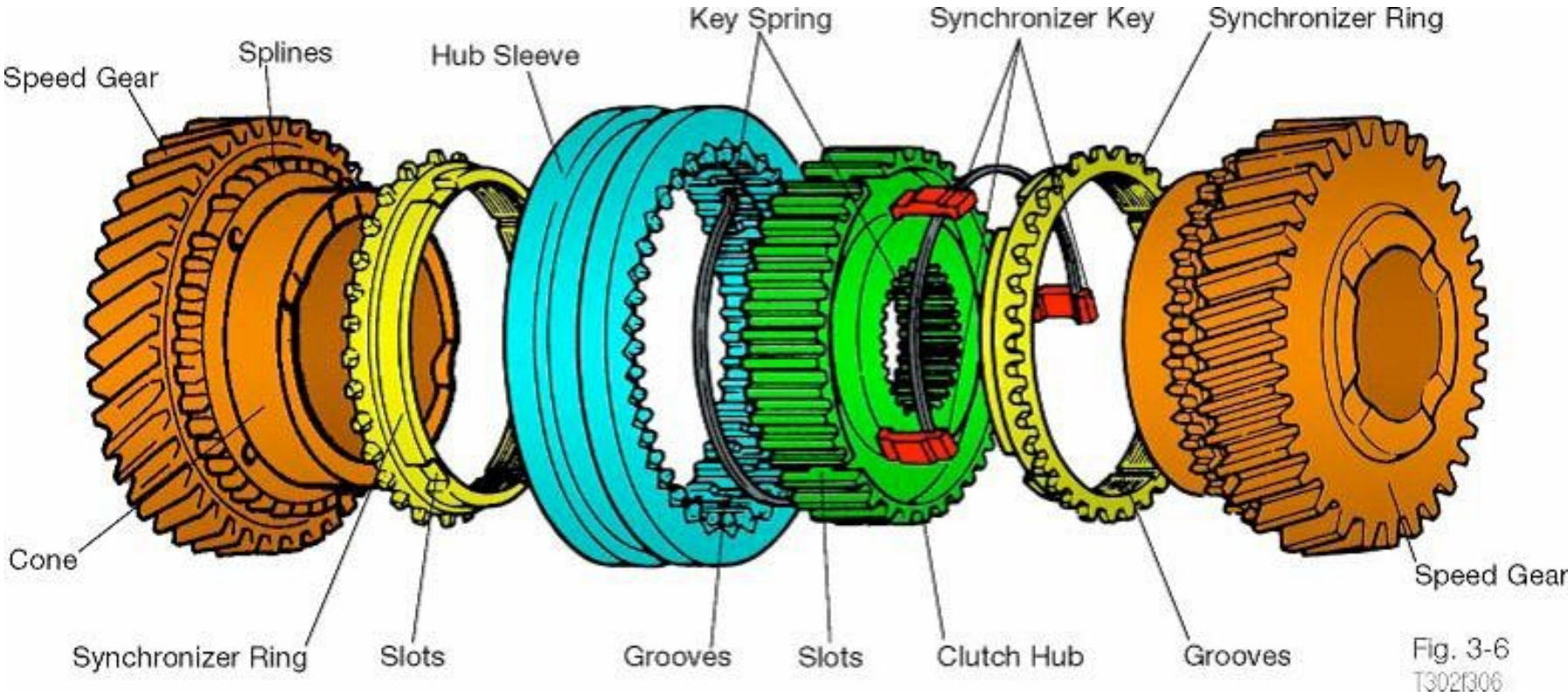
- **synchronized gear box**

Synchronized gear box

Synchronizer Components



The Synchronizer is made up of the speed gear, synchronizer ring, synchronizer keys ,key springs, clutch hub, and hub sleeve

How does synchronization works?

- 1-The speed gear is mounted on the output shaft. A needle roller bearing is installed between the speed gear and the output shaft, allowing the gear to rotate freely on the shaft
- 2-The synchronizer ring – also called a blocker ring – is made of brass and is installed on the conical portion of the gear. Narrow grooves are cut in the inside area of the synchronizer ring to provide the necessary clutch action of the gear. Three equally spaced slots are cut on the outside surface for the synchronizer keys to fit into.

