SECTION INDEX

Group R: Rear Axle and Transmission

Operations:

Rear Wheel Suspension

DESCRIPTION OF REAR AXLE AND TRANSMISSION (TYPE 741)

General

The transmission and rear axle, together with the rear mounted engine forms the operating unit of the car. The rear wheels are independently suspended on ball jointed half axles. The transmission housing is suspended in the front and rear on rubber mounts and contains the transmission and differential.

Transmission Housing

The tunnel type transmission housing is made of cast light alloy.

Transmission

The transmission has four forward speeds and one reverse. The forward speeds are fully synchronized and employ a lock-type synchronization. The forward speeds are constantly in mesh and are silent running due to the employment of helical gears.

Gear Ratios

To insure good acceleration and top speed various gear ratios for the different types of engines are used. For special purposes (competition driving etc.) it is possible to exchange individual gear pairs to obtain suitable transmission ratios.

The various gear ratios are shown in diagrams on pages R 9 to R 19. These diagrams enable one to determine the relationship between rpm and speed for the various ratios.

Example:

The engine is turning at 4000 rpm (left, vertical scale). The transmission is in third gear with a ratio of B 23:26. This will give an effective speed of 58.2 mph (intersection of the horizontal rpm line with the gear line 3 B). Similar examples may be read from the various diagrams.

Function of the Synchronized Transmission During Gearchanges

Gears are selected by a shift lever mounted on the floor tunnel within close reach of the steering wheel. A selector rod in the floor tunnel connects the shift lever to the gearbox. The reverse gear is engaged by a non synchronized sliding gear while the forward speeds are angaged through a self-servo lock synchronization which adjusts to the synchronizing load of engaging a forward gear. This variable synchronization enables quick shifting with a minimum effort.

The operations that take place when changing gears will be understood more easily if one first considers what occurs when the gears are stationary.

When a gear is engaged with all gears stationary, the sliding sleeve moves from its central position until it engages with the toothed ring on the gear. As the sliding sleeve moves toward the gear, it compresses the synchronizing ring until the external diameter of the ring corresponds to the internal diameter of the sleeve. As the sleeve passes over it, the ring expands again into the shallow V-groove in the sleeve.

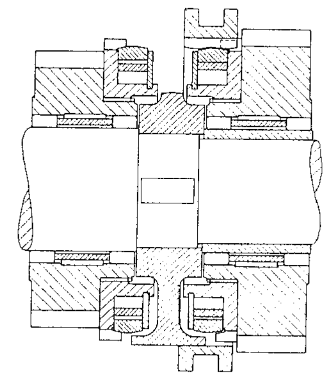

Fig. 1

When the sliding sleeve is moved in this way it must be pushed over the expanded synchronizing ring. The only resistance encountered is the pressure required to compress the ring and of course the sliding friction of the sliding sleeve over the ring. The brake bands, slider, and stop are not involved in such an engagement.

A considerably different process occurs when a gear is engaged while the car is in motion. In this case the synchronizing mechanism must match the speed of the floating gear on the pinion shaft to the speed of the shaft. This is done by employing a friction clutch effect to reduce the difference in speed between the two rotating members to be engaged, while at the same time preventing the sliding sleeve from engaging the gear until their speeds are equal.

During this process the clutch must be completely disengaged, since the torque exerted by the synchronizing clutch will cause the gearbox main shaft, and hence the clutch plate, to increase or decrease speed.

When a gear is changed with the car in motion the selector fork pulls the sliding sleeve away from the synchronizing ring of the previously engaged gear and continues toward the ring of the adjacent gear. As the sliding sleeve (rotating at the speed of the pinion shaft) engages the synchronizing ring of the next gear; the friction between the rotating ring and the sleeve exerts a torque on the ring which is transmitted by the brake band to the stop. The brake band is thus expanded preventing the synchronizing ring from contracting to allow the sliding sleeve to pass over it.

