

PRO-CAT

How To Live With Your Cat!

In 1986 if you had said to a less informed friend you were going to race your cat on the weekend, he could not have been blamed for either replying "I hope you beat it" or "Is that like racing greyhounds but with an electric mouse?"

July that year saw a new car appear on the racing scene. The name was just a little different from those popular at the time, Competition All Terrain was a mouthful compared to the popular Boomerang and Supershot and was soon shortened to "CAT". One of the earlier model magazines at the time track tested this new car and described it as follows:

"A flat pan chassis made from GRP as with the "B" and "C" 1/12 cars. A lexan undertray which can be left off if not needed (Their words not ours!!!) along with a lexan bodyshell etc." Dampers were Brimod and the 'crashback' front end was described. "The two axles run with a toothed belt between them and two small belts inside the gearbox. The belts appear strong so they should not be any problem(!!!). Everything that needs to be ballraced is and are included as standard" The telescopic driveshafts were described as was the torque splitter rear integrator also the single screw wheel fixing and tyres.

The car was of course the original short wheelbase version

with virtually all the main support parts in GRP and the chassis designed for stick packs. Priced at just £175.00 and presented in a white card box with a picture stuck on top this was far from cheap with the Optima then selling for £99.00 and the Hotshot for £97.00 and both in technical colour boxes.

But who races a box?

OK so enough for history, what happens now. Well as you all know the little short car grew up and sported a nice new long chassis and became the XL and then the XLS. A lot of the GRP became plastic mouldings and along came a bunch of people who started making nice things such as alloy chassis, proper differentials and belts that stayed in one piece and the CAT as it now was affectionately known was suddenly the car to have if you were at least half serious in racing.

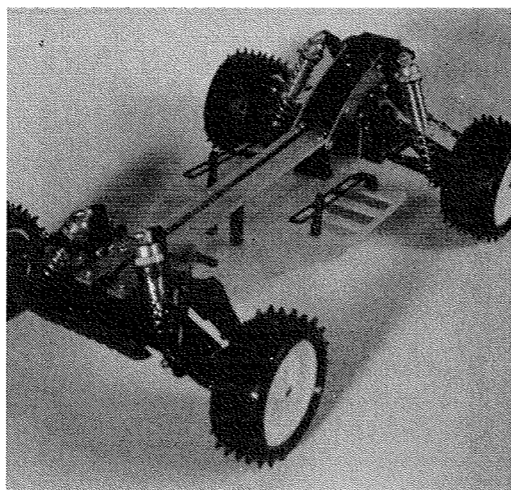
So how did it work?

Very well is the only answer but only as long as you were capable of building the thing! Unfair, perhaps but there have been and are still many people who just give up saying the car is just too complicated. So to the purpose of this article which is to go blow by blow through building a race winning CAT based on the latest ProCat kit using as many of the aftermarket

parts as practicable bearing in mind the average racers budget (that small! ED). This is not a replacement for the instruction manual but we will detail all they winning secrets that are necessary to make the difference between a car that is a joy to race and one in which you constantly blame every part for not working properly when the blame lies elsewhere! One other point to remember is that the CAT as with all exotic racing machinery must be regularly maintained. After every meeting strip the whole car and check every bearing and part, clean, lubricate and reassemble it's the only way.

The chassis

Now in saddle pack form, the GRP chassis comes complete with cell cut-outs for 7 cells USA style. Before doing anything remotely silly like assembly it is important to check certain vital areas.



Take a sheet of tracing paper and lay the chassis flat on the paper on a smooth surface. With a sharp pencil trace the entire outline as accurately as possible and mark every hole down the centre of the chassis carefully keeping the pencil vertical in all cases.

