

Of all the firms supplying British motorcycle makers with transmission components, H Burman and Sons of Birmingham is undoubtedly the best known. From the pioneering days before the First World War to the 1960s, Burman designed and built a vast range of clutches and gearboxes.

Postwar, Burman rationalised its product line, concentrating on the three-speed R and four-speed CP and BAP gearboxes. The R was intended for lightweights such as Excelsior's 148cc Courier two-stroke single. It was joined in 1953 by the GB30, a new four-speed design intended for the growing 200-250cc class and first seen on Ariel's 197cc Colt.

Basically the same design, the CP and BAP were described as medium- and heavy weight boxes. Both can be traced back to 1931 and the advent of foot change. The CP was intended to complement engines producing up to 17bhp, while the beefier BAP - with larger bearings, shafts and gears - could cope with up to 35bhp.

You'll come across the CP on pre-war 250 and 350cc models as well as ex-WD Matchless and Ariel singles. Postwar, it was fitted to the unsuccessful 250 and 350 Panther singles as well as Ariel's 1948 500cc parallel twin. For their big 600 and 650cc sloper singles, Panther standardised on the BAP and stuck with it right to the end of production at Cleckheaton in 1966.

Until 1948, the CP and BAP were lubricated by grease rather than oil, although in practice many owners employ a mixture of three parts grease to one part oil. That year saw the introduction of a Gaco oil seal next to the sleeve-gear bearing in place of a fibre ring. However, this provides a far from perfect seal with a pint of SAE50 on board, and Ariel recommended a 50/50 mixture of oil and light grease instead.

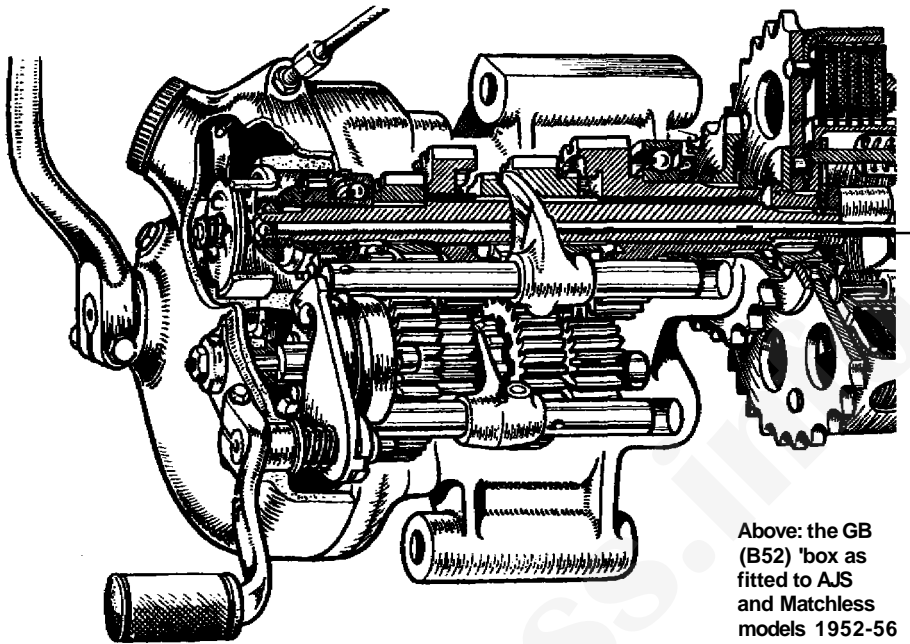
Burman's replacement for the CP and BAP was developed jointly with AMC and emerged in 1950 as the new transmission for the London firm's 350cc AJS 7R ohc single racer. Code named 7R 50, it featured a lightweight Elektron case, while both gearshafts ran on double-row roller bearings.

Just over a year later, the new four-speed B52, developed directly from the Boy Racer box, was announced for AJS and Matchless roadster applications. Both Ariel and AMC adopted the design for the 1952 model year, although Selly Oak dubbed it the GB.

