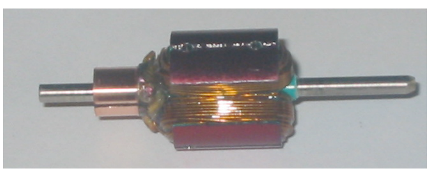
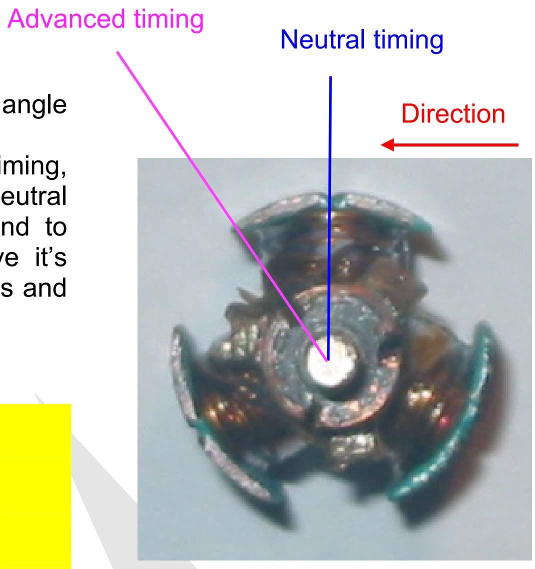
COMMUTATOR TIMING

In this and further pages we are going to explore some aspects of motor design which are taken for granted by experienced racers, but not necessarily understood by newcomers to the sport. There are many dimensions to the subjects covered, but these pages are intended to give an overall introduction to the various aspects.

Commutator timing



The commutator is the part of the armature which picks up electrical power from the motor brushes. Generally in modern slot car motors there are 3 poles to the armature stack and therefore 3 segments to the commutator. As the coil of the stack is energised by the motor brush contacting the specific segment of the commutator the armature will turn due to the magnetic field generated in the armature pole (or wind). The voltage and also the specific wind of the pole (in terms of the wire size and number of winds) determines the amount of force generated.



Commutator timing is defined by the number of degrees of rotational angle at which the power connects to the pole coil prior to its center line.
Many basic motors (Scalextric type, Plafit etc) have almost neutral timing, this has one benefit in that it will run the same in both directions. Neutral timed motors are efficient, however, advancing the timing will tend to increase the full revs of the motor, this does however also have it's downsides too. Below is a table which explains the theoretical pluses and minuses.

Neutral / low timing	Higher timing
Good Brakes	Progressively Less Brakes
Good Torque	Progressively less torque
Cool Running	Runs hotter
	Higher revs

With the ongoing design of slot cars becoming lighter and the use of spray glue and fish tyres, torque is not as high a priority in motor design as it used to be when cars were not only far heavier, but required huge amounts of "grunt" to pull through the rivers of tyre glue on the track. In fact now, with lighter cars, the emphasis is very much on smoothness of the torque curve so the car will not be subjected to adverse torque differentials on acceleration and cornering. Hence the rise of the high timed armature.
With the correct gearing, High timed armatures can represent a benefit not only in straight line speed, and acceleration, but overall drivability of the car as the motor exhibits less "punch".

As technology has not risen to the point of "traction control" in slot cars (for which we should probably be very grateful), the timing of the motor and gearing of the car have become important factors in preventing wheel spin and making a drivable car. A car which is easy to drive is more likely to win a race than a car which is a handful.

Commutator timing also tends to vary between motor types. 8 years ago a High timed Can motor armature would be in the region of 32 degrees, this is now seen as low, with standard timed arms at around 38 degrees and high timed armatures up to 48 degrees (this is however a little extreme and may work on high speed banked tracks, but not on flat, club tracks.) For practical purposes 45 degrees is around as high as one needs to go with C Can motors.
Strap motors are a different ball game altogether. In the days of the larger strap motors timing was usually around 20 degrees, however with the advent of "micro" sized strap motors with 0.300" & 0.250" stack lengths, it was found necessary to decrease timing to ensure better brakes and running temperature, with the average Scale Strap motor arm now running between 7 & 10 degrees.

Gearing is the all important subject when setting up cars with different amounts of timing. It is absolutely critical that high timed armatures are geared so the motor is achieving it's full rev potential around the lap. This is due to the fact that High timed arms produce far more heat and unless they are revving to their potential for a good portion of the time, they will overheat with expensive and dramatic consequences. This is harder to do with tracks that feature one long straight and lots of "twiddly bits" than it is with a track which has a good balance of corners and straights.
For this reason if you are planning to race on tight tracks, it is possibly better to stay with a lower timed armature as this will be less susceptible to incorrect gearing, the same goes for a tight track with one long straight, as if you gear the high timed armature to rev out around the corners, you will end up with a car which is all revs and no go on the straight or, conversely, a totally gutless car which you can fry eggs on at the end of the second lap!. Aim to gear the car so it is at full revs on at least 30% of the track running length
This is not intended to put you off using high timed armatures, only to tell you what to expect. There is never one armature / Motor / gear ratio which will be ideal on ALL tracks. Listen to what the more reliable regulars are using and this is always a good baseline to start at in terms of gearing and motor specs.

If "economy" has a high priority in your racing, also realise that Higher timed motors are revving faster and hotter which means more bearing wear, hotter magnets that go off quicker, and commutators that wear faster. So now you know - the choice is yours.

Checking the commutator advance using a timing protractor.

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