Turn the chassis over and line up the two lines of holes marked on the paper with those on the

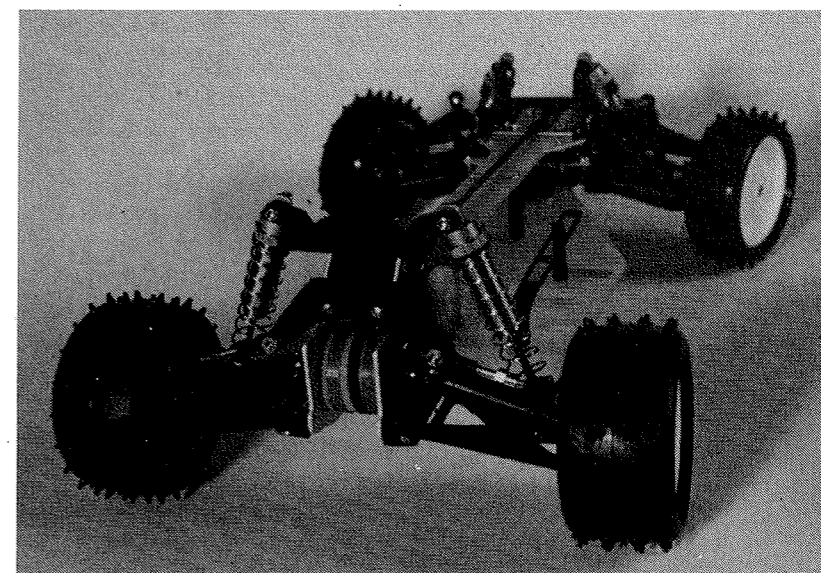
reversed chassis. Are they exactly identical? These holes are the key assembly points for the transmission and any misalignment will show up as belt run off or binding of the layshaft. If the holes are not identical obtain another chassis and compare the two. Don't start until the chassis is perfect and the holes exactly mirror imaged.

Now some work with a file is needed to clean up the cell apertures. The tiny tails left by the manufacturing process must be filed off and each cell aperture chamfered at 45 deg on the long sides (top face) to allow each cell to sit as low as possible in the chassis for lowest C of G. Work carefully keeping the angle and depth of chamfer constant and right up to the corners of the apertures.

Side Plates

The alloy side plates play just as big a part in the accurate build of the transmission as do the chassis drillings. Although the anodised plates now supplied in the ProCat are tougher than the plain alloy versions in the earlier kits they are still prone to bending due to stresses induced in the punching operations during manufacture. To check this lay each plate on a flat surface, ideally a glass plate (How about the glass topped coffee table?) and see if they lay flat. Is there daylight underneath? Turn them over and try again. Any "rocking" is trouble. To flatten lay the offending plate down (not on the coffee table!) with the highside upwards and using a wooden roller (1" dowel or rolling pin) gently but firmly roll out the distortion. Check repeatedly until absolutely flat.

The alternative here is to use the first of our aftermarket parts. Team Tanaplan can supply sideplates produced by CNC milling operations that are flat and also act as additional heatsinking for the motor.



Rear end view showing belts and MMS Differential

The Gearbox

The ProCat now comes complete with Schumachers' own version of the drum differential, the old integrator having passed away quietly. This is a three part screw together unit producing a passable drum assembly with crowned (the radius across the teeth to centralise the belt) tooth wheels.

Options now include a superdiff from Schumacher or the Model Motor Sport one piece drum differential which has proved itself to be trouble free and reliable under racing conditions.

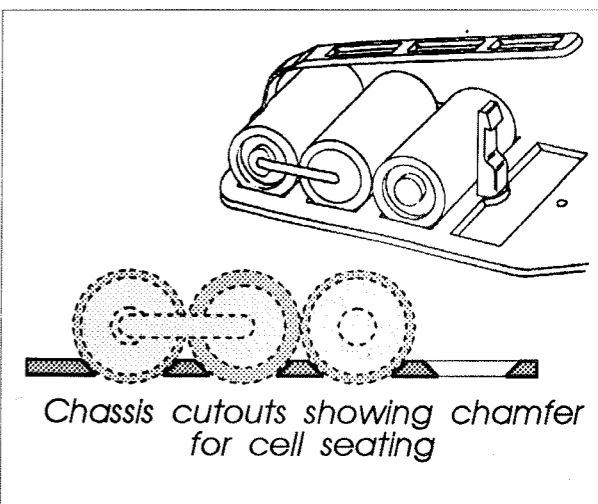
This has a flat toothform (no crown) but guides at the extreme edges keep the belts from straying outside their allotted positions.

A new version of this differential has now appeared on the market with guides for all belts.

The kit layshaft has a history of snapping where the gear drive pin hole is drilled as this weakens the shaft. As a result the popular replacement is

again the MMS one piece shaft which has the only disadvantage of not being able to take the standard kit gears, however this is discussed later.