Since this is what you will find stamped on both Ariel and AMC gearbox cases, that is what we will call it.

The GB represented an improvement on the CP and BAP in a number of areas. Both the mainshaft, supported in ball races, and the bushed layshaft were shorter and therefore less likely to whip under load. It was a stronger, lighter and more compact gearbox.

Gear selection was improved - with backlash in the gear engagement dogs more than doubled - although the GB still won't be hurried. The new selector mechanism featured steel selector forks attached to shafts in which steel pegs engage with a rotary face-cam actuated by a simplified positive-stop footchange employing a double claw quadrant.



Above: the GB (B52) 'box as fitted to AJS and Matchless models 1952-56

The gear pattern remained unchanged. It's up for first and then down for the higher gears. A drum-type gear indicator replaced a pointer.

The CP and BAP had featured a straight-pull clutch lifter lever, cable operated from the handlebar. Postwar, Ariel continued with a design in which this was external, while AMC's Burman boxes enclosed a smaller lever under a new outer cover.

The 7R's new gearbox came complete with a novel rotary lifter design of the ball-and-ramp type. The idea was to increase mechanical efficiency while lowering the leverage ratio. In fact all Burman transmissions seem to have a nice light clutch action.

The lifter features two circular steel pressings, spring-loaded via a central pillar. Sandwiched between the pressings, and contained within dimples in the stationary outer plate, are three ball bearings. When the lever attached to the inner pressing is pulled up, the rotation lifts the balls from their dimples, forcing the central pillar against the clutch pushrod via a steel ball.

On the GB, Ariel stuck with the older type of enclosed straight-pull clutch lifter, with adjustment via a sleeve nut under an external, oval cover secured by two screws. AMC went for the more compact rotary lifter - with an adjuster at the centre of the clutch pressure plate - and the Burman clutch in which the chainwheel is rivetted to a plain clutch body. Again, Ariel retained the older clutch design with its separate chainwheel and slotted clutch body, operating dry.

Another difference concerns speedometer drive. Ariel retained speedo drive from the gearbox, while AMC stuck with a separate Smiths drive unit on the rear wheel spindle.

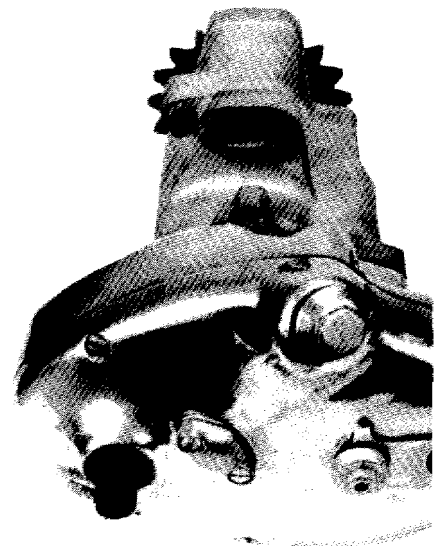
The GB can hold its liquor - SAE50 oil - due to the provision of spring-loaded synthetic rubber oil seals on the mainshaft pinion sleeve,

