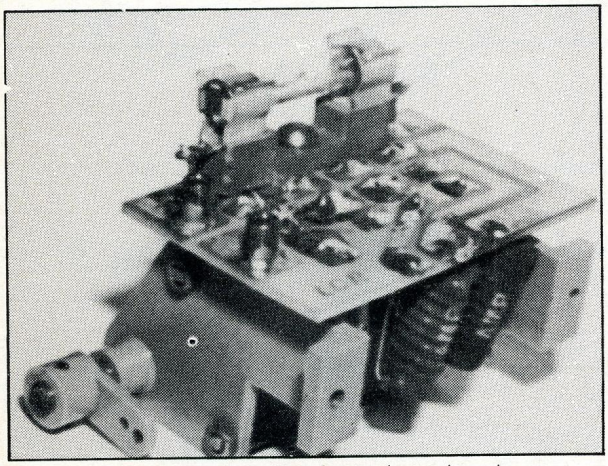
Speed Controllers for Electric Cars

AMERICAN MADE electric cars (and indeed cars made in Japan for the US market) make use of a resistor type speed controller which is basically a ceramic core on which the resistance wire is ribbon wound or a smilar flat plate serving the same purpose. A wiper is attached to a servo disc and wipes across the wire windings in an arc to vary the speed. Many of these ceramic type controllers are exactly the same as those used in hand held speed controllers for slot racing, so that the arrival of rc electric cars must have been a boon to those who had kept their slot car stocks!

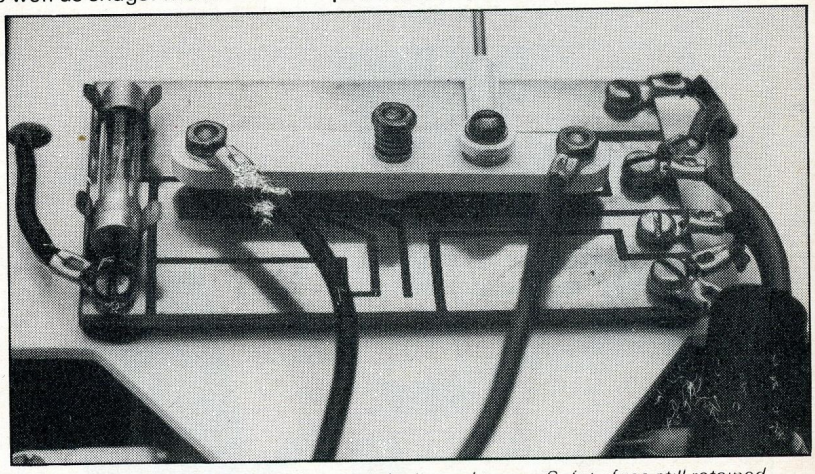
British and European kit makers decided almost from the start to use a printed circuit board which again used a variety of wiper to move across it and control speed. The very first British kit used a series of cams to control their cars but it was less efficient and more expensive that a pc board. Early examples were quite crude and tended to burn out in part by unintentional shorting, but, by dint of continuous experiment and improvement, they are now very reliable.

A third type of controller is the transistorised proportional little 'black box'. Cost is rather high but it has certain advantages as well as snags. Main advantage is that a separate servo for speed control is not needed so that the cost of this can be offset against cost of the controller (amounting to more than half its cost!) Disadvantage (shared with the ceramic type resistor) is that forward speeds only are possible in the standard models.