So far then we have flat sideplates, MMS layshaft and differential. We need now to look at the bearings and belts. The standard kit bearings are obviously supplied to a price but yet if looked after are very good. If using these remember to remove the black seals before fitting and to thoroughly clean, preferably by immersion in a non plastic solvent liquid. Lubricate sparingly with a dry lubricant (not oil or WD40) as any liquid lubricant will cause drag. Fit as shown in the assembly manual. We cheated here and fitted metal sealed stainless steel



Chassis cutouts showing chamfer for cell seating



races. Expensive but very free running and less likely to jam up during a race.

Now to belts. Just as there is no real contest regarding differentials so there is little choice when it comes to choosing belts for your winning car. Wasp Racing responded early to the needs of the racer by producing a pair of orange high flexibility belts for the SWB CAT and these soon gave way to the more advanced HE 72 belts which suit all the long wheelbase range.

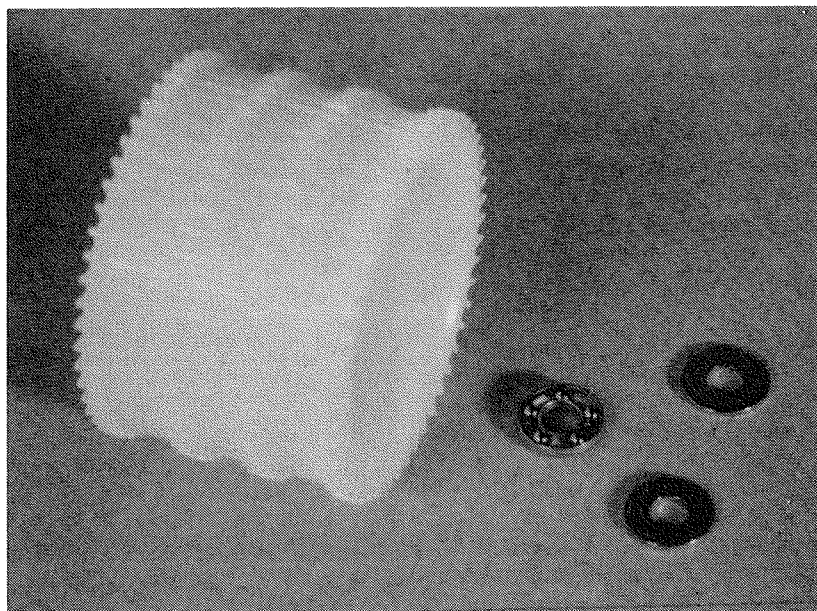
Inner transmission housing

To shield the belts from ingress of debris and to locate sideplates together, part U070, inner transmission housing is provided. This stretched "U" shape of plastic is vital in providing accurate location of sideplates to each other and to the chassis. Schumacher have produced an aluminium version of this piece which not only provides even greater accuracy of location but acts as a huge heatsink for the motor.

MMS also produce a similar part in both clubmans and pro-lightened styles with extra heatsinking fins.

So we now have all the ingredients for a successful and accurate gearbox. Assembly will be as for the same unit using kit instructions.

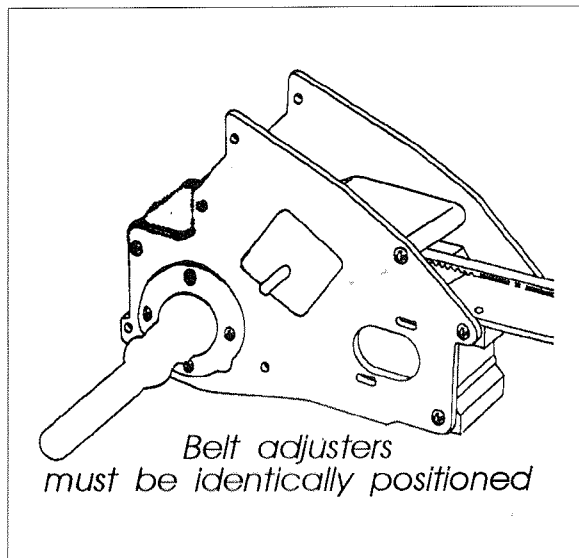
The belt adjuster cams on either side of the sideplates at the rear carry both the rear axle bearings and control the tension on the belts by moving the axle location forwards (slack) or backwards (tight). With the emphasis we are showing on an accurate gearbox, it must be realised that adjustment of the belts must be identical side to side. Any out of alignment of the rear axle will cause belt run-out and therefore the adjuster cams must be considered as single units and moved together. For the purist who requires smaller increments of belt adjustment there are on the market alloy adjusters with holes at closer