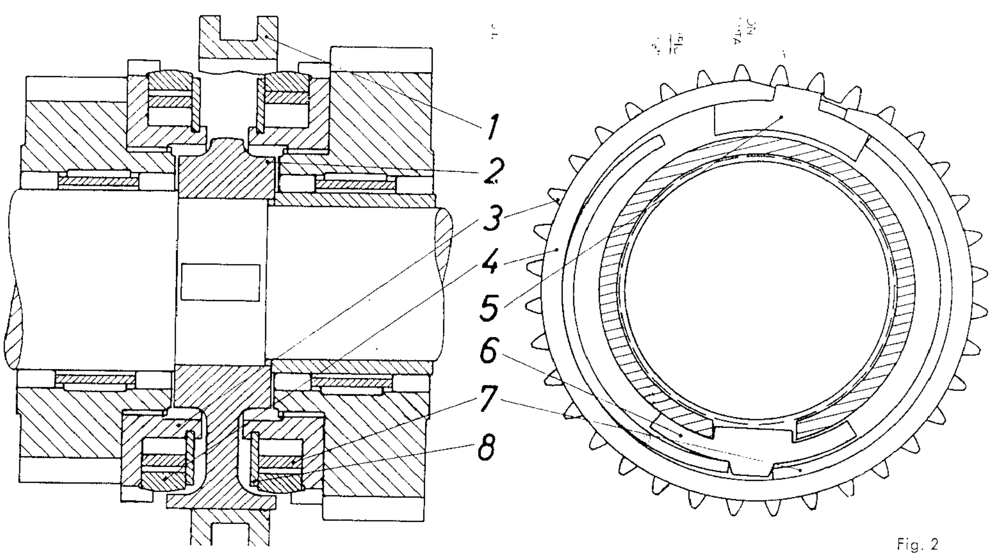

Fig. 2

1 **Sliding sleeve**
2 **Spider**
3 **Toothed ring on gear**
4 **Synchronizing ring**
5 **Slider**
6 **Stop**
7 **Brake band**
8 **Lock ring**

The gear to be engaged is forced to assume the same speed as the pinion shaft by the sliding sleeve. As long as there is a difference in speed between the sliding sleeve and the synchronizing ring, which is constrained to rotate with the gear, the radial force exerted by the brake band prevents the synchronizing ring from being compressed. It is thus impossible for the teeth on the sliding sleeve to engage with the teeth on the ring attached to the gear until their speeds are equal.

As the difference in speed between the sliding sleeve and the gear decreases, the friction force between the synchronizing surfaces is reduced. When the two speeds are equal the slider no longer transmits a force to the brake band which in turn no longer expands the synchronizing ring, allowing it to be compressed by the sliding sleeve. The sliding sleeve passes over the synchronizing ring and engages the toothed ring of the gear, thereby firmly engaging it with the pinion shaft. The synchronizing ring expands in the shallow V-groove in the sliding sleeve, holding the sleeve in engagement. A locking device to hold the selector shaft when a gear is engaged is therefore unnecessary.

The same synchronizing and locking components are used for all gears of the gearbox with the exception of the first gear. Since this gear is often engaged from a standstill, care has been taken to insure that it can be engaged easely witout interference from a locking mechanism.

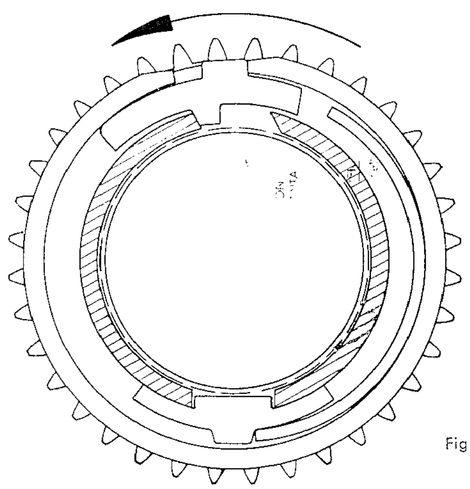

Fig. 3

As shown in Fig. 3 the slider used in this case is equipped with a lug which engages directly in a recess in the hub of the toothed ring attached to the gear. Also, one brake band has been omitted. Compared with driving speeds, the idling speed of an automobile engine is very low. If the clutch is disengaged in order to engage first gear, the main shaft will quickly come to rest. To reduce this time still further, and thereby enable the driver to engage first gear quickly without grinding, a synchronizing mechanism is required (to act as a brake).