How does synchronization works?

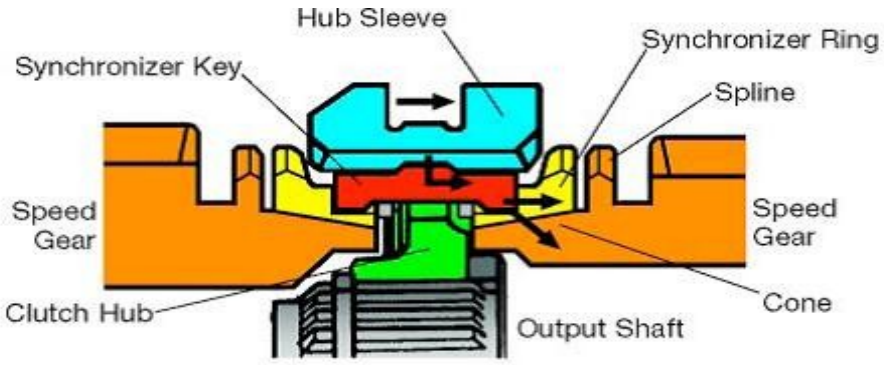
- 3-Two key springs are installed, one on each side of the clutch hub to hold the synchronizer keys in place against the hub sleeve.
- 4-The clutch hub is fit to the output shaft on splines and is secured by a snap ring
- 5-Three synchronizer keys are installed in the three equally spaced slots in the clutch hub and are aligned with the slots in the synchronizer ring.

How does synchronization works?

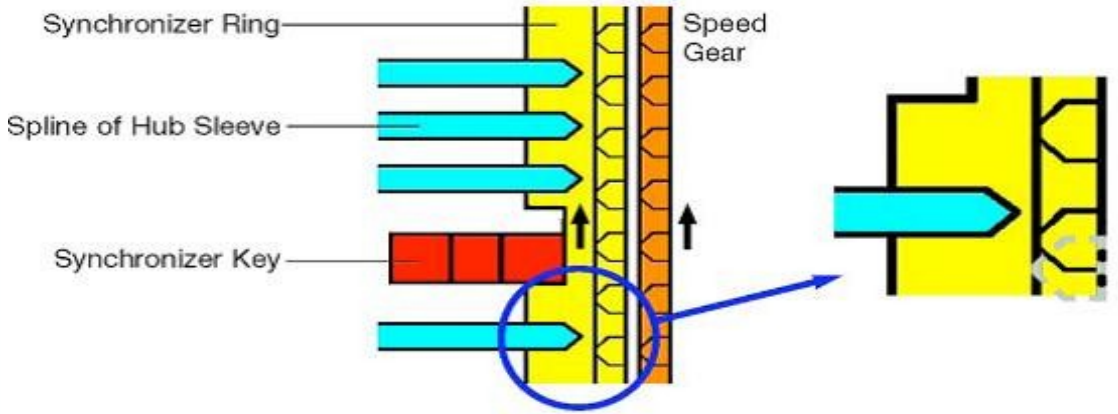
- 6-The hub sleeve has internal splines that slip over the clutch hub splines, engaging the spline teeth of the speed gear. An internal groove cut in the center of the hub sleeve splines centers the hub sleeve. The hub sleeve is indexed by the three spring loaded synchronizer keys

THE SYNCHRONIZATION PHASE IS DONE ON THREE PHASES

Synchronized Gear Shift – first Stage



Cross Section



Top View

Fig. 3-7
T302f307

- When the transmission is in neutral, the synchronizer key detents hold the hub sleeve in the neutral position

Input Shaft → Main Drive Gear → Counter Gear → Counter Gear Shaft → 1st Gear → Clutch Hub Sleeve → Clutch Hub → Output Shaft

