

# All you need to Know...

This month we are going to look at ways of keeping our motors in tip-top condition. This may sound like just another boring article repeating the same old facts, but I hope that there will be enough information to give everyone a source of inspiration.

Most maintenance is simply a matter of common sense and the occasional bit of effort. Whatever you do, you should make up your own minds, as there are a certain amount of 'pork pies' put about by people interested in selling new motors.

## Routine Testing and Diagnosis

The first thing to do is connect the motor to a pack of nicads and listen. If the motor revs freely, and sounds smooth, then it is likely that all it needs is a good clean. If you are testing a standard class motor, then cleaning is all you can do, as you are not allowed to dismantle the motor.

Next you should check the commutator for excessive brush bounce, as detailed below. If it is poor, then you will need to have the commutator

Lesro to name but a few.

If the commutator was showing appreciable brush bounce, then it will need a true. This can be accomplished by sending to the people listed above, although these days, there are numerous portable commutator lathes available, and it is quite likely that you may have access to one of these. If used properly then these can give very good results, as described in one of the later sections.

endbell to remove the majority of carbon dust and dirt, and then use a brush to clean away the remaining dirt. This should get rid of the majority of muck, but if you want to clean more, then you should wipe with motor cleaning spray and a cloth.

## Cleaning the Commutator



Armature cleaned with motor spray.

# Electric Motors

## Part Four

### General

If there is one area that is crucial to the way in which a motor performs, then it is the brush, and commutator contact performance. A good contact here will give your motor all the "stunk" it can supply, but a poor contact will strangle the performance and possibly damage the commutator or brushes.

A good motor will have virtually no brush bounce, and the brushes will be free from any deposits of carbon or "gunge" which can limit their resistance. If you can maintain good contact, then you can deal with 98% of all motor problems. All future references are to the Yokomo/Sagami style of motor with external brushes, but the same procedures, modified accordingly would equally apply to other types of motor.

On a safety note, be careful when using motor sprays to clean components. Apart from the damage its CFC's are likely to do to the ozone, they must be used in a well-ventilated area, as they normally contain 1-1-1 trichloroethane (or some derivative) which can be dangerous if used without caution. In addition make certain that it doesn't contain any lubricant, for example switch cleaner, as this will reduce the performance of the motor.

"skimmed", or "trued". If it is OK then all you need to do is give the motor a clean as described later.

### Checking for Brush Bounce

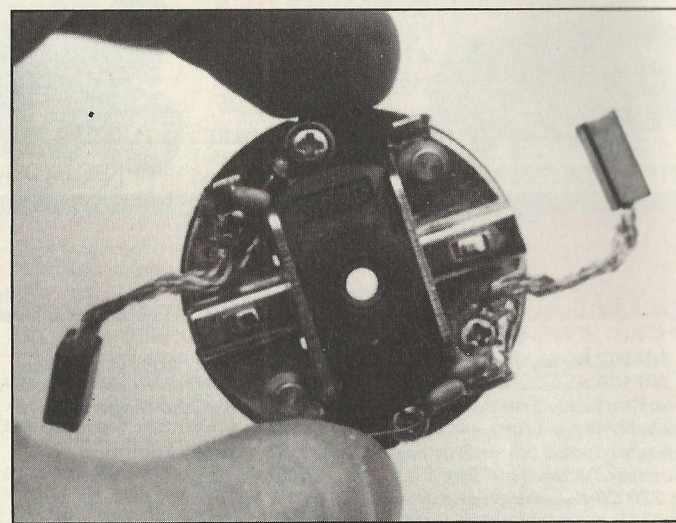
With the motor connected to a pack of nicads, lightly touch a small allen key or jeweller's screwdriver on the top of the brush (see figure 1), to feel if there is any brush bounce.

Feeling for the brush bounce is simply a matter of practice, but a bad motor is very easy to detect, as the allen key or screwdriver will vibrate noticeably, and practically try and jump out of your hand!

Another sign of brush bounce may be an increase in revs when the allen key or screwdriver is touched to the brush.