When braking the gear, the force exerted by the friction between the sliding sleeve and synchronizing ring acts on the slider, and through its lug, directly on the gear. The lug is sloped so that the slider is forced outward while its longer end bears against the inside of the synchronizing ring. This small force is sufficient to enable first gear to be easily engaged while providing sufficient synchronization to prevent gear clash.

If a change from second to first gear is made while the vehicle is in motion, the first gear must be accelerated. There is a normal brake band on the side that comes into operation in this event, giving the same servo action as in all the other gears (Fig. 4).

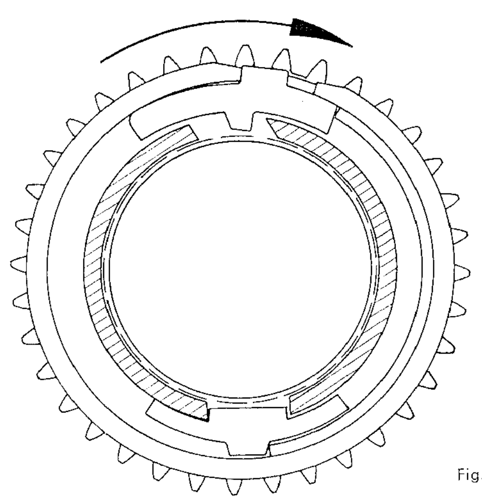

Fig. 4

Rear Axle Drive

The power is transmitted by a spiral bevel gear differential with bevel spider gears through the axle shafts to the rear wheels. Accurate adjustment is essential for the life and silent operation of the ring and pinion gears.

The ring and pinion gear ratio is 1:4.428 (7:31).

The differential divides the drive to the rear wheels to equal the different paths traveled in curves.

Rear Wheel Suspension

The rear wheels are independently suspended. Road shocks are transmitted from the wheels by the radius arms to the left or right torsion bar. The torsion bars are anchored in a splined socket which is welded into the middle of the torsion bar tube.

The different number of splines on the ends of the torsion bar permits an exact adjustment of the rear wheel suspension on both sides. Hydraulic, double-acting, telescopic, shock absorbers absorb road shock and prevent the vehicle from recoiling.

Vehicles of the type 356 B/1600 GS and 356 B/1600 S-90 have a compensating spring as standard equipment. The compensating spring, a single transverse leaf, is attached at both ends to the axle tube suspension brackets and is pivoted against the transmission housing under the differential at its center. The compensating spring acts as an anti-stablizer.

Oil Capacity

The capacity of the transmission is 3.5 liters (approx. 3.75 quarts). Oil changes should be made according to the lubrication chart using only approved lubricants. An oil change requires approximately 3.5 quarts (3.2 liters).

Components of Synchronizing Mechanism

1. Sliding sleeve

The tapered inner circumference of the sliding sleeve makes the friction contact with the synchronizing ring. In addition, when the gear is fully engaged, the internal teeth on the sliding sleeve engage with corresponding teeth on the gear, and thereby form a positive coupling.

The sides of the inner circumference of the sliding sleeve are tapered with a shallow V groove in the center which the synchronizing ring engages to retain the sliding sleeve when the gear is engaged (no locking device is therefore needed to hold the selector shaft when gears are engaged) (Fig. 5).

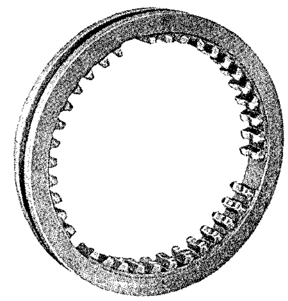

Fig. 5

2. Spider

The spider has three arms that carry the sliding sleeve which is free to slide exially. In addition to guiding the sliding sleeve, the spider transmits the drive torque (Fig. 6).