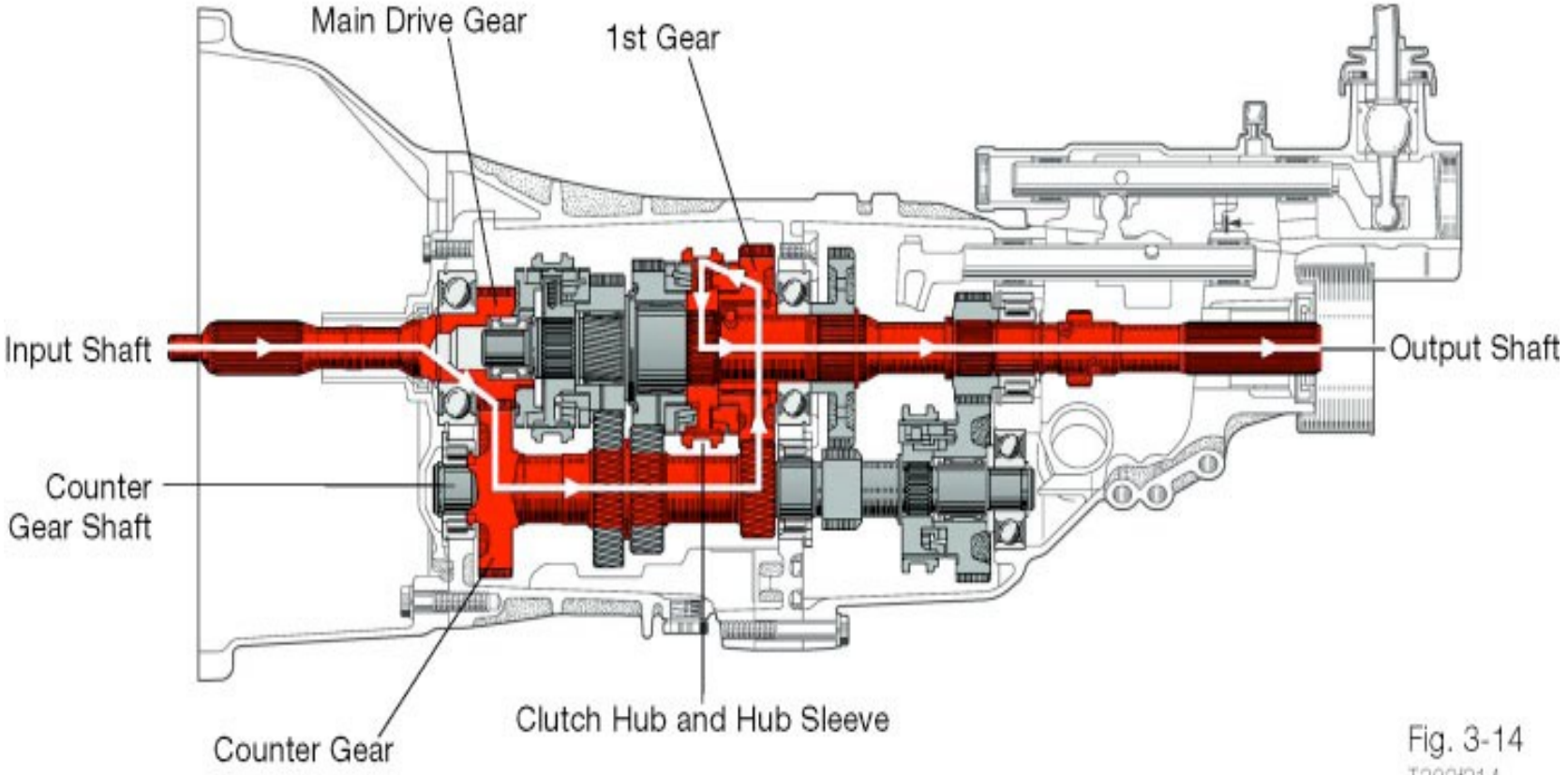


Fig. 3-14
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Second Stage

- The taper of the sleeve spline pushes against the taper of the ring teeth to exert more pressure on the gear cone

Input Shaft → Main Drive Gear → Counter Gear → Counter Gear Shaft → 2nd Gear → Clutch Hub Sleeve → Clutch Hub → Output Shaft