After checking for brush bounce touch the allen key to the metal can of the motor. In this way, you will be able to get a feel for the balance of the armature as well, as this will also be felt as a vibration.

If this is significant, then it may mean that the vibration felt at the brushes was probably caused by the poor balance, rather than the out of true commutator, and it should be sent off to be re-balanced. This can be accomplished by sending the motor off to a variety of outlets, e.g. MG Model Products, Parma UK Ltd, or



### Routine Maintenance and Cleaning

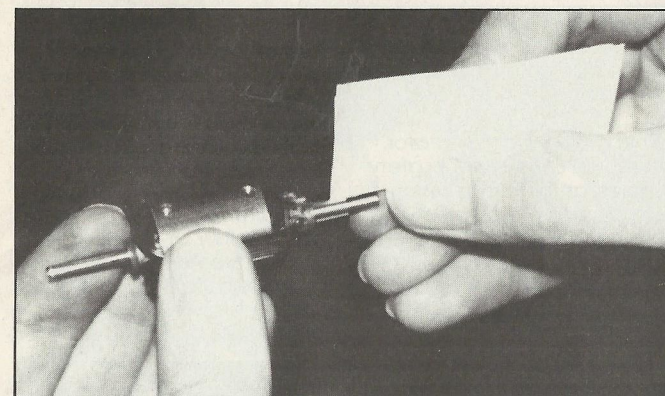
#### Modified Class

Mark on the can, or take note of how much timing was set on the endbell. Remove the brush springs and pull the brushes out about 2-3mm. Loosen the two screws holding the endbell on, and rotate until it comes free. Carefully remove the endbell ensuring that you do not lose the washers used to space the armature. Remove the armature, again making sure that you do not lose any of the washers.

Lightly tap the can and

Spray the commutator with motor spray, and using a cotton wool bud, gently rub at any marks. If they do not want to budge, or if the commutator looks badly eroded near the brush slots, then you should consider re-truing it, even if the test for brush bounce was OK. If the commutator looks OK, but there are "stubborn" stains you can use a rubber comm cleaning stick to polish the commutator. The best way to do this is to spin the armature in a drill, and lightly rub the commutator with the comm stick. Try not to over do it, as they can be very abrasive.

Lastly, clean the slots using some thick paper, or thin card,



Slots cleaned with paper.

by rubbing up and down the slots between the armature segments, and once finished spray again to ensure no dirt remains.

### Bearings

These are best checked by spinning the armature in each bearing. If they feel notchy, stiff or noisy, then they will need to be cleaned. The best way to do this is to remove them from the can and endbell, and flush liberally with motor cleaning spray or lighter fuel. If they cannot be removed, then they can be cleaned in situ using the spray. However, be very careful not to force even more dirt into them from inside the motor. After cleaning, do not forget to apply a light oil, and re-check for freeness.

If they are still bad, then they will need to be replaced. This is not a particularly easy task, but do not despair, since there is a special tool available that will allow them to be exchanged without damage. This is made by PK Corally, and should be available through Intronics.

From my experience, I think that it is probably best to avoid cleaning the bearings when they are new, as the original grease will act as a barrier to any incoming dirt or dust. Once you have flushed away this grease, then they will need to be cleaned on a regular basis, as the dirt will penetrate more easily.

### Brushes

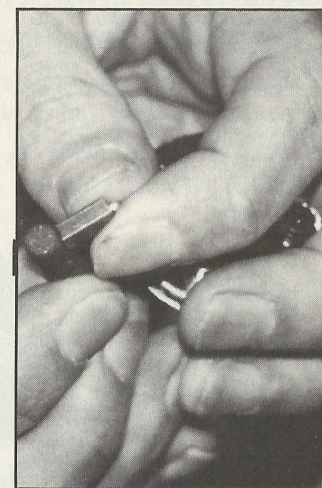
Brushes are very important to the way in which a motor performs, and unfortunately should be treated as "disposable". If you think that the motor has gone "off", then it is always a good idea to start by looking closely at the surface of the brush, as this can tell you a lot about the

motor.