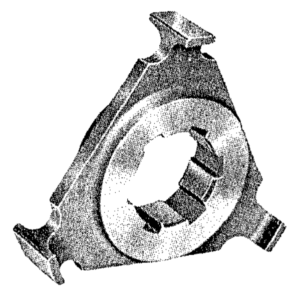

Fig. 6

3. Toothed synchronizing drive ring

The toothed ring forms the coupling between the gear and the sliding sleeve. It carries the synchronizing ring and the brake bands (Fig. 7).

The toothed ring of the first gear has two diametrically opposed recesses. The recess with the chamfered edge is for the lug on the inner side of the slider. The lug on the lock ring must never be inserted in the recess with the chamfered edge, but always in the recess that locates the stop.

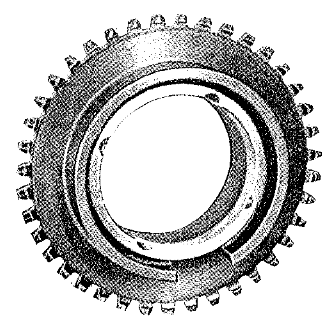

Fig. 7

4. Synchronizing ring

The synchronizing ring is a split elastic ring. The V shaped ridge on the outer surface serves both as a synchronizing surface, and a retainer for the ring in the sliding sleeve.

One side of the ring has a groove which, when assembled, must face the lock ring (Fig. 8).

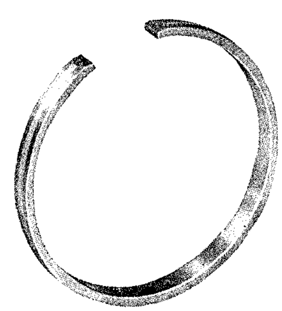

Fig. 8

5. Slider

One end of the synchronizing ring bears against the lug on the slider which transmits the synchronizing torque to the brake band (Fig. 9).

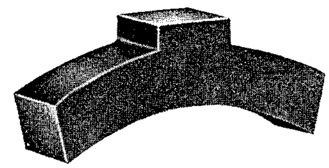

Fig. 9

The slider employed with the first or low gear is modified in that it also has an inner lug (Fig. 10).

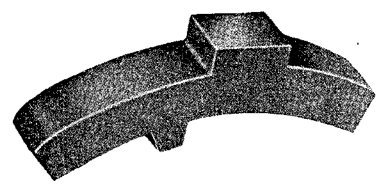

Fig. 10

6. Stop

The stop is located in the recess of the toothed ring which is attached to the gear. It transmits torque (frictional torque) from the synchronizing elements to the toothed ring which is attached to the gear (Fig. 11).

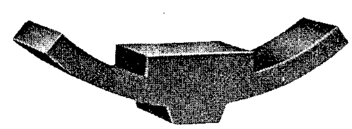

Fig. 11

7. Brake band

The brake band is bowed outward between the slider and stop by the force from the synchronizing ring, thereby expanding the ring against the inside of the slider (Fig. 12).

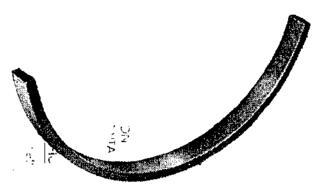

Fig. 12

8. Lock ring

The lock ring retains the synchronizing ring and the lock system elements on the drive ring (Fig. 13).

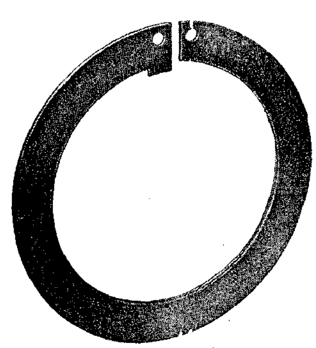

Fig. 13