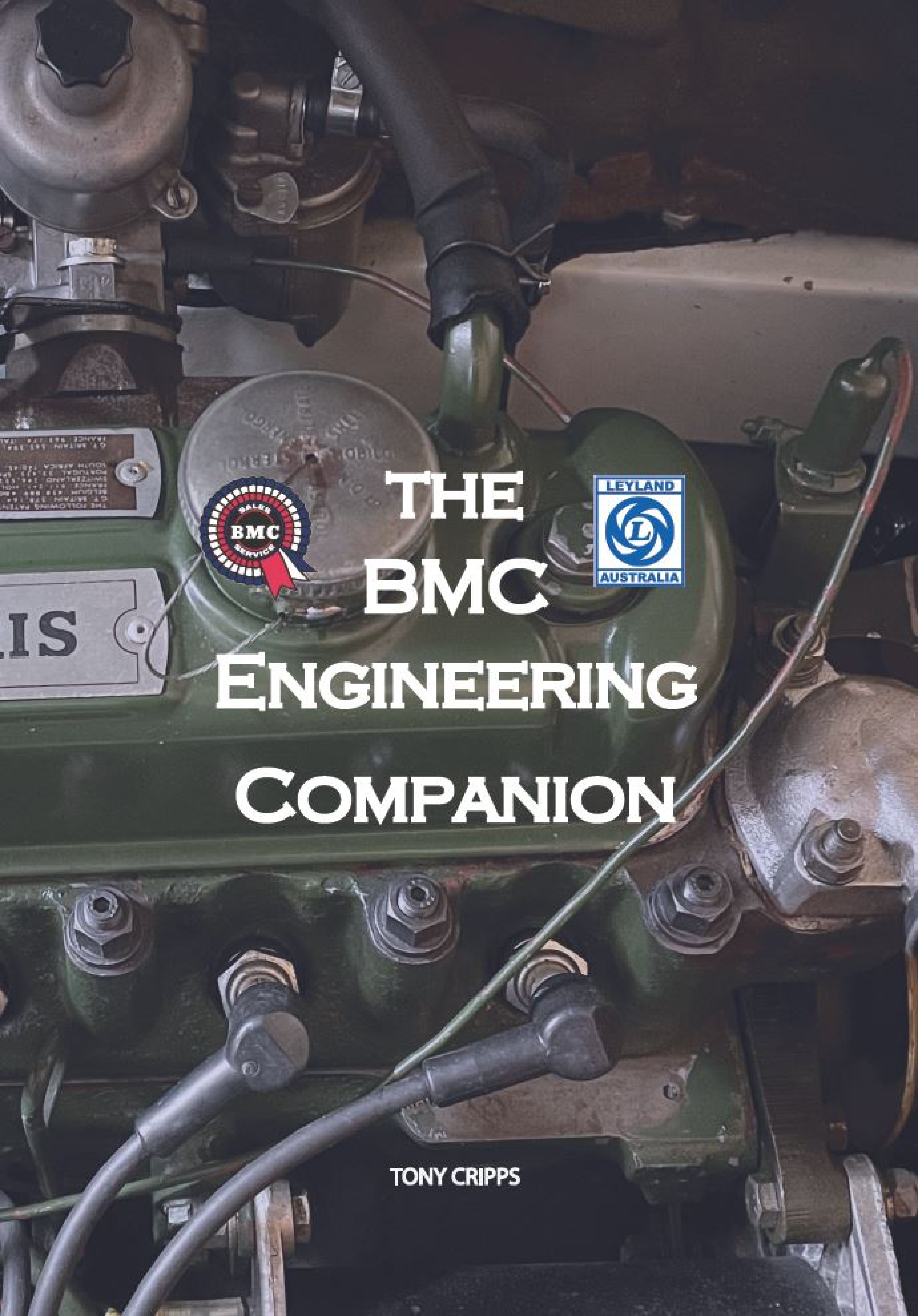

The BMC Engineering Companion

TONY CRIPPS

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between 1st and 2nd, the engine rpm (in the newly selected gear) may fall below that of maximum torque if, perhaps, there is a significant grade being negotiated during a down change.

