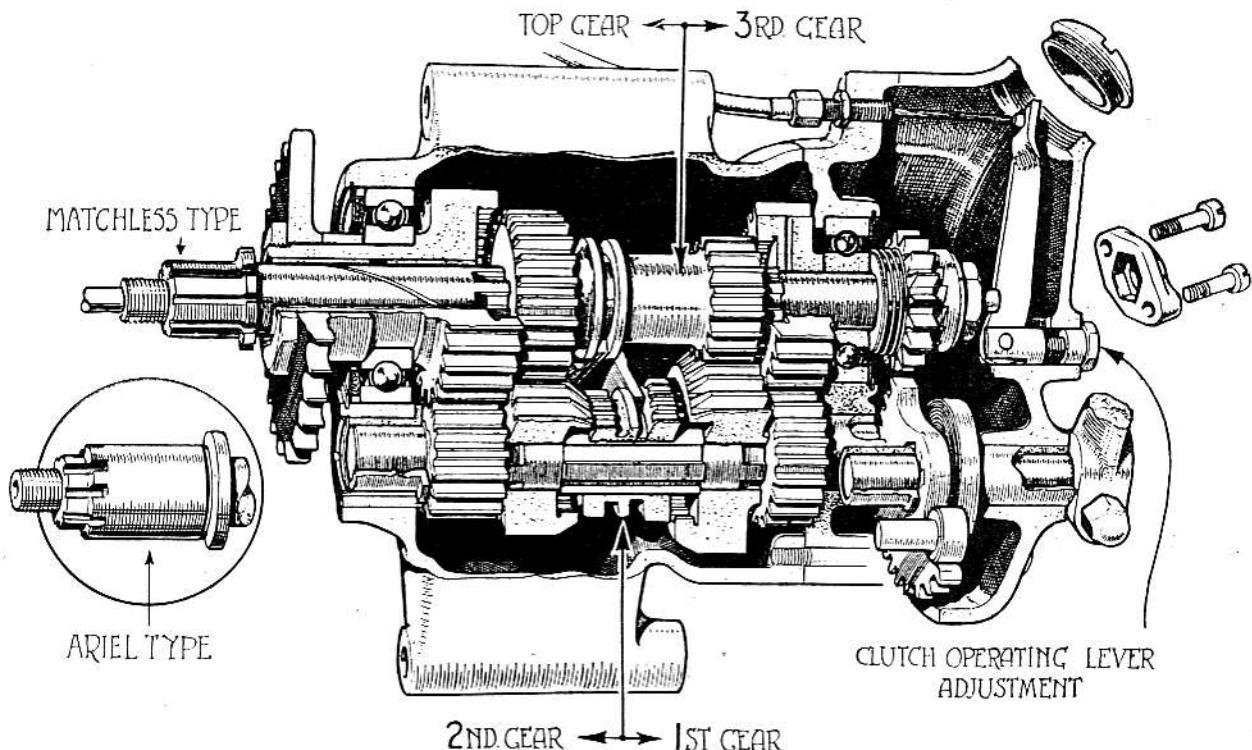


Full Instructions on How to Service W.D. Types of THE BURMAN GEARBOX



Although there are minor differences in the clutch operating mechanisms of the Burman gearboxes fitted to W.D. Ariel and Matchless machines and certain "impressed" models of other makes, the assembly of the gears as shown in this sectional drawing is common to all types.

BOTH the W.D. Matchless and Ariel machines use a Burman gearbox which is basically the same, so the intention is to deal with the two in one article, merely pointing out the differences. In the first place the clutches are different, that on the Ariel being a three-plate pattern which runs outside the primary oil bath chaincase and gains additional support from an outrigger bearing which is located in the chaincase. The Matchless has a four-plate clutch running inside the chaincase, with a shock absorber incorporated in the backplate. Naturally the splines are different on the drive ends of the shafts; also there is a variation in the overall lengths.

The clutch is best removed whilst the gearbox is in the frame, by undoing the four spring retaining nuts with a slotted screwdriver. This will enable the end plate to be removed so exposing the mainshaft nut which can be undone with a $\frac{1}{8}$ -in. box spanner, when the whole body is free to be pulled off its splines.

The Matchless clutch sprocket comes away with the main portion of the clutch, but the Ariel requires different treatment. On the latter, when the clutch body has been removed the clutch sprocket and outer clutch housing will remain in position on the needle roller bearing. The outer housing is detached by undoing the six bolts in the centre of the housing, and the sprocket complete with its needle roller bearing will

slide off the main shaft so soon as the outer half of the chaincase has been removed. Care should be exercised not to lose the rollers which should be stuck in their cage with grease before starting any reassembly.