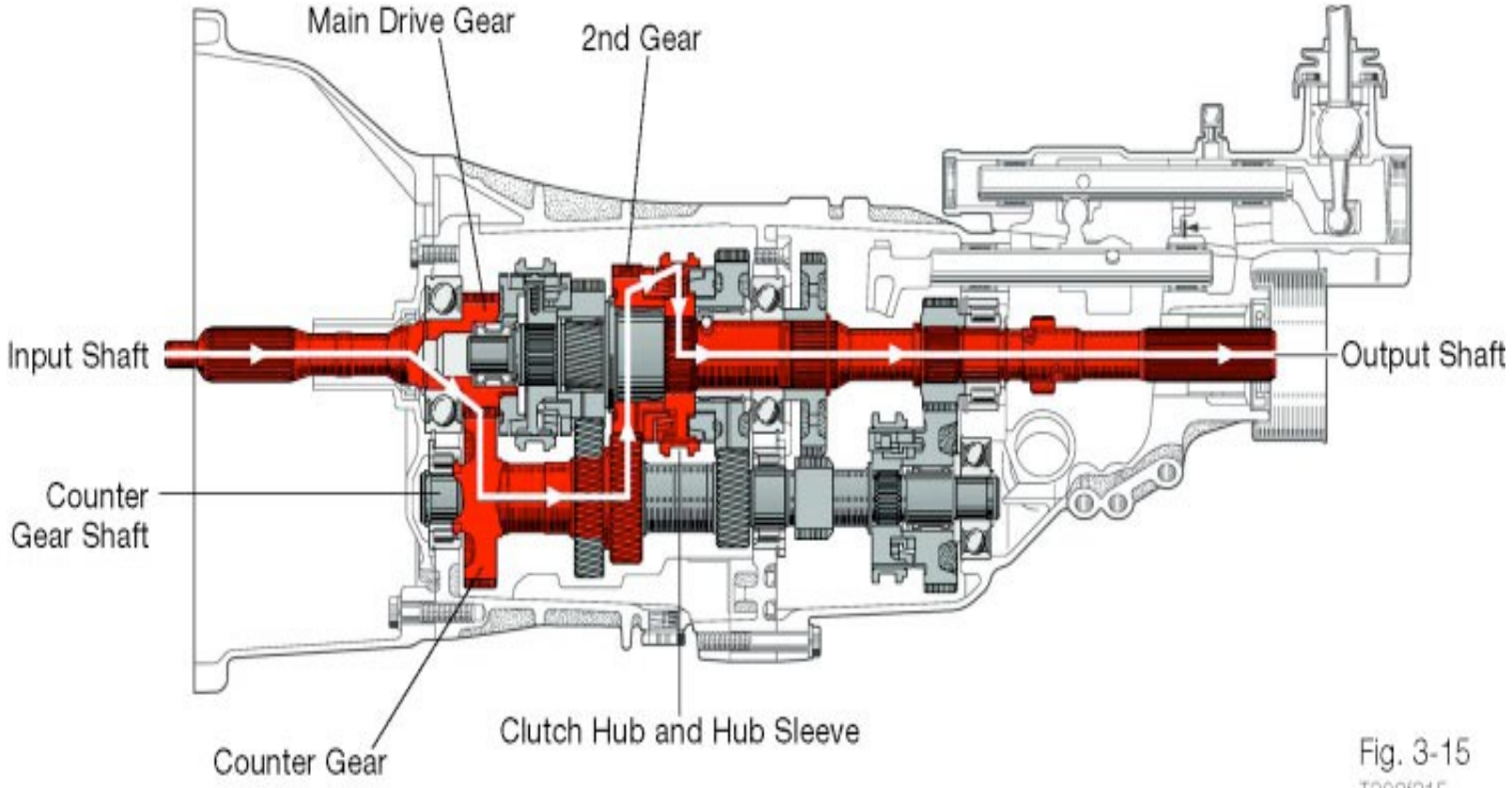

Fig. 3-15
T302f315

Third Stage

- When the speed of the hub sleeve and the gear become equal the hub sleeve engages the splines of the gear

