**Controlling micro motors in model locomotives.**
Having spent over 12 months developing chassis around micro motors I have drawn several conclusions.
 Firstly, micromotors are fine provided it is fully understood to be a very different drive unit from the familiar iron cored motor - Mashima 1015 etc. Micro motors have enabled us to scratch build diminutive models otherwise impractical due to their size and in many instances these can be built 'cab free'. My particular interest lies in 009/00n3 industrial narrow gauge locos so torque not speed is the main criteria. Being 3 pole motors these motors have little torque at low speed and as these motors run at a high maximum speed high gear ratios are required to achieve useable torque at low speed. Fortunately Nigel Lawton came to the rescue here with his miniature belt drives which enables us to obtain the required primary reduction within the limited space available.

PWM does not help - based on my experience and open to debate. Not only does PWM have little effect it can cause premature failure of these motors. These motors are coreless and the absence of the iron core means there is insufficient back emf to provide feedback control. Many 12 volt PWM controllers output peak pulse voltages of over 20v, these pulses are short, for an iron cored motor are limited by the feedback and present little problem due to the cooling effect of the iron. These small motors are generally designed for 6v operation and commutation performance and wear is calculated at this voltage, increasing the voltage increases arcing and thus wear rate at the commutator dramatically as can be seen when running a motor in a darkened room.

Running a 6v motor on a 12v controller requires some form of current limiting. A resistor can offer some protection and has proven quite adequate for many users particularly running just end to end or under light loads. For continuous running or exhibition running, especially where guests are permitted to control, and to protect against stalled currents I prefer more positive protection.

As my proposed layouts will all run micro motor powered locos I can consider using a purpose built controller. Below is the a fairly simple DC current limited controller circuit I am using based around the current limiting configuration of the LM317 IC. With this I can set the maximum current to 50ma (for a 6v 6x10 motor) and remove the current limiting resistor. Results thus far running my LB on the test track look promising, certainly offering better low down speed control and power.
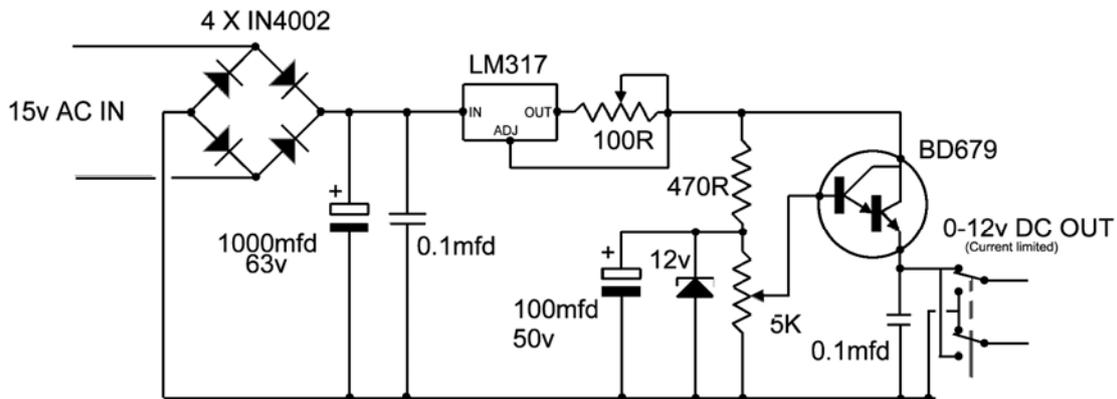
Current limited controller for coreless micromotors