Above: MMS differential and Parma's Thrust washer

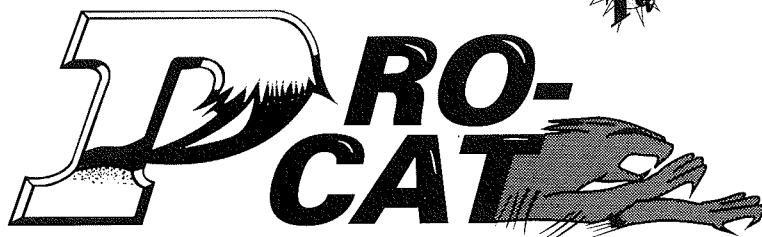
increments. Using standard adjusters and the equipment detailed above, the correct setting of the indicator flags will be found approximately at the 4 o'clock position (viewed from RHS) or 2 holes to the right of the flag. Check you have the latest adjusters, these can be identified by a raised pip on the flag tip.

One final point for this month, when assembling the kit thrust race discard the plastic ball holder. This causes more foul ups than anything. Fit the thrust washer on the axle screw, then apply some silicone grease and seat the balls in the grease - don't worry they will stay there. Now fit the other washer and assemble. If



you are not happy doing it this way buy the thrust race that Parma sell with the metal ball retainer. These are very good indeed.

Next month - assembling the main chassis and belt + front end.





PRO-CAT

How To Live With Your Cat! (Part 2)

Last months build programme for the ProCat left you holding what should be a very free running and squarely assembled rear gearbox with in the other hand an accurate, checked chassis with all chamfers filed out. This now means you have to turn the pages with your nose!

Now lets assemble these two parts together. Before fitting the gearbox to chassis, the main drive belt to the front gearbox must be looped onto the rear differential pulley and over the layshaft. The kit belt is currently a 323 tooth version in black neoprene. The only option to fitting this belt is the WASP products moulded belt which I understand are available in two lengths. The one quoted by WASP for the current kit is the 320 tooth version although they do also have a 324 tooth belt which fits chassis like the Composite Craft which are slightly longer. The question of belt length relates very much to the adjustment available on the front gearbox and we will leave the belt decision hanging until having discussed the front gearbox.

So, with the belt looped over the gearbox assemble the parts to the chassis ensuring that the fixing screws are not over-tightened thus distorting the assembly. I know we keep

on about getting things square etc but of all the CATs we have had to service because of belt problems etc the blame always fell on sloppy assembly and screws done up tight enough to stress plastic and make removal almost impossible!

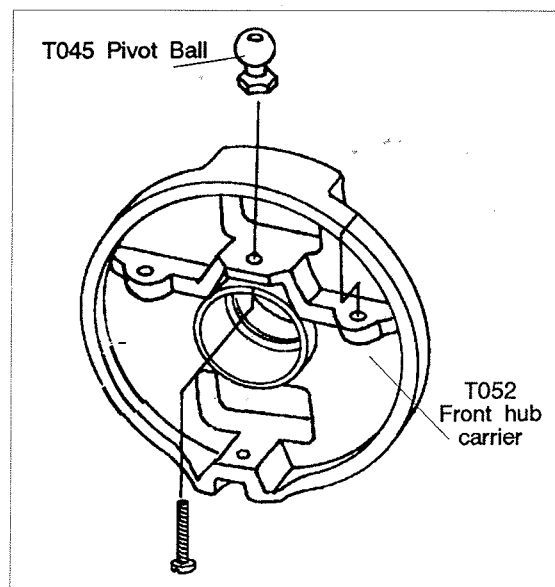
Now with the rear end of the car assembled lets look at the front gearbox. Certainly the most innovative part of the construction must be the "crashback" assembly which allows drivers the luxury of attacking immovable objects with the front end and in most cases getting away with it! Unfortunately the nature of the swinging assembly makes the area around the gearbox slightly more complicated than for more conventional cars but we'll soon sort that out.