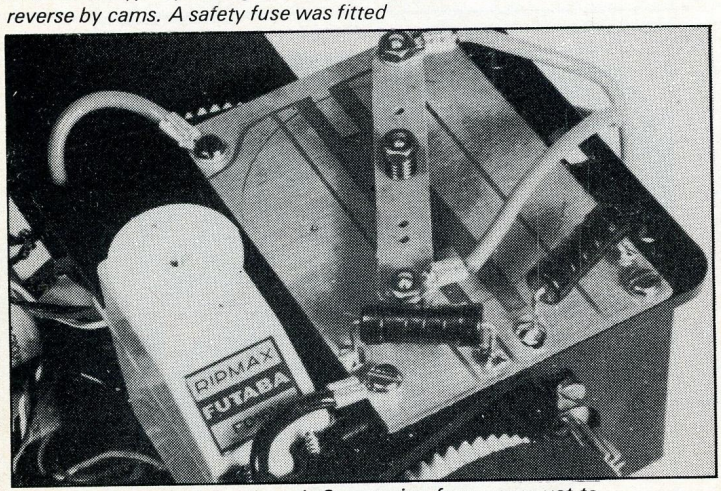
The printed circuit boards provide both forward and reverse speeds — this latter can be very useful if you get into a tight corner. Some of the very latest electronic controllers do permit limited reverse, but the cost goes up again. In the same way it is possible to modify a ceramic type to give a limited reverse facility.



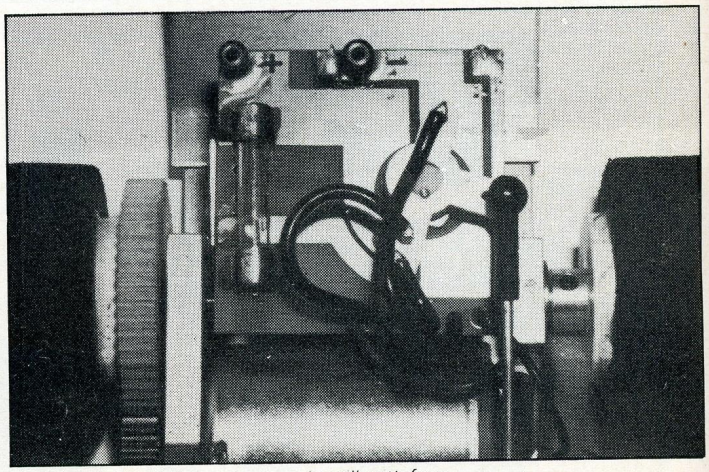
First British type operating three forward speeds and reverse by cams. A safety fuse was fitted



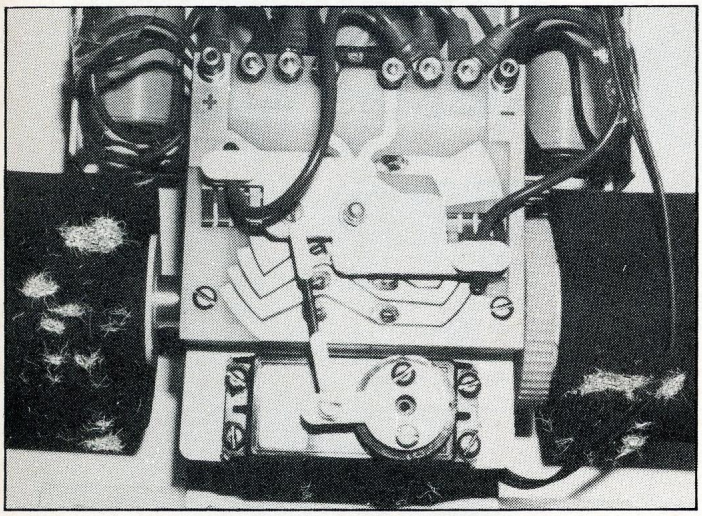
First of the printed circuit boards with quite limited range. Safety fuse still retained