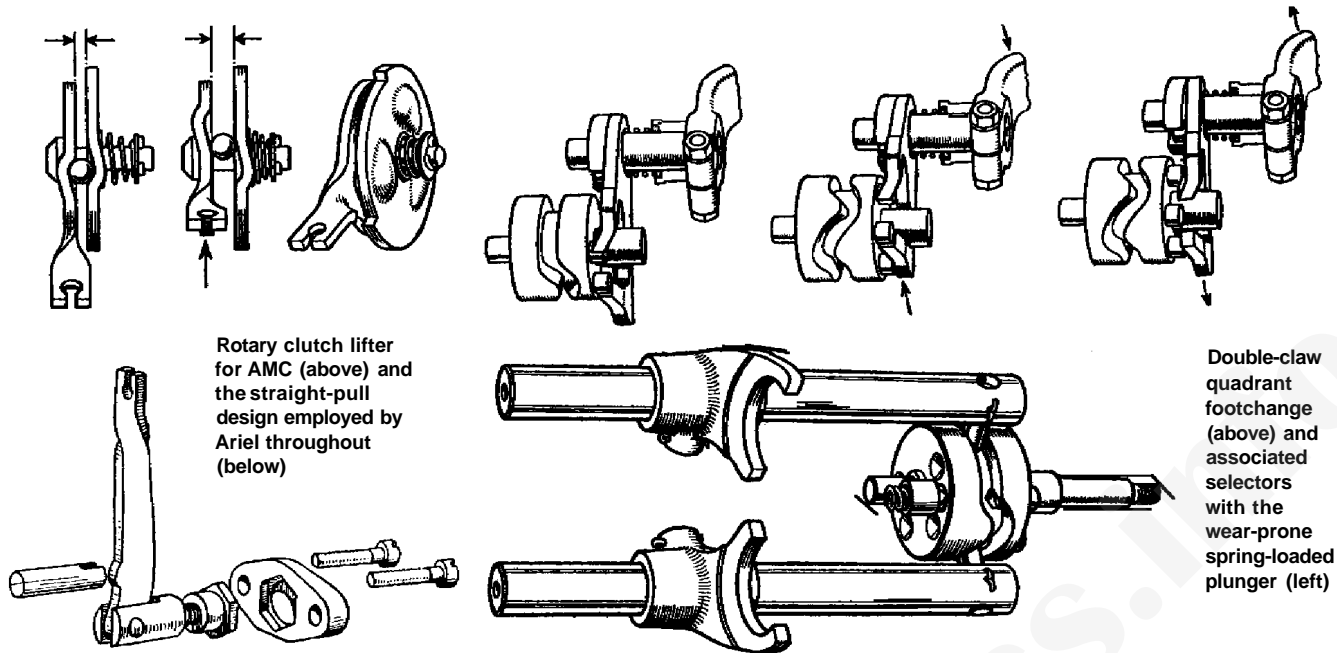
kickstart and gear lever shafts. And at long last Burman made a gearbox with an oil-level plug.

Ariel employed its own GB variant from 1952 to the end of four-stroke production in 1958. Exceptions are the Colt's GB30 design and the fact that the trials HT5 uses the AMC-type Burman. AMC, of course, soon dropped the GB, re-equipping its ranges with the Norton-AMC design made in London and fitted for 1957 along with a Norton-type clutch.

Identifying an Ariel or AMC GB gearbox is reasonably straightforward, although it gets a little more complicated when you need to identify particular model applications.

**Below: basically the same GB design, but spot the differences between the Ariel 'box (left) and AMC unit (right)**





Rotary clutch lifter for AMC (above) and the straight-pull design employed by Ariel throughout (below)

Double-claw quadrant footchange (above) and associated selectors with the wear-prone spring-loaded plunger (left)

AMC-Burman unique visual clues comprise:

- Identical top and bottom lugs.
- Clutch cable enters top of outer cover.
- Slotted inspection/filler cap.

Ariel-Burman giveaway details are:

- Elongated mounting hole in top lug.
- Clutch cable enters rear of inner cover.
- Speedo drive take-off from front of inner cover.
- Hex-headed inspection/filler cap.

Let's imagine that you want to establish that the gearbox fitted to a machine is the original fitment. Each GB box is stamped with a code on the top of the inner cover. This commences with GB and ends with a letter (A to M, without I), which is the month, and two figures which tell the year of manufacture.

So, if someone tries to sell you a 1955 350 AJS with a gearbox stamped GB23 F 55, it's a fairly safe bet that this is the original box as it was made in June '55. But what about the rest of the code?