The first decision to be made before putting the front gearbox together is what front pulley is to be used. The kit pulley is of the same diameter and number (51) teeth as the rear differential and it follows therefore that the drive speed of front and rear wheels will be the same. The options now however are to fit a reduced size pulley at the front to give an "overdrive" to the

front wheels for improved cornering on tight and twisty circuits.

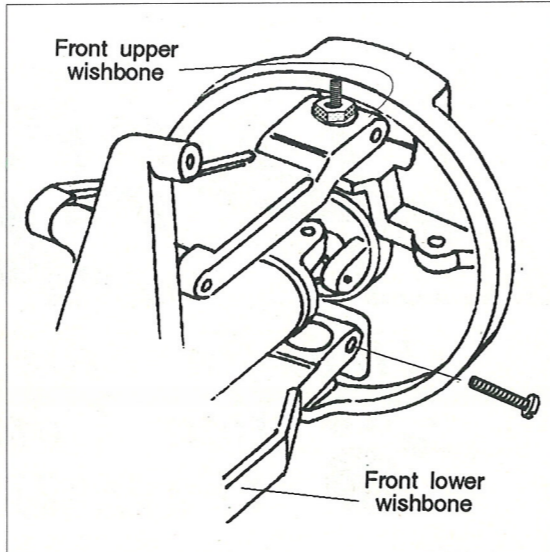
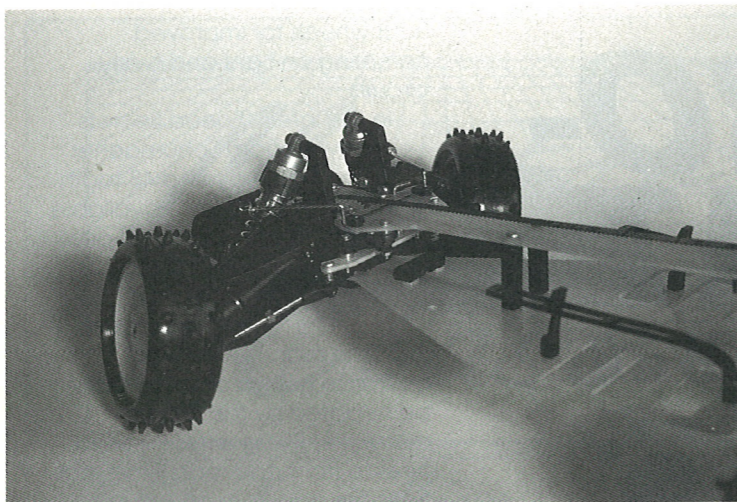
In the latest "Speed Secrets" adverts from Schumacher you will see a 48 tooth front pulley is available which will drive the front wheels 1.06 times faster

than the rear. The value of overdrive pulleys can of course be negated by the simple mistake of fitting different sized tyres to front and rear. If the rear tyres are smaller in effective diameter because the fronts have great big long spikes then the traction ratio can easily be reversed. We can only guide on this point and suggest you keep a list of tyre sizes which are related to each other to maintain the desired traction ratio otherwise forget overdrive and fit the standard size pulley.



In last months article we neglected to tell one very important point regarding Model Motorsport differential assembly. This of course relates to the front diff as well and is the gluing of the thrust washers to the diff thrust pads. Firstly, wash your hands to remove grease etc and then thoroughly clean both the washers and nylon thrust pads with a solvent cleaner that will not attack the plastic. Don't





use white spirit or petrol as they are oily. If in doubt methylated spirits is safe and works well. If you use a motor cleaner spray, leave the washers for ten minutes or so to warm up as the aerosol will chill them and allow dew to form which will inhibit the superglue. Now there are two ways of applying the superglue. First way is to place a few spots (not big drops!) around the face of the thrust pad and place the washer onto the glue, rotating to spread glue and then applying pressure until set. The alternative is to assemble the washers and pads dry and run a thin bead of glue around the edge of the disc/washer. Assemble these into the diff unit (don't use any grease at this stage) and tighten the screw to give diff tension.

The advantage of the latter method is that the washers are guaranteed to sit square on the pads and the superglue will run into the gap between them by capillary action. This method is recommended.