Input Shaft → Main Drive Gear → Counter Gear → Counter Gear Shaft → 3rd Gear → Clutch Hub Sleeve → Clutch Hub → Output Shaft

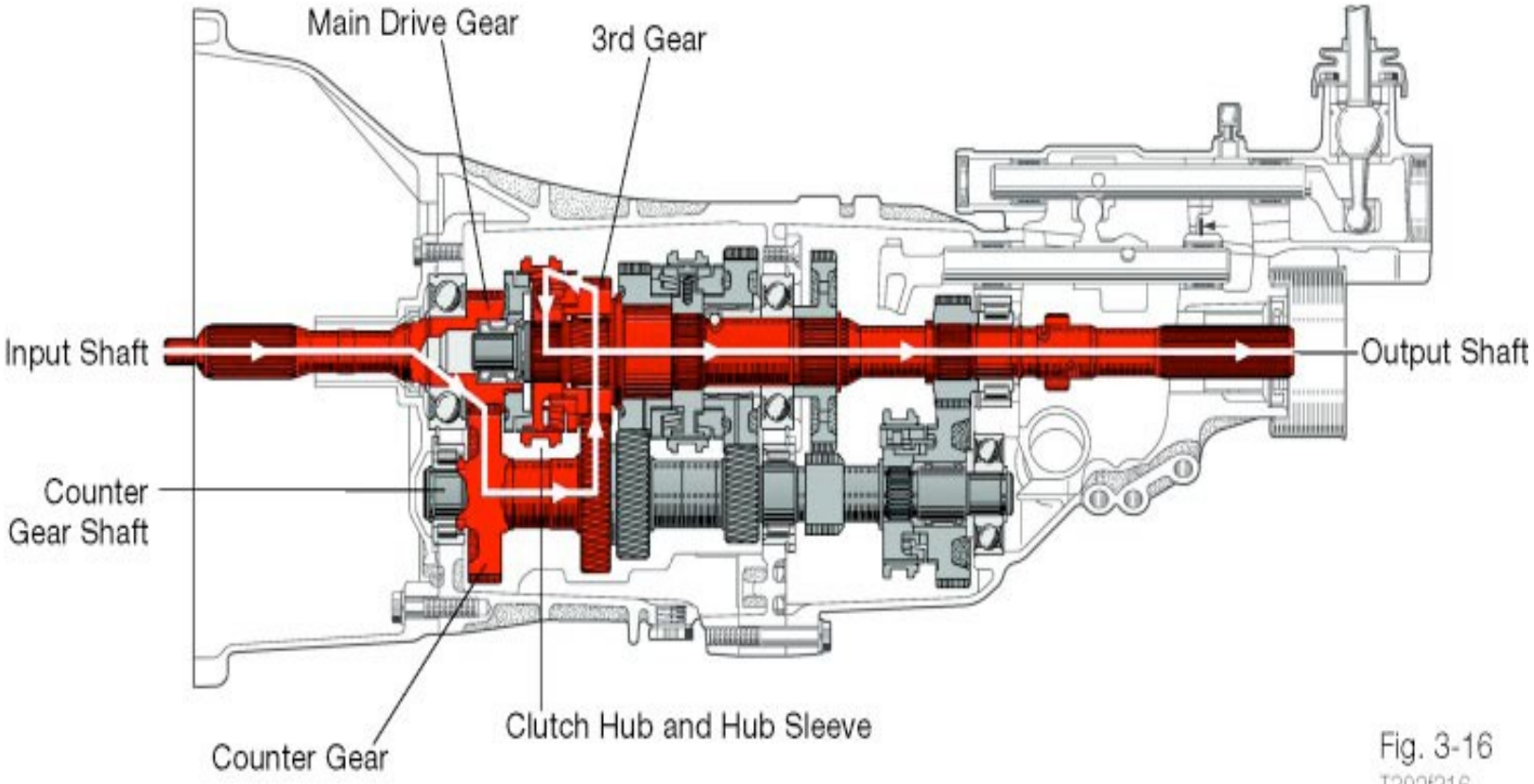

Fig. 3-16
T302f316

Input Shaft → Main Drive Gear (4th) → Clutch Hub Sleeve → Clutch Hub → Output Shaft