For example you can tell if the alignment of the brushes is out, by looking carefully at the way that they have worn. If the performance was not good, and the brushes look bad, then there is obviously a problem that needs investigating.

### Maintenance of Brushes

Remove the brushes from their holders, and look very carefully at the brush surface. If they look "clean" and slightly "wet", then they are working well, and should be left alone, or lightly cleaned with a dry cotton wool bud. If they look "dull" and "smoky", then it is a good idea to clean them with a cotton wool bud soaked in motor cleaning spray.



If there is build up of any matter, then this needs to be removed, or the brush replaced. The best way to remove this build up is to use one of the rubber commutator cleaning sticks, and rub across the surface of the brush. However if you always suffer from such build ups, then I would suggest that you think about changing to another type of brush, as this can be a

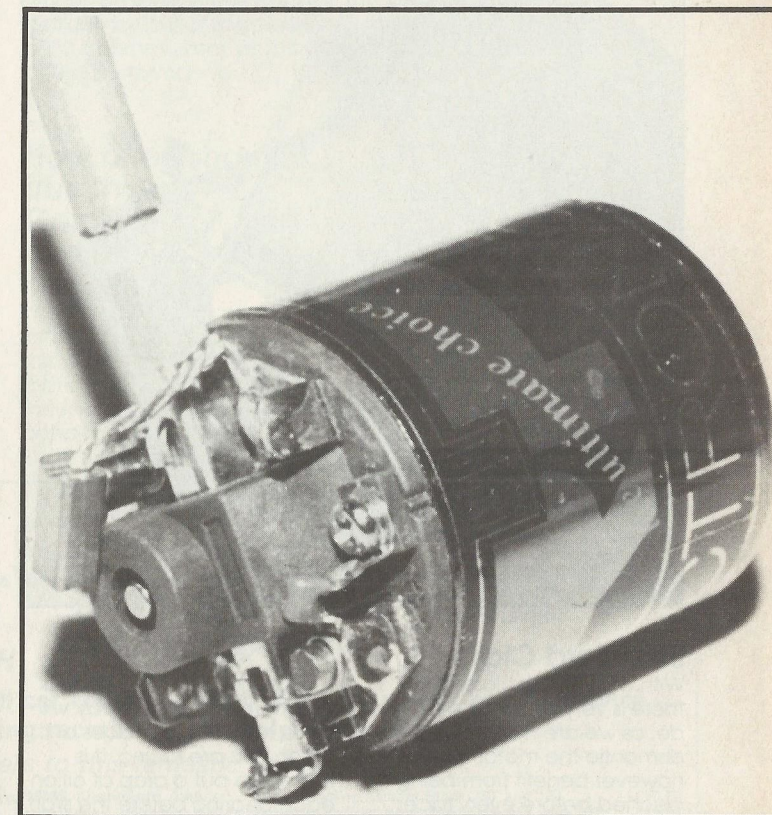
major problem with some brushes.

If the brushes have changed to a bluey/purple colour, where they have got too hot then they should be replaced. This is because there is the danger of the lubricant inside the brush having been burnt off, and this may cause later damage to the commutator due to the increased friction.