If you are unlucky enough to have a washer come unglued then before re-gluing, remove all the hard residue with a sharp knife. Don't try to glue on glue, it doesn't work.

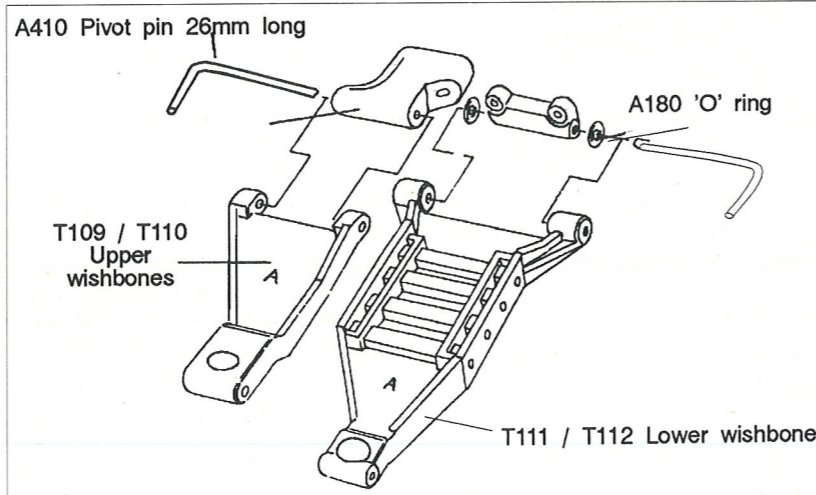
One point concerning the new schumacher super diff, the washers have hex holes in the centre that key to the pads. No gluing needed there! The kit front diff uses friction paper washers to give drive.

Check at this stage that the two gearbox halves will fit into the slot at the front of the top deck. If they are tight, file the sides of the top deck slot until the gearbox slides in easily and goes right to the back of the slot with no effort but with no slop. If it doesn't go right back the belt adjustment will be limited, if its too tight the pulley may be pinched.

The assembly of the rest of the front gearbox is as per the instructions except that instead of fixing it to the chassis/topdeck with 8 screws we chose to use the alternative long screws that pass right through the whole assembly. This requires drilling out the holes in the T057 suspension brackets to allow the screws to pass through. This also has the advantage of holding these fiddly parts in check as they are

always trying to escape. Don't over-tighten the screws holding the diff casing halves together as this can cause binding and belt/pulley problems.

When fitting the one way drive shafts we reversed the fitting shown in the assembly manual for the following reasons. By having the one way joint inboard as shown in the kit, any change to full drive requires a full dismantling of the front end. Fitting the one way outboard allows the change to full drive to be accomplished very quickly by just pulling off the one way shaft and replacing with standard. This also helps if the one way needs attention. This is of advantage if you indulge in tarmac surface racing where 4WD braking is a must. If you follow our method, don't



forget to reverse the shafts side to side as the joints are the other way round.

With the front and rear gearboxes fitted to the chassis/topdeck and the belts all in place and drive shafts dangling, we can look at the fitting of the suspension arms. The pivot pins are hard steel piano wire and are impossible to cut using a hacksaw. We've seen people trying to cut them with pliers etc and the resulting mess is pretty awful. The easiest way is to take a triangular file and file a deep 'V' where you want to cut the wire. File both sides preferably and then just snap the wire using either pliers or a vice. Do watch your eyes doing this.

Ideally grind the ends of the wire smooth with a power tool or else file them smooth.

The bends in the anti roll bar at the front need to be accurate and there must be no distortion of the wire in the middle or the belt will rub.

Now the steering.

The weak link if anything must be the centre track rod T170. This is a fibreglass strip and has been known to snap under impact but only when the car in question is leading the "A" final!

Corrally produce an aluminium version but check you buy the correct length as the old XLS version is shorter. Model Motorsport are also producing this item in steel -bet you can't break that!

Back to the steering, we have always replaced the two screws that pass through the top deck to carry the steering swivels with longer versions and fitted them with a nylock nut instead of relying on plain nuts and

threadlock. We've never had a failure yet!

One additional tip is to fit the centre track rod ball joints upside down. This puts the hex form that normally seats on the track rod under the ball joint (rose joint) and in the event of a shunt stops the joint popping off.