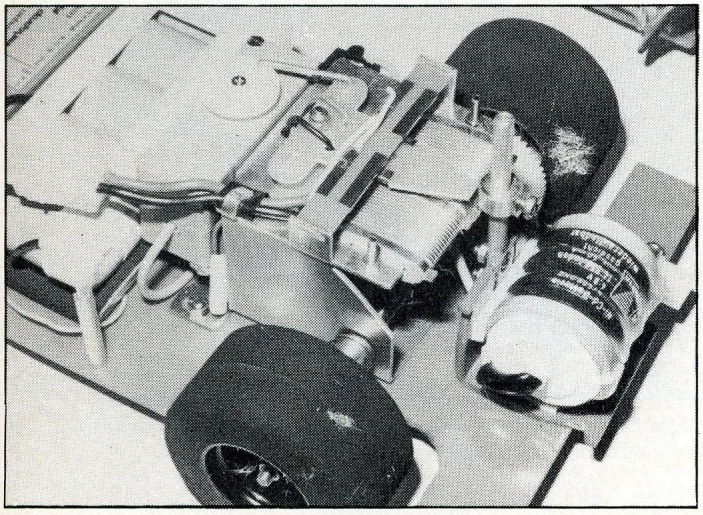
A rather more ambitious board. Connection from servo yet to be made into any one of the three holes in lever. Note additional resistances coiled on right.



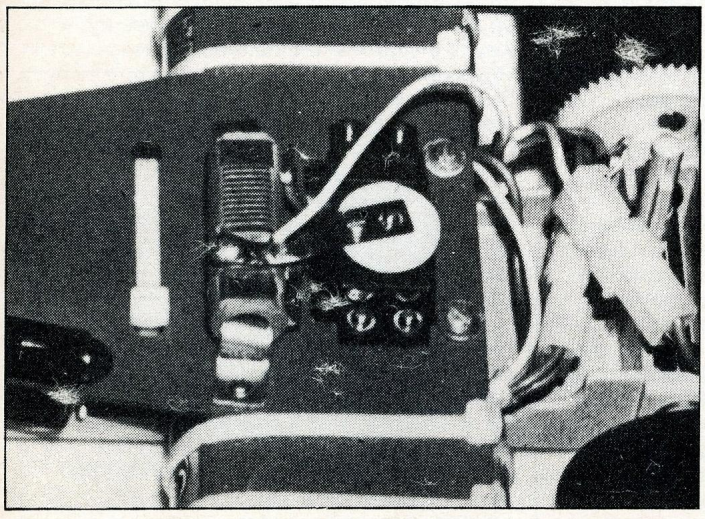
Another fairly early version: again still with fuse



Circuit board with choice of 4- or 6-cell operation and six forward speeds plus reverse



Japanese style ceramic core wire wound. Flat shape allows more contact area



Swedish version with round ceramic core, placed directly on radio plate with underslung nicads

How the Controller Works

If you switch on an electric motor it goes flat out until the battery to which it is connected has been exhausted. By putting a controller in circuit with the motor you are preventing this flat out performance. The slower you go the longer the battery will last; the faster you drive the shorter time you will have.

A six-cell ni-cad has six cells each of 1.2 volts, or expressed another way 1.2 amp-hours. That is they will each supply 1.2 amperes for one hour. The energy storage in a six-cell is six times this of course. However, you will not be using it at this rate but probably at about 6 amps or more so that instead of an hour's running you will be down to 10 minutes or less.

If you think of your domestic electric light bulb the higher the watts marked on it the brighter the light and the more current consumed. This is why the careful householder adjusts the brightness of his lights to his needs — it helps keep the bill down!

