The Ferret pre-selector gearbox

A **pre-selector** or **self-changing gearbox** is a type of manual gearbox used on a variety of vehicles, most commonly in the 1930s. The defining characteristic of a preselector gearbox is that the manual gear-shift lever is used to 'pre-select' the next gear to be used in advance. Then a separate control - a gear-change foot pedal - normally the left pedal installed in place of the usual clutch pedal, is used to engage the gear in one single operation without needing to work a manual clutch. Wilson pre-selectors were common on Daimler cars and commercial vehicles, as well as on many London buses. Military use began in 1929, including tanks such as the German Tiger I and Tiger II, through to the modern Challenger 2.

Pre-selector gearboxes are not automatic gearboxes, although they may have internal design similarities. A fully automatic gearbox is able to select the ratio used; with a pre-selector gearbox this remains the driver's decision. The best known of the pre-selector gearboxes is the Wilson design. Some gearboxes, such as the Cotal, shift gear immediately the control is moved, without requiring the separate pedal action. These are termed 'self-changing' gearboxes. For the driver the Wilson pre-selector gearbox offers two advantages:

- Fast shifting, with only a single operation. This requires less skill to learn than techniques like double declutching, and it offers faster shifts when racing.
- The ability to handle far more engine power, with a lighter mechanism.

To change gear, select the one you want and kick the pedal down to the floor in a single decisive smooth motion, letting it come straight back up. **Do not hold it down and in so doing ride the clutch**. If it doesn't quite select you will get a false neutral and the pedal will either come back up really hard, and subsequently be very heavy to depress, or will stay engaged down with a racing engine. Correct selection of any gear, full depression and release of the GCP will rectify this. After changing gear I always select the next gear, either up or down. (You need to ensure that the gear selector lever is properly engaged in its detent within the gear selection housing). I then operate the GCP when needed.

The Wilson gearbox relies on a number of epicyclic gears, coupled in an ingenious manner. A separate epicyclic is required for each intermediate gear, with a cone clutch for the straight-through top gear and a further epicyclic for reverse. Unlike the "crash" gearboxes of the first half of the 20th century, the gearwheels in a pre-selector box are permanently meshed in an epicyclic layout, a benefit of which is the transmission of large torques whilst still being controllable through a small input force. The friction components of the gearbox are brakes rather than clutches. They can be mounted on the outside of the gearbox to make maintenance easier. Changing gear with the Wilson box relied on the control of the brake bands that held each epicyclic's annulus in fixed position. The brake band to be selected was controlled by a rotating cam, moved by the gear shift lever. Only one band was engaged for each gear selection. This small lever could not provide enough power to engage and lock the brake band, thus the need for the pedal.

The actual movement of the brake bands was controlled by the 'toggle' mechanism, a distinctive feature of the Wilson design. When the pedal was pressed and released, a series or 'busbar' of finger-like levers were pressed upwards by a strong coil spring, against a series of light linkages or 'operating struts'. The position of each linkage was controlled by the gear selection camshaft. If the cam (for each gear) held the linkage in place, rather than allowing it to swing out of the way, the busbar finger would then press, via the operating strut, onto the toggles controlling the brake bands themselves. These toggles provided the additional leverage necessary to hold the brake band in place, under the force of the coil spring, until the pedal was next pressed. A further characteristic of the Wilson design was the use of self-adjusting nuts on each band, to compensate for wear. The action of engaging and disengaging each band was sufficient to advance the ratchet nuts and so adjust for wear by taking up any slack. This is why the gearbox should be taken through the gears, one gear at a time, depressing the GCP 6-10 times in each gear prior to driving.

The Wilson gearbox was produced with a variety of clutches. The best-known is the fluid flywheel, a hydrodynamic device used to transmit rotating mechanical power as an alternative to a mechanical clutch**. Do not rev the engine with the brakes applied and a gear selected**, you will boil the flywheel fluid and cause the seal to fail. Take the vehicle out of gear when stationary; the flywheel does *not* act as a brake in the way that a mechanical clutch does.