In the same way drill the top ball joint seating 3mm clear in the upper wishbones T109/110 and elongate the hole slightly to allow for vertical travel. Fit a socket headed screw down into the upper ball joint which will eliminate entirely the chance of this joint popping off.

Right that's our page allocation for this month, next month we will be showing how to make the shock absorbers work, spring settings, wheels tyres and gears.



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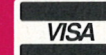
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UNDERPANS



How To Live With Your Cat! (Part 3)

steel rubbing on dry rubber, but then its too late!

Clean the pistons carefully and trim all moulding flash with a very sharp knife. Ensure the cut-outs are exactly the same size then carefully rub down the outer edge with very fine wet & dry paper used wet. Check regularly that

the pistons are a smooth running fit in the shock body and that there is no trace of binding anywhere along the full length of the stroke.

Watch the fitting of the cap to shock body as the threads are fine and any cross threading will damage them beyond repair. If the threads don't run easily

together don't force them but check to see whats wrong.

SPRINGS AND OILS

Available from Schumacher we have the following range of springs.

Take away the shock absorbers from a family car and within 50 yards the driver would probably jump out saying the steering and brakes don't work.

Why? because shock absorbers are perhaps the most important part of the whole suspension system of any car and therefore the greatest care must be taken to ensure they function correctly.

In our models, the shock absorbers also carry the spring assembly and are generally exposed to everything the track can throw at them in terms of grit, dirt and water.

We have found the standard kit shocks to be excellent if assembled correctly. There is certainly no sense in going out and buying alternative shocks for this car when the standard items are so good. If you really are stuck don't forget Schumacher's sell ready built shocks under part number U633D (Front) and U634E (Rear)

The assembly of the ProCat shocks follows a fairly conventional pattern but remember that all parts must be assembled correctly. When fitting the "O" rings make sure that all components are lubricated during assembly. Use a silicone spray for this but remember that the only other time they will be oiled is when they start leaking due to dry

SPRING NUMBER		FREE LENGTH	NUMBER OF COILS
FRONT	F2	50mm	9
	F3	41mm	6.5
	F4	34mm	7
	F5	38mm	8
	REAR	R1	88mm
R1.5		77mm	12
R2		68mm	12
R4		62mm	11

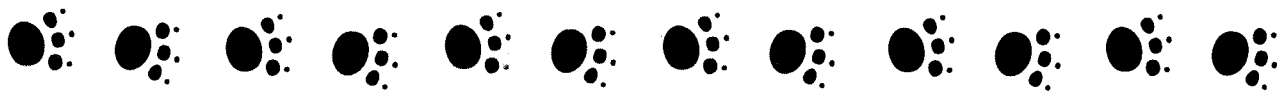
The lower the spring number, the softer the spring becomes. Thus F2 is softer than F3 and R4 is stiffer than R1. A complete spring tuning set is available as part number U767O (Front) and U768P (Rear).

The only alternative that we have found to be additional to the above are the Associated "silver" springs which work well on flat or gently undulating tracks where fairly slow spring travel occurs.

The choice of spring and shock oil is very complex and is difficult to advise. Many drivers prefer to fit the split ring type spring adjuster with a clamp screw but tend to fit light springs and then tension them almost to the limit of the shock body length.

As a rule of thumb, if you need to tension springs more than three-quarters of the shock body length then they are too light rating. Go and fit a harder spring (higher number). Over-tensioning the spring only reduces the working space between coils and reduces the smoothness of ride. This makes a car "choppy" or jumpy over bumps and many drivers then go off and use heavier shock oil to combat this.

Find a spring that suits the car and track when tensioned within the above limits and stick to it. By suitable I mean one which allows full suspension travel to occur smoothly without the car jumping sharply at the peak of a bump when the spring fully compresses. Use



the lightest shock oil you can get away with and which will still keep the car from bouncing when landing from jumps.

Above all keep the shocks clean and make sure all grit is washed away from the shaft after a meeting. Use soapy water and an old toothbrush!