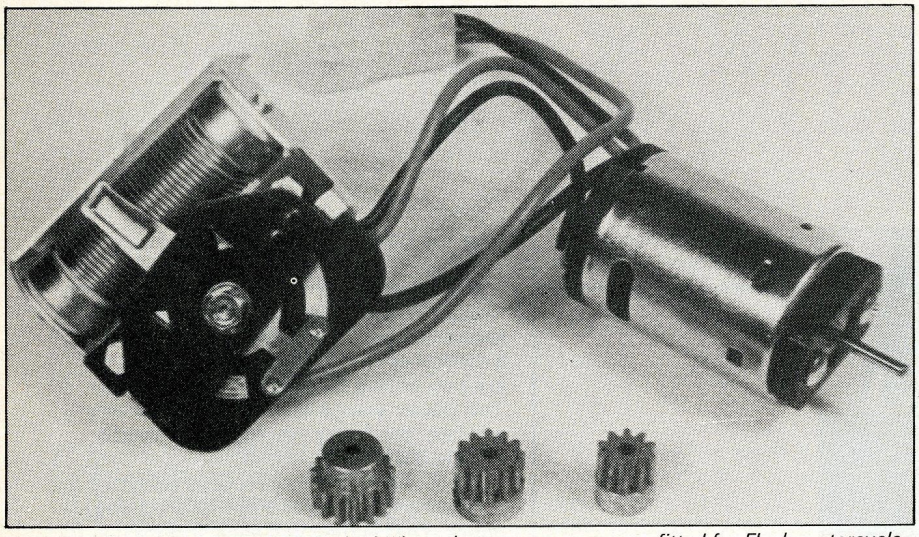
When you block the passage of current with your controller by making it pass through a winding of resistance wire this blocked current must go somewhere — it is dissipated in heat as you can easily feel. There is, alas, no way of sending it back unused to be stored for when you need it! **All** speed controllers waste this current in heat losses, some more than others.

Ceramic Wound Resistors

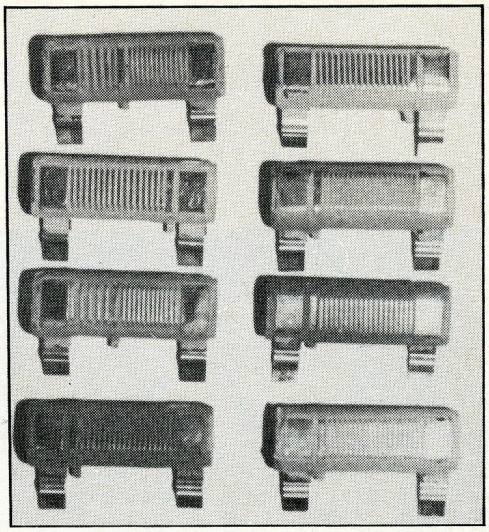
Experts will tell you that in theory this is the best type of controller to use, **provided** they add, it is perfectly assembled. It can have low heat loss and can be changed to suit particular types of circuit layout or track surface.

A colour coded range of these resistors is available (from Parma amongst others). Lower ohm resistors give fast high speed response, but don't do so well at slow speeds. Higher ohm resistors give better slow speed response but are not so good in response at high speeds. They must be kept clean and the button on the swing arm must be in good contact with the windings. A fine emery cloth will serve to keep the resistor clean and current passing. With this type of controller you must anticipate braking or accelerating since there is a degree of time lag. This can be helped by shortening the wiper arm throw or by using servos with a fast response. Another way, with brake band type resistors is to reverse them — using the shorter brake band as your speed band and vice-versa.

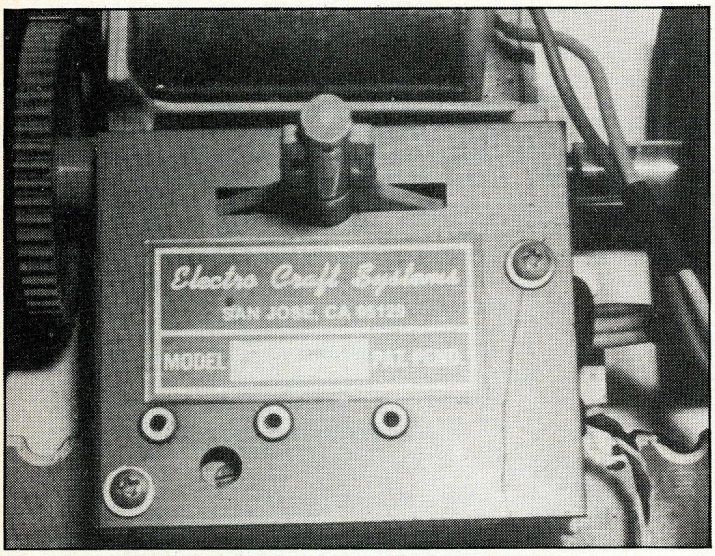
You can also obtain (Jomac) an adjustable brake pot which can be used to adjust your maximum braking level. It can be used with any resistance type speed control system.