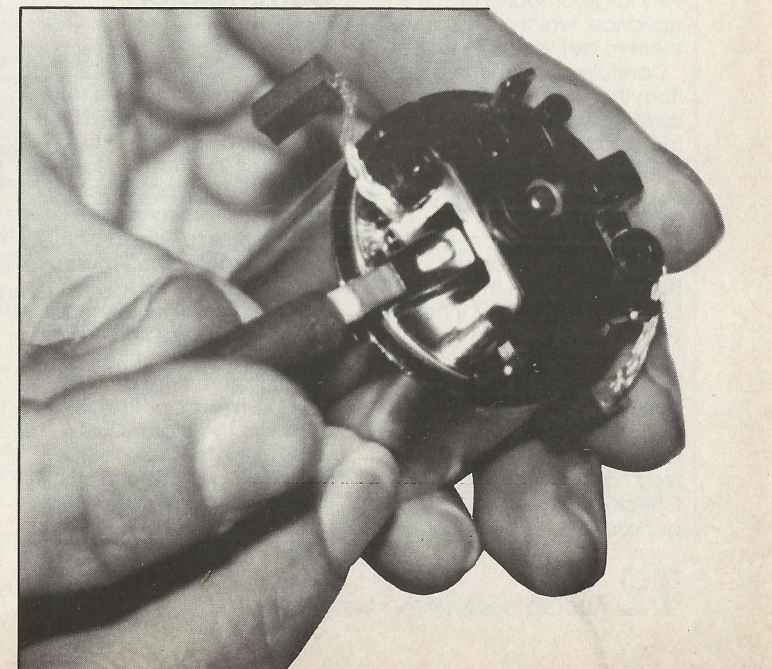
If they have noticeably worn, then again they should be replaced, as a worn brush will not locate properly in the brush holders.

### Re-assembling the Motor

Before replacing the brushes in the holders, clean the brush holders with a cotton wool bud, soaked in motor spray. Then insert the brushes into the holders, feeling carefully for tight spots. These will need to be removed, either by removing any burrs on the brush holders with a small file, or by filing the brush slightly. This will stop the brush from sticking in its holders.



Abrasive rubber comm cleaning stick — invaluable for cleaning commutator and brushes — especially in standard class racing.



The springs should be checked for equal tension, and set up according to the type of track. Generally a track that doesn't require a high top speed will benefit from having very firm springs. Conversely a track where there is a long straight would work better if the springs are loosened off slightly.

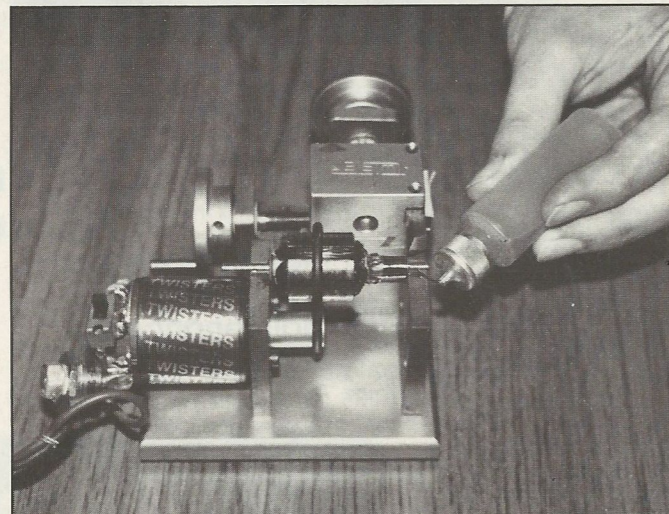
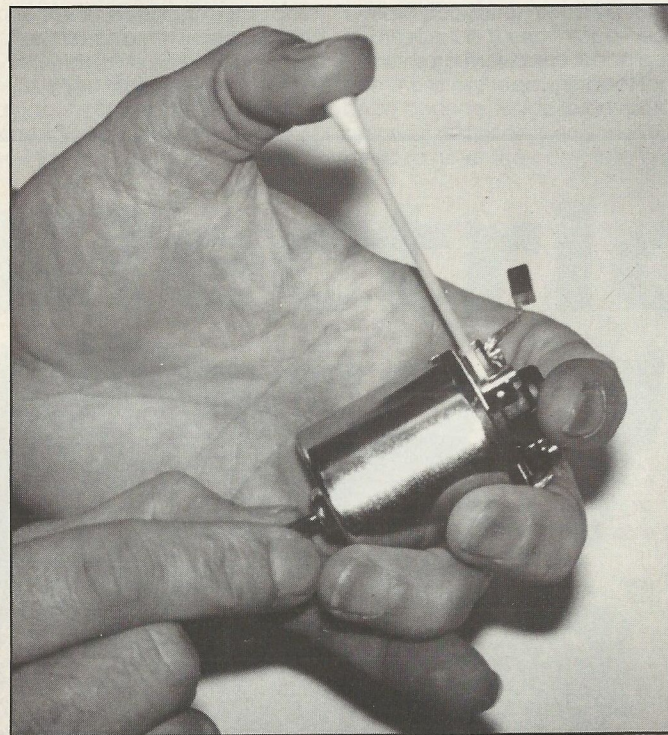
modified motors, and then insert into the holders. It is worth noting that the brushes fitted to a standard class motor are probably not very good ones, and that you may want to replace with a higher performance brush.