Ariels are easily identified. However, in 1956 all the Ariel four-strokes of 350cc and over, except the Square Four, adopted full-width hubs, necessitating an increase in mainshaft

length for the new chain line. The primary chaincases were altered to accommodate the outward move of the clutch and a wider engine sprocket spacer was fitted.

'People run into problems when they swap engines,' says Roger Gwyn of Draganfly Motorcycles. 'They want to know why their clutch is rubbing on the primary chaincase.' So avoid mixing pre- and post-'56 Ariel transmission items. Here's some useful data:

**GB gearbox codes: Ariel**

Code	Models	Clutch
GB5	NH 1952-55	5 plates
GB6	VH, VHA, KH, KHA, VB 1952-55	7 plates
GB7	4G 1952-59	7 plates
GB10	VCH 1952-53	5/7 plates
GB11	HT 1955	5 plates
GB25	FH 1955	7 plates
GB30	LH 1954-55	7 plates
GB33	LH 1956-59, FH 1954	7 plates
GB34	HS 1954	7 plates
GB39	NH 1956-59	7 plates
GB40	FH, KH, VB 1956-59	7 plates
GB44	FH 1956-59	7 plates
GB45	HS 1956-59	7 plates
GB47	HT 1956-59	5 plates

**GB mainshafts: Ariel**

Part number	Models	Plain shaft length
3629-52	4G 1952-59	3 1/2 in
3630-52	all except 4G, LH, 1952-55	2 7/8 in
3630-56	as above, but 1956-59	3 1/6 in

We'd love to be able to provide you with similar information on Burman boxes fitted to AJS and Matchless models. Unfortunately, we've yet to encounter someone who's broken the code stamped on them. Examples are GB1 A, GB2A, GB23, GB26 and GB27, followed by year codes.

However, it's worth remembering that all AMC roadster GB boxes are identical internally. Gearing changes were effected by fitting different engine sprockets.

About 160,000 GB gearboxes are said to have been made, with many still giving good service over 30 years on. So what wears out?

A high-mileage unit will need new ball races and bushes. There are eight bushes (plus an extra one for the speedo drive on the Ariel variant) and two ball-race bearings. Since they're steel, the two small bushes on the kickstart and gearchange shafts also tend to wear the shafts themselves.

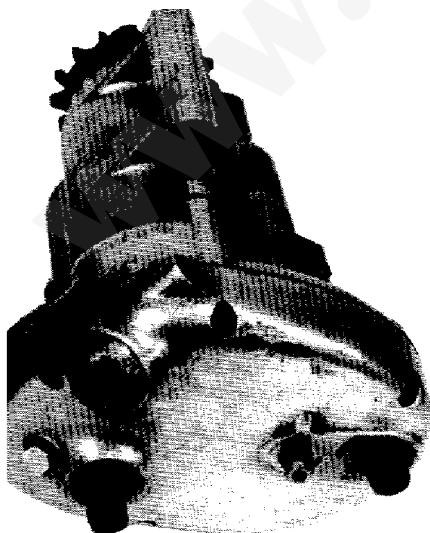
The mainshaft may also be worn where the fourth gear bushes bear upon it. Draganfly recommend hard chroming worn shafts which can then be ground to size. A major bearing problem is the 62mm x 1 9/32 in x 16mm driving gear bearing. Yes, it's a metric ball-race bearing with an Imperial bore! It is no longer available off the shelf, so a metric bearing must be machined out.

While worn shafts and chipped shaft splines can be recovered, bent shafts must be replaced. With plenty of secondhand units around, you should be lucky. Russell Motors' Les Myers says the firm is investigating the cost of manufacturing new GB mainshafts.

Myers reckons that parts for GB units are in



Machining a gearbox shell at the Burman factory in 1952



# All change!

much shorter supply than those for CP or BAP boxes. Russell are especially flush with CP parts, many from ex-WD stockpiles.