Since we know that the manufacturer has given bottom gear a ratio of 3.53 (1098cc) and 3.2 (1275cc), we can compute the expected geometrical ratio:

$$g = \frac{1}{\sqrt[3]{3.53}} = 0.657 \text{ and } g = \frac{1}{\sqrt[3]{3.2}} = 0.678$$

For a geometric progression, $s_1 = k$, $s_2 = kg$, $s_3 = kg^2$ and $s_4 = kg^3$, we thus have a comparison in gear ratios:

	1098cc			1275cc	
k	3.53			3.2	
g	0.657			0.679	
	Theoretical	Actual		Theoretical	Actual
s1	3.53	3.53		3.2	3.2
s2	2.318	2.22		2.171	1.92
s3	1.522	1.43		1.473	1.36
s4	1	1		1	1

Table 2.7.3 *Comparison of geometrical gear ratios with factory specified gear ratios.*

These data show that the gear spacing chosen by BMC are not quite in a geometric progression. A graph of engine rpm (gearbox input) vs gearbox output rpm illustrates the significance of the gear ratios.

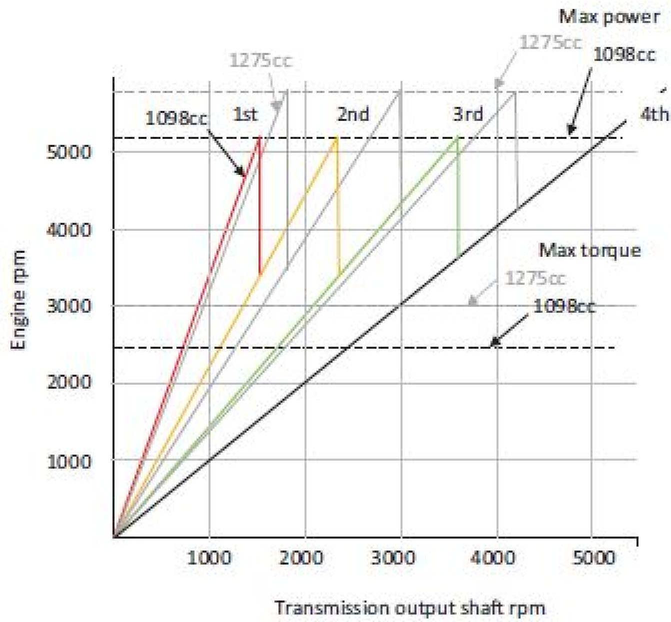

Fig. 2.7.1 *Gearbox ratio characteristics for 1098cc (heavy lines) and 1275cc (light lines).*

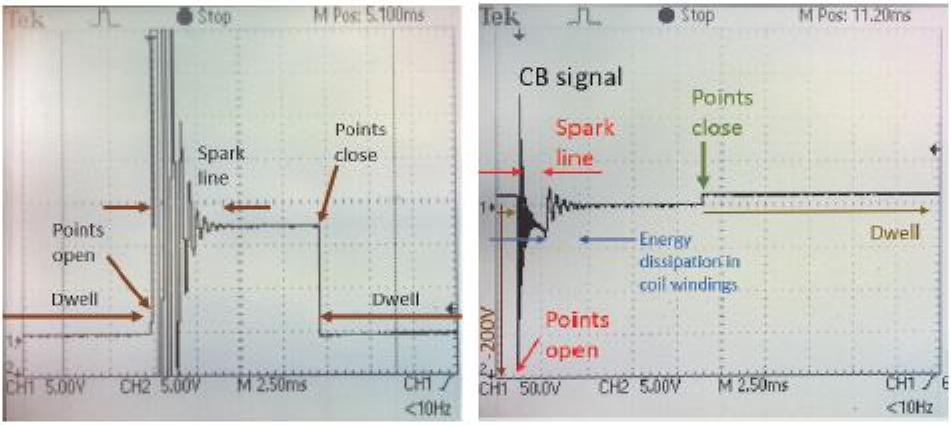

Fig. 4.2.3 Voltage waveform at the CB terminal while engine is running. (a) Negative earth configuration (b) Positive earth.

As far as igniting the fuel air mixture is concerned, it is the spark at the kick voltage that is the most important. The remaining spark during the spark line does not contribute significantly to combustion of the fuel.

It requires more voltage to initiate a spark at the spark plug than to maintain it since the gases in the spark plug gap have first to be ionised. Once ionised, the gases under dielectric breakdown and the voltage needed to maintain the spark is much reduced. The spark continues until there is no more ionised hydrocarbon gas present to sustain the spark current. The spark at the plug gap continues while the magnetic field diminishes and the oscillations due to the capacitor are reduced. The energy in the magnetic field appears as heat at the discharge at the spark plug gap. After the spark is extinguished, the remaining magnetic field dissipates and the potential at the CB terminal (and thus placed also across the capacitor) thus reduces. When the points finally close, a back emf is produced at the primary SW terminal opposing the battery voltage and the potential at the CB terminal goes negative before slowly rising to zero.