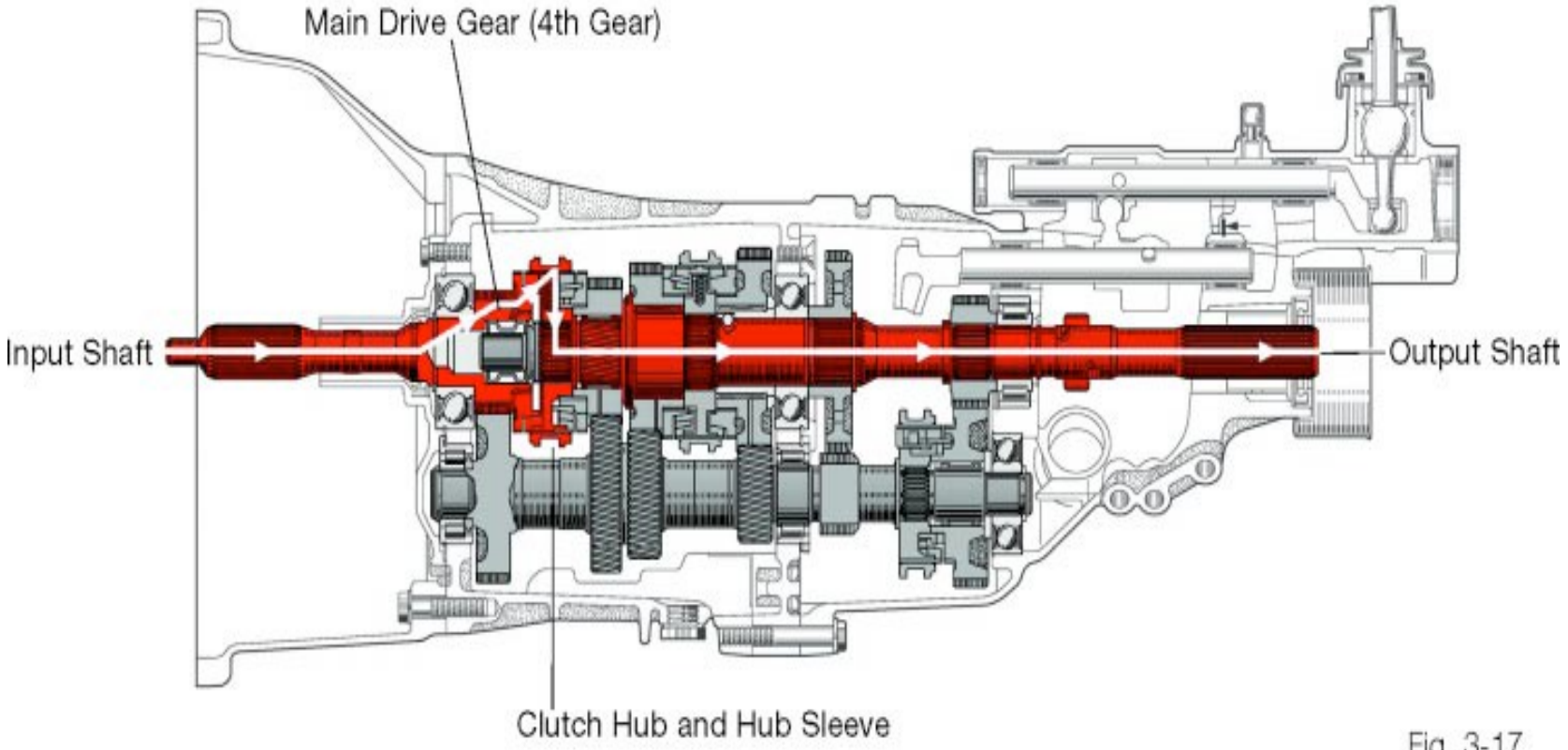

Fig. 3-17
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Input Shaft → Main Drive Gear → Counter Gear → Counter Gear Shaft → 5th Gear → Clutch Hub Sleeve → Clutch Hub → Output Shaft