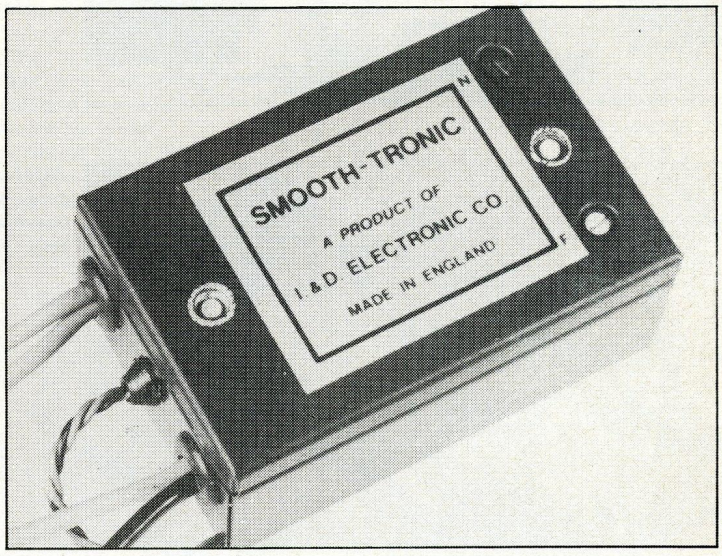
Wire wound ceramic core with attached wiper plate to go on servo as fitted for Eleck motorcycle. Note also motor and choice of gear ratios.



Range of resistors from Parma, USA. Note variety of windings. Wide spacing indicates braking area. Available in various ohmages.



Electrocraft electronic proportional speed controller. Very thin and designed to fit on Jerobee chassis pillar. My first and still going after nearly four years.



Smooth Tronic very neat and matchbox size. First British made on the market and integral part now of Spectron kit car.

Printed Circuit Board Controllers

This type has the virtue of a built in reverse facility. As flat plates they are not difficult to install. Control methods vary slightly. They may have wiper arms attached directly to the servo disc or there may be an arm extending over the pc board pivoted about the middle to which a control rod from the servo disc is attached. This would seem to provide the best contact with the least strain on the servo.

According to their design they can have a number of different speeds (gears shall we say?) limited by the size of the pc board. Up to six gears (or subdivisions of the board) is quite practical without too cumbersome a plate. There is always the risk of burning out a gear (the metal of the pc board is very thin) but that need not stop you — you just jump the non working gear. The beauty of these multiple gears is that speed is smoothly and progressively controlled thus helping to get the most out of each battery charge, and also by the very smoothness ensuring a minimum of unrehearsed slides on a too slippery track.

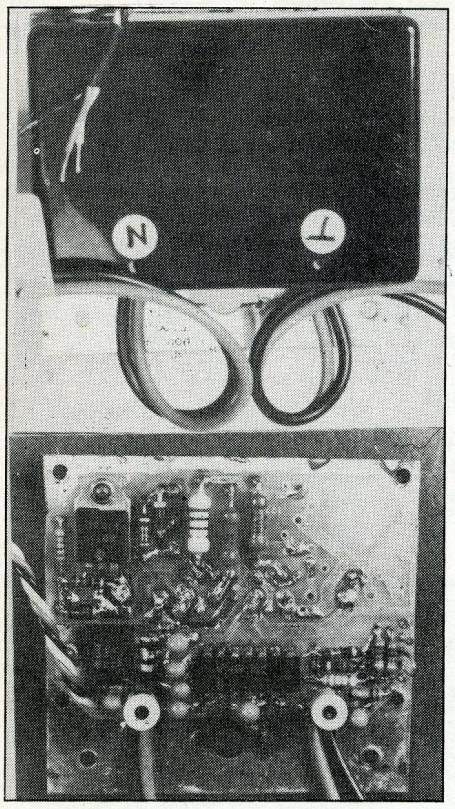
Electronic Speed Controller

Finally comes the electronic speed controller. This is normally fully proportional forward speed and dynamic breaking, plugging into receiver with a regulated 5-volt supply taken from the motor ni-cads which eliminates receiver battery and throttle servo. The latest types also offer the additional facility of reverse.