All this occurs over a small fraction of a second but can easily be seen on an oscilloscope. But a warning. An ordinary laboratory oscilloscope is usually not set up to handle hundreds of volts (the kick voltage) even though the coil might be powered by 12V, an automotive diagnostic oscilloscope which has the necessary capability to handle this input has to be used.

4.2.3 Ballast Resistor

BMC cars (in Australia) are usually not fitted with ballast resistors that are seen on some inferior makes, but it is worth knowing what they are for. The ballast resistor is placed in series with the primary side of the coil. Its resistance changes with temperature (doubling or tripling its resistance from cold to hot). The resistor is often bypassed by the cranking circuit. What this ballast resistor does is to make the process of ignition more reliable when cranking a cold engine. In this system, the ignition coil is designed to work on about 8 to 10V. When the starter motor is engaged, the battery voltage drops to about 10 V, and so this is applied directly to the coil. The coil is designed to have an acceptable rate of current rise when 10V is applied to its primary. It does this by having a lower primary resistance in its windings. When cranking stops and the engine is running, the

As can be seen from Fig. 7.1.2, the roll centre may be above, at, or below ground level. When the vehicle rolls, the centre of mass shifts position, and the geometry of the linkages also change, and the roll centre thus also moves.

What then are the consequence of the roll centre location?

A low roll centre results in large roll angles. In this case, spring deflection may be excessive compared to suspension travel available and may result in bottoming or topping out against the bump stops. A low roll centre also results in a shift in the position of the centre of mass such that the reduction in force on the left hand side of Fig. 7.1.1 may reduce to zero (lifting of the inside front wheel, and so adversely affecting handling leading to understeer.

A high roll centre reduces the roll angle, but the wheels move sideways with consequent slip at the contact patch which adversely affects cornering.

Manufacturers usually design for a fairly low roll centre at the front and a higher one at the rear.

In a Morris Mini, the upper and lower arms are essentially parallel as shown in Fig. 7.1.3. The roll centre is found at the intersection of a line drawn parallel to the links, beginning at the centre of contact with the road, to the vehicle centreline. In this case, it can be seen that the roll centre is fairly low in relation to the centre of mass of the vehicle. The rear roll centre is drawn through the axis of the stub axles. As is usual custom, the front roll centre is lower than the rear roll centre.

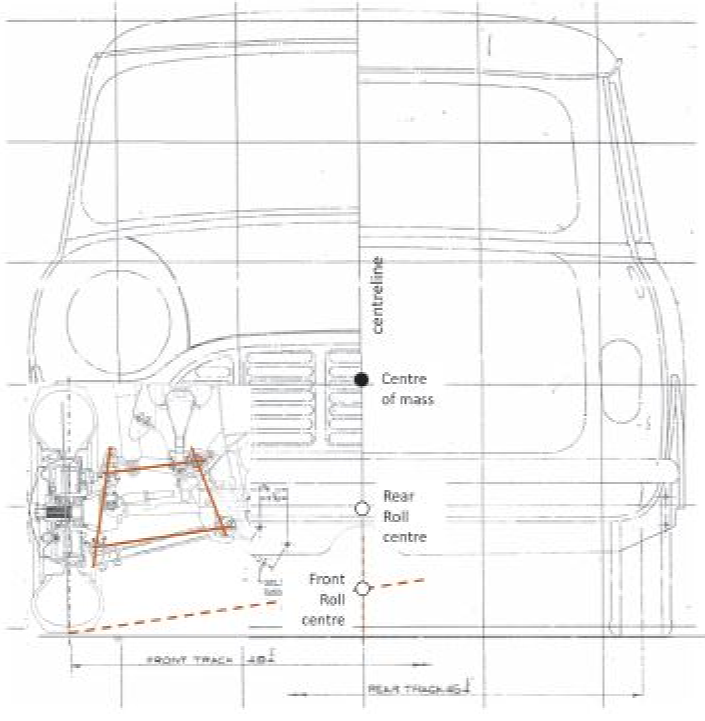

Fig. 7.1.3 *Front suspension detail, Morris Mini.*

The roll axis therefore looks like that shown in Fig. 7.1.4.