In either case the long clutch-withdrawal rod can now be removed, but care must be taken not to lose the $\frac{1}{4}$ -in. ball, which in the case of the Ariel is located inside the adjusting cup at the lever end, and in the case of the Matchless fits inside the main shaft between the long rod and the short operating rod.

It will be seen that the Matchless has an enclosed lever and fulcrum, which is adjustable by moving the fulcrum bodily towards the clutch to decrease the clearance and vice versa to increase the clearance. This is done after removing a hexagonal headed cap from the outer cover and unscrewing the sleeve nut to decrease the clearance. The correct amount of play is $\frac{1}{32}$ in. at the cable end of the operating lever. The same clearance is recommended on the Ariel, but the adjuster screw must be turned clockwise relative to the plunger in order to decrease the clearance. The adjuster screw and the plunger are automatically locked by the sides of the pressed-steel withdrawal lever, and the cable must be detached from the lever before any adjustment can be made. A further variation in cable length can be obtained on both machines by an external adjuster.

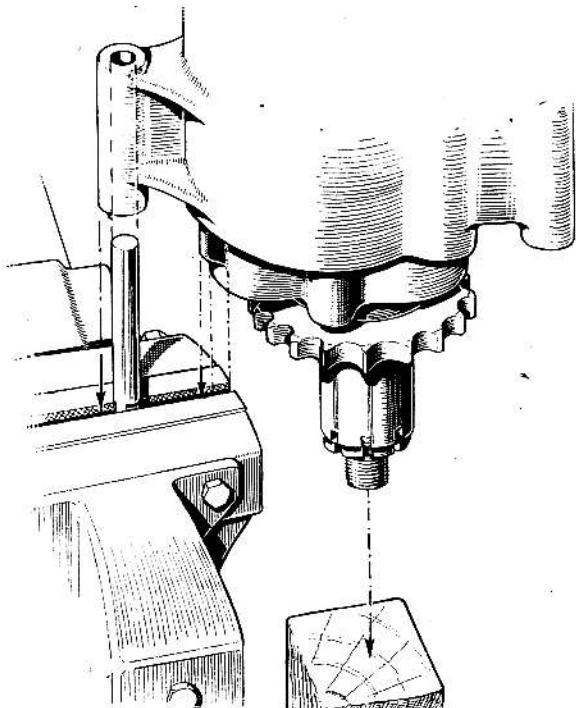
Up to the present we have dealt with only the

external units appertaining to the clutch and its withdrawal mechanism. Now, having disposed of them, it is possible to continue with the dismantling and reassembly of the gearbox itself. Before doing so, however, emphasis must be laid upon the importance of keeping the clutch-withdrawal mechanism properly adjusted. It is a job for the rider to do and if done at regular intervals little harm will come to the clutch. Neglect of these matters may lead to a burnt-out clutch, worn-out withdrawal mechanism, or damaged selector gear.

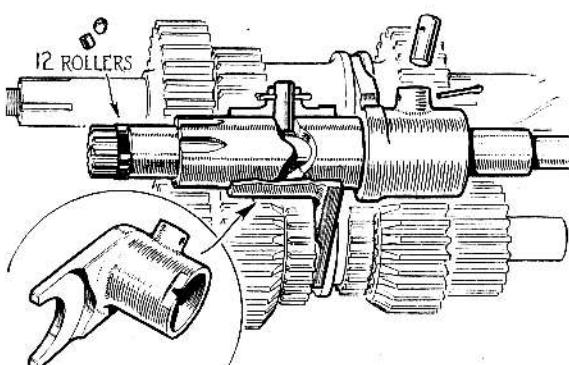
New Clutch Springs

When reassembling a clutch with new springs, the spring nuts should be screwed up until their heads are just flush with the end plate, and if any alteration is made to their tension, they must be tightened or slackened by equal amounts, so that the plates withdraw evenly.

