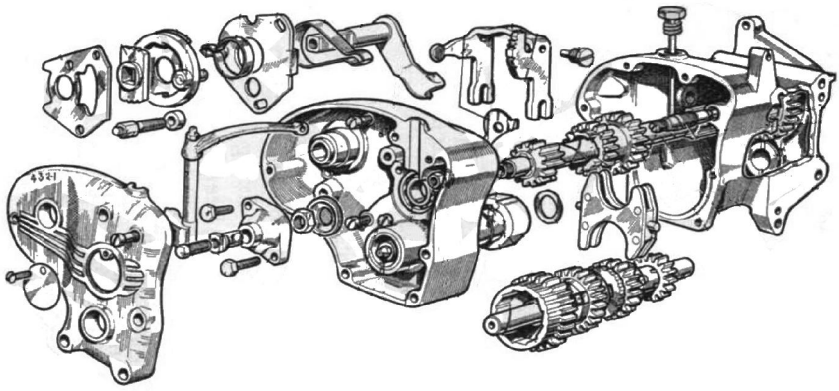
7 Gearbox

From its original concept the Villiers gearbox has had so many jobs to do, from wide ratio trials, through the many and varied roadsters and minicars, to the close scrambles and racing ratios. Information on the type of internal ratios, and even the number of teeth on the output sprocket, appear stamped on the left hand side of the box, but this information must be treated with some suspicion as substitution is again a simple matter.



It is a straight-forward matter to pick a set of ratios that will do justice to the branch of the sport that we intend to pursue. As three and four speed boxes were used, it is best if we forget about the former as the combination of gears was less, and little is compatible between the two gearboxes.

Figure 36 GB covers with and without kickstart

First let us look at the outer shell in which to place these ratios. The original cases matched up with the crankcases of the 9E, and then were

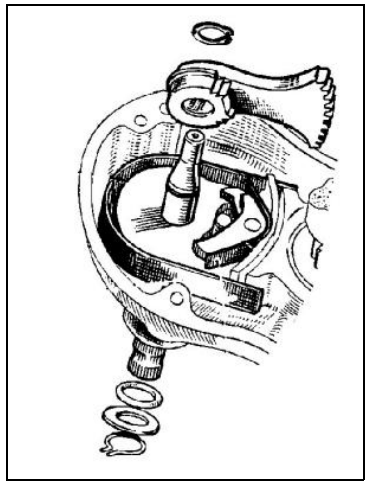


Figure 37 Post 1962 gear selector

modified to match the unfaired cases of the 36A, but internally they were exactly the same. The only difference being the kart or minicar box which did not have the kickstart facility, the layshaft bush in the kickstart shaft being put straight into the box outer cover. Some cases had a speedo gearbox facility driving off the layshaft, an ideal refinement for a trials bike, but for racing this can be blanked off using the special cover supplied by the manufacturers. Once the shell has been chosen to match with the crankcases, it is yet another simple matter to pick the internals to suit the task for which it is intended. The only consideration to cosmetic appearances is which year should it represent? Before 1962 the selector mechanism caused problems in that it was not strong enough for rough use, and should not be used, this being identifiable by the large nut holding the selector spring stop into the outer cover plate. Post 1962, this nut was deleted and a set of uprated selector pawls added, together with a simplified mechanism. This is the box to go for, parts are available for both types.

Having been designed five decades ago the box has some draw backs, the biggest being the use of plain bearings, but this is far outweighed by the versatility of its internals. The main output bearing is a 6205 ball race, and when replaced should be substituted with a C2 which has less radial clearance than the C3 bearings used on the crankshaft. The gear selection problems can be eliminated by careful building and use of the uprated parts, ie hardened selector pawls, stronger selector detent springs and modified cam barrel bearings. Needle roller conversions are available for the first gear pinion end of the mainshaft, and for the layshaft. In the road racing role, the box can cause problems, as the plain bushes are not up to the stresses handed out by a tuned engine. A change to needle roller bearings, as used in the Starmaker box, might cure this problem but would require the services of a good machinist to install, and those that have tried this have had occasional problems with cages collapsing. A broken needle roller bearing causes havoc far more serious that a worn bush.

Look at the pawls in the photo on the left, these are for the later mechanism, they are correctly hardened and have extra width. The points must be reasonably sharp. The points can and do snap off with regular brusque gear changing. The symptom is poor gear change, or no gear change at all in one direction. These uprated pawls are available and are both wider and tougher.

On the Minicar box, without the kick start facility, the lay-shaft right hand bush can be replaced with a shell backed needle roller bearing of 9/16 X 3/4 in. The left hand end of the layshaft, and the right hand end of the main shaft both measure 508 thou, which is neither a metric or imperial standard size. In this case the shafts need to be ground down to 0.5 in and used with a ½ X 11/16 in bearing. Invader tried the use of needle rollers, but found that the shafts (and not the rollers) wore out very quickly, as the bearings ran directly onto them, this then caused meshing problems which accelerated pinion teeth wear. They now prefer to use the bronze bush (the bush being cheaper than a shaft) and change it regularly. The only answer to this problem would be the complete redesign of the gear box castings, to accommodate a set of larger ball bearings, but this would still leave the problem of the high gear pinion bush, as the space available is very limited. Pinions also tend to be another problem area, being adequate for normal use, they do wear heavily when used for racing, wearing through the case hardening of the teeth in a very short time. Greeves understood this problem on the Mk 1 Silverstone, and produced an uprated set, which were identified by a ring cut in the gear end face.

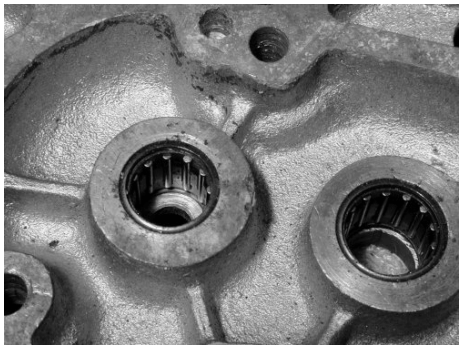


Figure 39 Gearbox with needle roller bearings

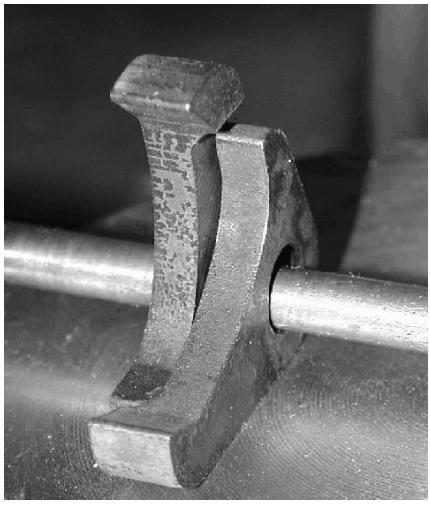


Figure 38 Uprated gearbox pawls

Look carefully at the photo (Fig 40). It shows two standard gearbox pawls, on the left is a new one, and on the right it is damaged with the usual missing point, leading to poor or non-functioning gear selection.