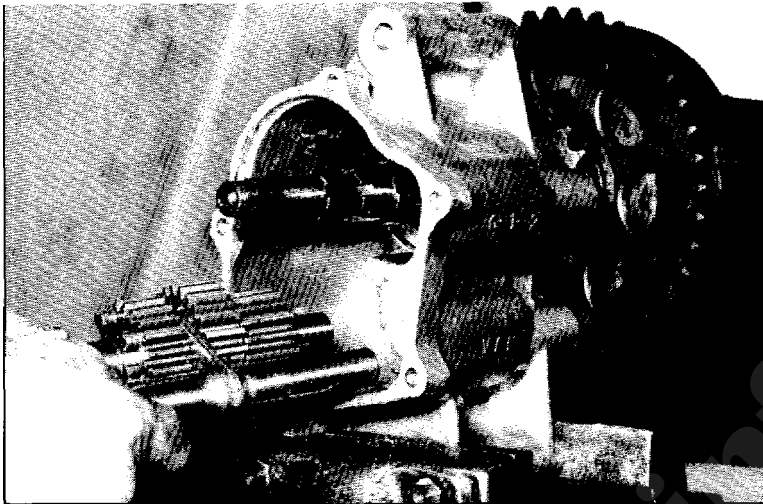
If your kickstart slips or jams, examine the ratchet assembly, where the driving ratchet is probably worn or damaged. Jumping out of gear often indicates that the small spring-loaded selector cam plunger is worn. This should be conical at one end. Worn selector shaft pegs can also cause a box to jump out of gear. Look for flats on the pegs.

Burman gears and their engagement dogs seem to be remarkably robust. Excessive wear and chipping should be obvious. If you have a box down, it's a good idea to replace both of the footchange quadrant springs. One is an easily recognised large U-shaped leaf spring, the other a small coil spring.

There are quite a few sources of Burman gearbox parts, and you don't need to restrict yourself to firms specialising in your marque. Bushes, bearings, gears and other internals are common to both Ariel and AMC variants. It pays to take the parts you wish to replace with you, for gears and bushes may not be labelled very accurately.

If you're going to overhaul a GB, it's best completed off the bike, with the lower mounting lug clamped in a vice. A good step-by-step strip was published in *Motorcycle Mechanics*, December 1959.

Because Burman made so many different gearboxes for such a range of motorcycle makers, the firm is sometimes credited with



Left: best way to work on a 'box is to clamp the lower lug in a vice

others' designs. The Norton 'laydown' box - which gave way to the Norton-AMC design in 1956 - is a case in point. It is often referred to as a 'Burman box'. In fact this was a development of a Sturmey-Archer design, but made for Norton by Burman.

Burman's GB is reckoned to have been one of its best designs. But with its major customer opting for the slicker-shifting, but more expensive, Norton-AMC gearbox it was clear that the firm would be wise to concentrate on its other automotive products.

There can't have been much profit in motorcycling. For when Phelon & Moore considered using the AMC gearbox in order to continue the production of Panther singles, the asking price was four times what Burman had been charging •

## BURMAN PARTS SUPPLIERS

### AMC

**Russell Motors**, 125-127 Falcon Rd, Battersea, London SW11 2PE (01-228-1714).

**Hamrax Motors**, 328 Ladbroke Grove, North Kensington, London W10 (01-969-5380).

**Joe Francis Motors**, 340 Footscray Rd, New Eltham, London SE9 2ED (01-850-1373).

**AJS & Matchless Owners Club Spares Scheme**, Trent Business Centre, Canal Street, Long Eaton, Nottingham NG10 4HQ.

### ARIEL

**Draganfly Motorcycles**, Old Town Maltings, Broad Street, Bungay, Suffolk NR35 1EE (0986-4798).

Special thanks to Draganfly and Ron Hughes of the AJS & Matchless Club for the loan of gearboxes.