Turning to the gearbox itself, a hypothetical case must be taken in which the gears themselves have to be



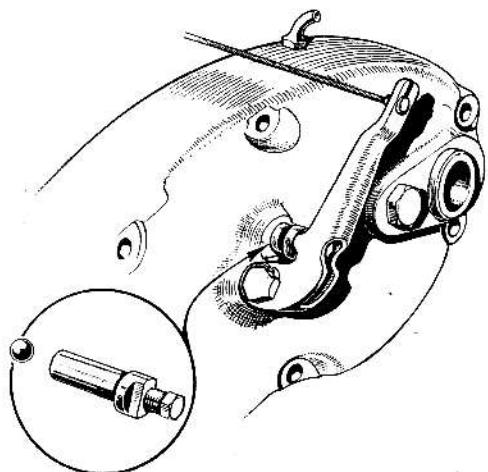
A $\frac{1}{2}$ -in. diameter steel bar held in the vice by two "flats" forms a handy support for the box. The small lug shown also slips between the jaws to prevent rotation. The mainshaft is supported on a wooden block.



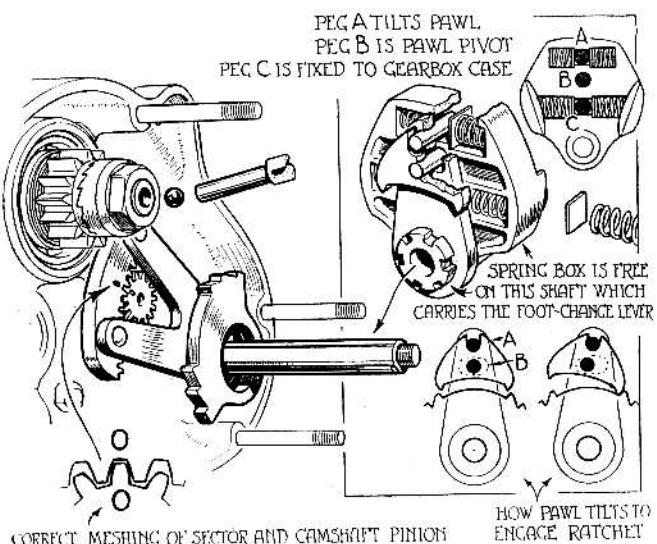
The two gear selector forks are moved by pins fitting in cam grooves machined in the selector shaft. Note the roller bearing at the end of the shaft. (Inset) A complete selector fork. They are of different lengths.

removed from the box. This can be done whilst the box is still in the frame, but for workshop purposes it is probably advisable to remove the box to the bench.

For this purpose a $\frac{1}{2}$ -in.-diameter bar about 4 ins. long should be obtained and one end machined or filed until there are two flats 1 in. long by $\frac{1}{4}$ in. apart. This end is then gripped in a vice and the gearbox bottom mounting boss slipped over the bar. A flat lug is incorporated on the gearcase casting on the bottom side of



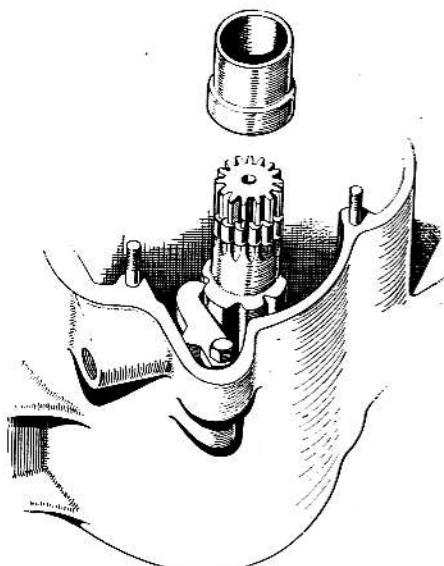
This illustration shows the external type of clutch operating lever fitted to the Ariel-pattern box. (Inset) The operating plunger with its adjustment. Note the ball bearing which takes the thrust. The Matchless-pattern lever is shown in the drawing on the previous page.



At first glance a complicated piece of mechanism, the foot change gear is really quite simple and extremely robust. These sketches explain the principle involved and the correct method of "timing" the assembly.

the drive end main-bearing boss, which is intended to slip in between the open jaws of the vice so preventing the gearbox pivoting round whilst work is being done.

Placing the box with the kick-starter side uppermost, the nuts securing the kick-starter casing to the inner cover should be undone, when part of the change-speed mechanism and the kick starter will draw off complete. (In the case of the Ariel the external clutch lever must first be removed.) At this stage the positive-stop mechanism can be examined, and any faulty parts



(Above) An old bush or similar sleeve will prove useful for retaining the rollers on the selector shaft prior to replacing the end cover.

replaced. There are no special points to watch in this mechanism, but it is essential that the foot-control ratchet and pawl are marked so that they get replaced in the correct position. Normally they are centre popped before leaving the works, but if not, the necessary marks can be made quite simply as shown in the accompanying sketch.