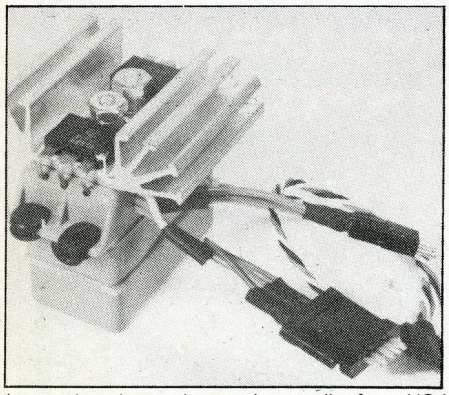
The package comes in a stout container with detailed installation instructions (not difficult) and should last out a number of cars. If you unscrew it you will find a complicated pc board layout. Do not fiddle with it unless you are nearly good enough to design your own! According to make there will be limited adjustment that can be made without opening the little black box — this should content you.

The first one I had was the Electrocraft from USA which came with my Jerobee package deal. Unfortunately it was wired up so that my throttle went the opposite way to my normal left handed usage. However, Richard Gammon, of Smoothtronic and Spectron fame, was visiting and he saw that the expert maker had provided an alternative wiring change on the pc board and in a couple of minutes had effected the change with a tiny little iron and it has worked right way round for me ever since. But I would never have dared to do it myself — let alone know which wire to move!

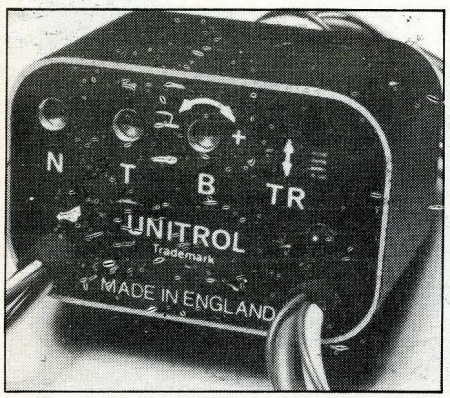
Richard's Smoothtronic was the first electronic controller to be readily available over here and has continued to be in demand. It is included in the Spectron car kit made and marketed by his firm I & D Electronic Co., now of Peterborough. It could be claimed as the first British kit that could regularly be expected to win contests 'straight out of the box'. The



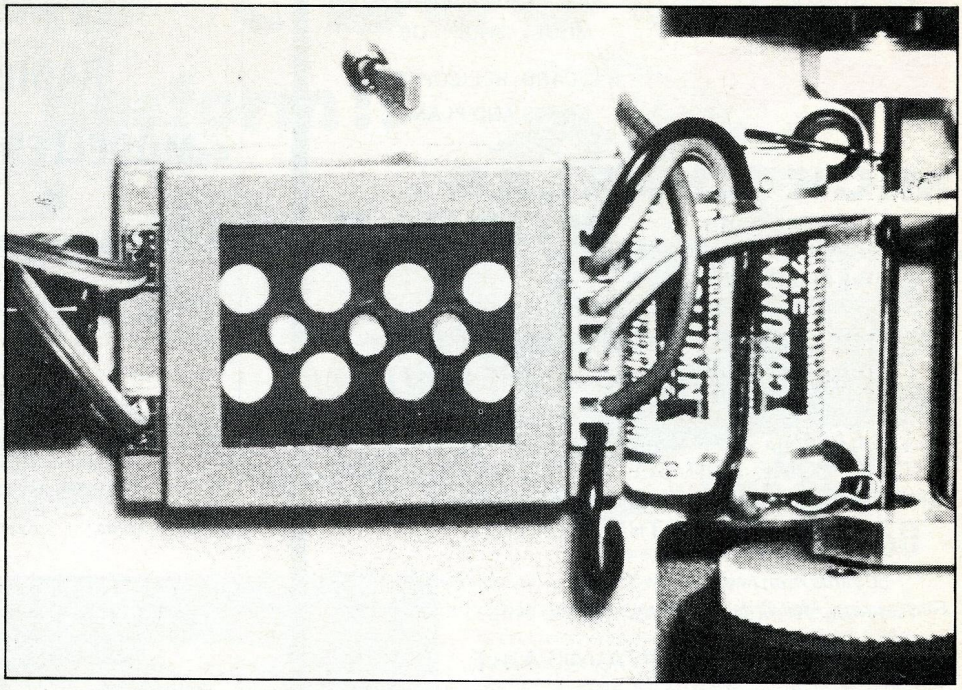
Nick Adams Demon, shown as box and internal layout. Originally made for clubmates, now being produced in three figure monthly output for Gemini kits.