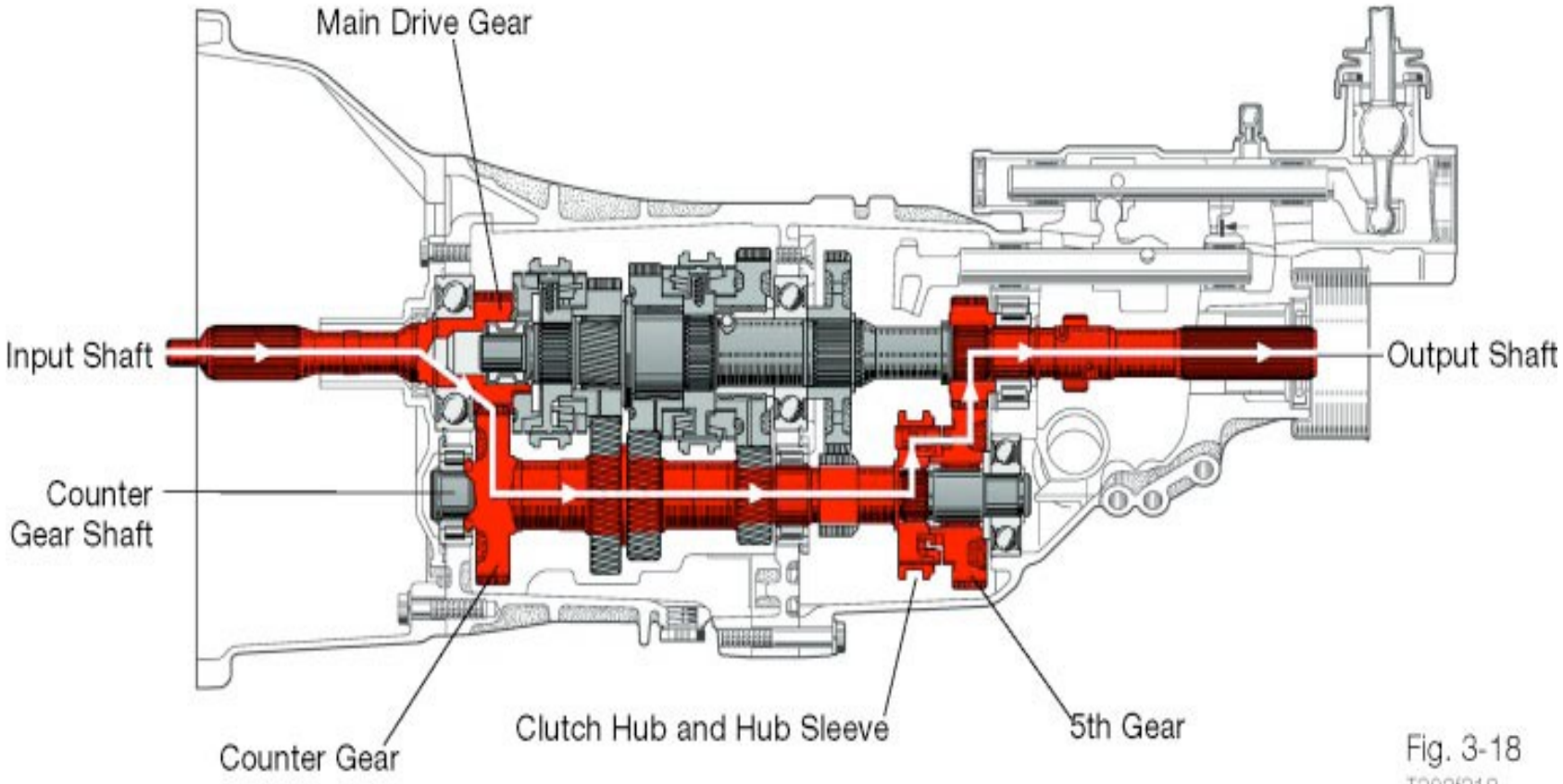

Fig. 3-18
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Input Shaft → Main Drive Gear → Counter Gear → Counter Gear Shaft → Reverse Idler Gear → Reverse Gear → Output Shaft