Check that the spring tension is OK, and the brushes are not binding in the holders,

causes of the damage. In this way you can evaluate which are the best brushes to use, how much advance is best etc.

When truing a commutator, you should always wear safety goggles, as there can be quite a lot of swarf thrown up while making a cut. Best finish is normally obtained from a diamond tip, as most other tips wear within about five armatures.

Switch on the lathe, and gradually move the tip, until it just starts to cut the commutator, and then cut across the commutator from left to right. Wind back to the left, so the tip is no longer touching the commutator, and switch off the lathe. Look very carefully at the commutator to see how much more needs to be cut off. For coarse cuts, wind in 2-3 graduations on the tip, and for



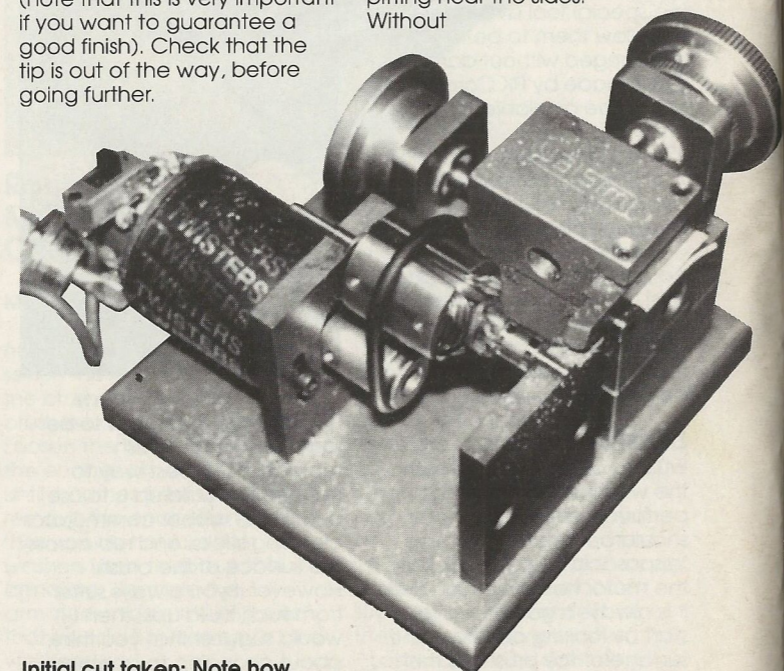
### Method

Place the armature in the lathe, and put spacing washers at each end of the shaft, ensuring that there is absolutely no play, which could result in damage to the tip. Connect the drive band to the armature, and put a drop of oil on each end of the shaft (note that this is very important if you want to guarantee a good finish). Check that the tip is out of the way, before going further.

Armature fitted into lathe, and packed to fit.

fine cuts, 0.5-1 graduation will suffice.

Repeat the above procedure, until it is a clean cut all the way across the face of the commutator, including any damage or pitting near the sides. Without



Initial cut taken: Note how the commutator has worn with use.

### Standard Class

With a standard class motor, there is very little that we can do, as we are not allowed to dismantle the motor. They do however benefit from being cleaned before every race, especially at an important meeting, as most modern standard class motors have very large amounts of advance, which can cause them to get very dirty inside.

Carefully remove the brushes from their holders. Using motor spray, liberally spray the entire motor through the brush holder slots, to flush out all the dirt and carbon from the motor. Leave to dry. Now insert a rubber comm leaning stick through the brush holders, and spin the armature by hand (sometimes it helps if you leave the pinion on).