A point to watch in the kick starter is the return spring, the inner anchorage of which is correctly positioned when it is on the central spline of the quadrant, and it is advisable to leave the kick-starter lever on its spindle so that it is easily moved back to clear the quadrant stop when replacing the cover.

The Kick-starter

The nut on this end of the main shaft can be removed, so enabling the kick-starter ratchet, pinion and sleeve to be withdrawn, after which the main shaft will drop out through the final-drive sprocket. A further set of nuts and studs hold the inner cover to the main gearbox casing. When they have been undone with the aid of a box spanner ground down to clear the selector-spindle nut, the inner cover is free to be withdrawn leaving the two trains of gears and the selector shaft in a similar position. Care must be taken not to lose any of the 12 rollers which form the race on the gear-operating camshaft. For replacement purposes they can be held in position by grease, or, as an additional precaution, a camshaft bush slid over the rollers is a good tip until the inner cover itself is ready to be replaced. The pawl-spring socket at the bottom of the gearbox must be undone, after which the complete gear assembly, including the selector fork group, can be removed from the gearcase *en bloc*.

The Driving Gear

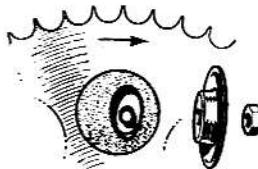
The driving gear, final sprocket and main ball race are now left in the case. To dismantle this assembly the gearbox must be removed from the vice and inverted on to an old third-gear wheel welded to a 1½-in.-diameter pedestal, which can be mounted on the bench or clamped in a vice. It is desirable to have a pilot 1¾ in. diameter protruding ½ in. above the old gear wheel.

(A similar tool was illustrated in the B.S.A. gearbox article, January 30, 1941.) A large and powerful box spanner with plenty of leverage must be used on the nut after the locking tab has been turned back.

Removing the main ball race can generally be done by warming up the case, but should the bearing be tight, a drift 1½ ins. diameter and 6 ins. long should "do the necessary." Of course, the spring-in clip and dust-excluding washers must be taken away before any attempt is made to shift the race. Replacing this bearing calls for a drift with an outside diameter of 2½ ins. recessed to a depth of 1/16 in. round a pilot 1¾ in. diameter by ½ in. long.

Reassembling

When reassembling the dirt-excluding device, care must be taken to place the *dished side* of the flat washer



CORRECT POSITION FOR SHOCK-ABSORBER RUBBERS

(Left) This illustration shows the correct position for the clutch shock absorber rubbers as viewed from the kick-starter end of the box.

towards the ball race. The kick-starter end bearing on the main shaft is not a tight fit in its housing, so no harm will come if it is removed and replaced by using the end of an old main shaft as a drift. Both the lay-shaft bushes require a double-diameter drift for removing and replacing them, the pilot being .610 in. diameter by ½ in. long, whilst the drift part is .75 in. diameter by about 6 ins. long.

In the event of any gearwheel bushes or other plain bearings being in need of replacement, new parts can be pressed in without any reaming being necessary.

If the gear-selector operating forks are removed from their shaft, note that they are different—the longer one operates the layshaft sliding dog.

Points to Remember

Turning to the assembly, this is the exact reverse of dismantling and, therefore, should not present any difficulty to a mechanic who has stripped the job down. All the splined gearwheels must be quite free on their shafts, and having made certain of this point a sub-assembly of the layshaft with gears, the main shaft gears (except the driving gear which should already be in its bearing) and the camshaft and fork assembly should be held together and fed into the gearcase, the main shaft being pushed up through the sprocket and driving gear. It is a help to prop the bottom end of the shaft off the bench until the inner cover and kick-starter ratchet have been replaced, or else the main-shaft wheels can get misplaced.

To tighten the kick-starter ratchet nut the box should be moved off its pivot pin and gripped in the vice by the final sprocket.

Coming to the positive-stop gear-change mechanism, this must be reassembled with the marked tooth on the gear end of the camshaft in mesh with the marked tooth on the ratchet, otherwise the gears will not engage correctly. It is possible to assemble the foot-control mechanism in one complete unit with the end cover, but it is easier to build up the pawl, the ratchet, the operating plate and the spring box before replacing the outer cover and then the foot-control lever.