Interesting electronic speed controller from USA by JoMac. Fins are for cooling. Size is same as servo case (perhaps even same moulding).



Another British unit, small and neat by Unicorn Electronics.



Clever experimental unit by MacGregor Industries. Not commercially produced as yet. Two little batteries operating reverse not accepted for official racing.

smooth tronic is about the size of a matchbox.

Next in line of public appearance — this is not intended as a which is the best list! — came Nick Adams' Demon I. Nick is Chairman/Editor of the now famous **Ally Pally Newsletter** as well as a founder member of the Ally Pally Electric Car Club the first London r/c electric car club with its original circuit on the high speed skating rink at ill-fated Alexandra Palace. The Palace authorities had already decided they could let the hall at better rates than the club paid, so a move had already been made before the fire. The original Demons were made on a one-off basis to order, mainly for club members and done as a spare time occupation, now Nick has teamed up with Phil Greeno and more are being made for sale and insertion in the Gemini car kit designed by Phil and as car fans will know an outstandingly successful kit, also 'straight out of the box' winner quality.

Another very interesting electronic controller comes from L & M Electronics. This is rather squarer than the others being 2¾ x 2½ x ¾ in in size. It enjoys a limited form of reverse in standard form. Pulling back the stick through the neutral point you come to reverse, wait 3 seconds and reverse operates. As soon as the stick is moved back to neutral the reverse effect ceases and forward motion is resumed. It is really intended as an occasional 'get out of trouble' facility — quicker than a marshall would move the car in a race perhaps!

The usual external access to trimpots is provided. I got mine from Brian Field of The Red Baron Models in Enfield.

Unicorn Electronis of Coventry have brought out their Unitrol (I saw it first at the National Championships in Bradford in 1979). This is another almost matchbox sized outfit 52 x 33 x 32mm dimensions. It enjoys both forward and reverse speeds — the latter with no delay. Considerable power adjustment is possible to suit the skill of the driver; on loss of radio signal brakes are applied by a failsafe unit.

MacGregor Industries whose radio outfits will be well known have also come mildly into the market with experiments in this area. They showed a prototype controller at the Nuremburg Toy Fair which followed quite different lines with the reverse function operated by two mini cells. However, this idea has not, I think, been pursued since it was pointed out to them that these extra mini cells would be barred in racing by the existing rules. A pity perhaps since it looks a very neat job and the extra batteries are insignificant in size ... but rules are rules.

From USA comes the Jomac controller which has the virtue of novelty. It is designed to be the same size as a servo and uses a similar type of case. It has an outside (and outsize) heatsink with fins such as are seen on ic engines which should give adequate cooling. It works on a feedback system where it adjusts car speed to that signalled by transmitter. It also has adjustable torque which means that it can be set to suit track surface — an asset with very slippery floors. Brake is also adjustable. It appears to operate only with Jomac receiver.

The electronic controller range do use rather more current than other forms of speed control, but this extra is really so small regarded as a percentage of power available that it can be ignored in making your choice.