When you are certain that the commutator is as clean as possible, flush again with motor cleaning spray, to remove any bits of rubber that may have been left behind. Check and clean the brushes, as described in the section on

as per the modified section. Lastly, do not forget to give the bearings a drop of oil, as the motor cleaning spray will have removed all traces of it. When you are racing, it is normal to put a drop of oil on each bearing before the start of each race.

### Truing a Commutator

If there was any detected brush bounce, then it is time to give the commutator a true. We shall look at the steps involved, using one of the excellent "Twister" mini lathes. One important point before we start, is that for one of these lathes to work properly, then the motor shaft must be perfectly true, and free from any "burrs", as it runs in plain bearings on the lathe. Never use a pair of pliers to remove the armature from a "stubborn" can, as this can damage the motor shaft making it impossible to true. While truing a commutator, it is a good idea to try and gain information as to the likely

thick paper, to gently rub away any swarf or fine burrs along the edges of the slots. Do not be tempted to use a scalpel after removing the armature from the lathe, as this will raise a burr, negating the effort you have just expended. Spray again to finally ensure that it is perfectly clean.

If you have followed the above procedure carefully, you should have a perfectly round, and clean commutator, ready to be replaced. As a final note, when you reassemble, make certain not to put fingerprints on the commutator, as this will affect performance.

### How often should I true the Commutator, and can I overdo it?

I normally true my armatures after every six or seven runs. In this way, I very rarely take more than 2/3 fine cuts, and the motor is kept in top condition all the time. If this

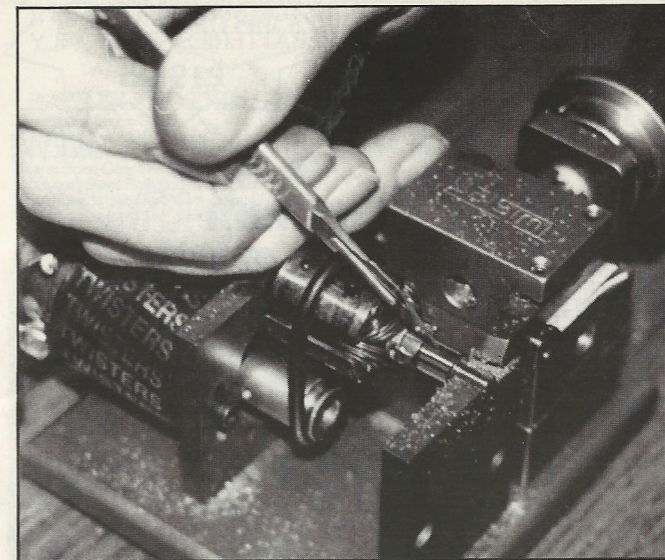
was left to about every 15 runs, then I think that the drop in performance would just start to become noticeable. Any more than this, and the motor will not be running at its optimum, and that after 30 runs it would be starting to suffer.

Truing them fairly often does not mean that you will get less life from an armature, as the amount that needs to be removed is very small. If they are left for a long time, then each true will need to remove a much longer amount.

When you true the commutator, it is always a good idea to change the brushes at the same time, so that they are given a fresh start. However, if the brushes are working well then you can replace them less often, for example every second true would suffice.

This concludes the series on Electric Motors. Next month we will start looking at ways of waterproofing various parts of the car, to cope with typical British weather!!

DAVE GALE



removing the commutator, carefully remove any burrs from the slots between the segments, using the back edge of a scalpel or modelling knife. Depending on the size of the burr, you may need to be quite firm, but it must be done with care, as you must not cut into copper, only remove the burr.

Now give the commutator a

Slots cleaned by scraping with back edge of scalpel.

fine finishing cut, to remove any burrs that may have been added in the above process. Carefully remove the armature, and spray with motor cleaning spray to remove any oil, dirt or copper turning. Now clean the slots using a piece of thin card or

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