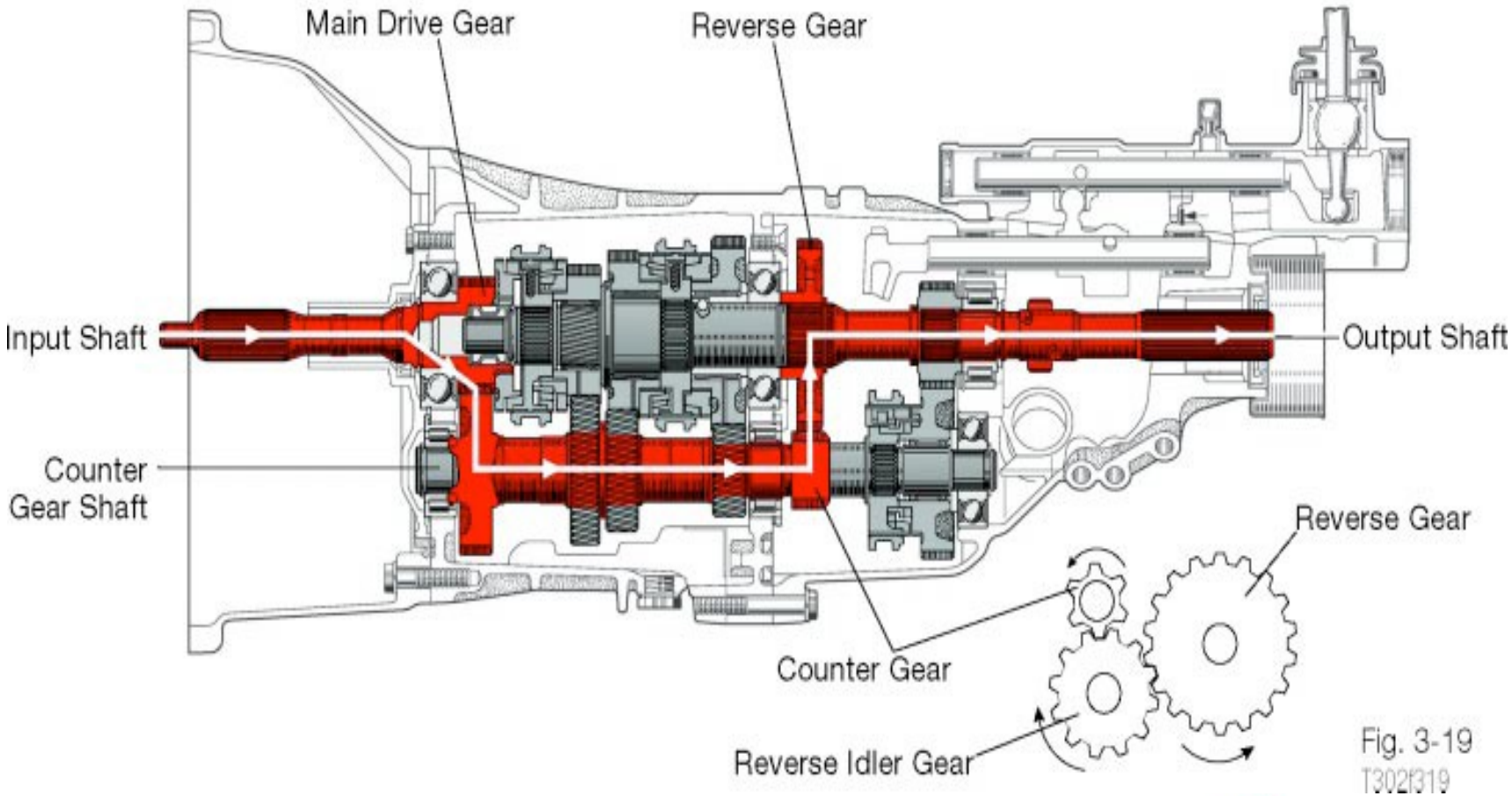

Fig. 3-19
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