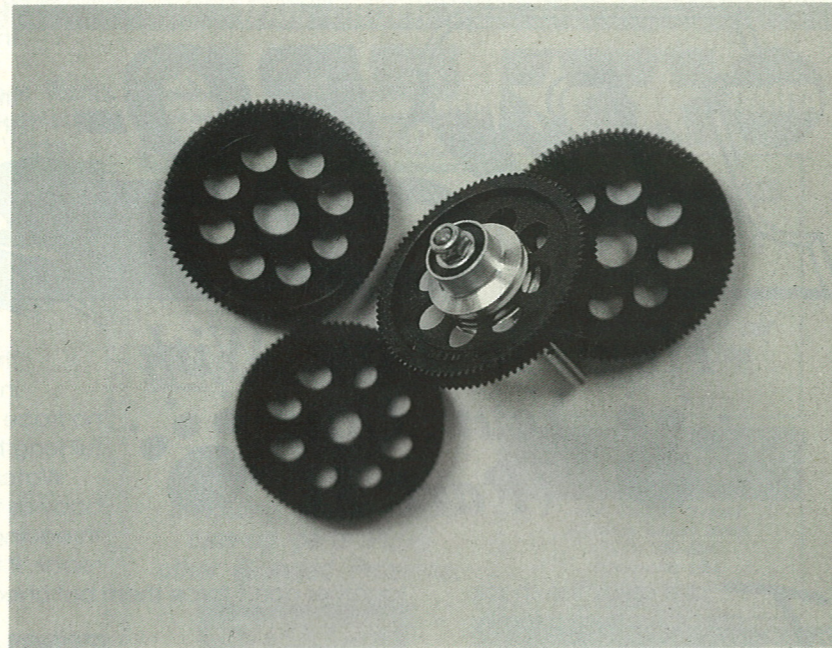
WHEELS

With the introduction of their new Cougar 2WD car, Schumacher announced a new range of wheels with extra internal stiffening ribs. This provided the much needed stability in wheel shape and thus tyre adhesion during hard cornering.

After the controversy over tyre sizes at the Australian World Championships, Amark, a far eastern manufacturer, introduced a new 2.2" wheel to fit the CAT as did Trinity (USA) who also had tyres for this size as well.

For those of you pondering on the benefits of 2.2" wheels we will digress and enlighten you.....

The tyres causing all the fuss at the World Champs were low profile. This type of tyre has a much reduced sidewall dimension which means that under cornering loads the movement of the tyre sidewall is reduced, it is stiffer in fact and keeps the tread area in better contact with the ground just as full size tyres do. If this was applied to a standard size wheel the overall diameter would be reduced by the new sidewall



height which would in turn upset the gearing of the car. Enter the 2.2" wheel, low profile and gearing now stays much the same but with the aforesaid advantages.

The new "blue" natural rubber tyres from schumacher seem to give terrific performance on most surfaces, the only tyre to improve on this on loose dust is the Losi "X" pattern but they are difficult to obtain.

GEARING

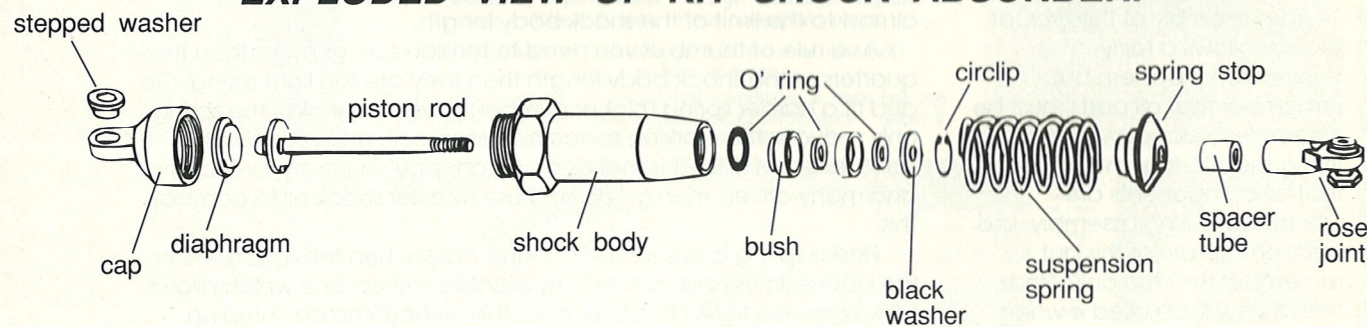
The standard car comes with 45 pitch as standard with Schumacher's own moulded gears and steel pinion.

There are several options open here depending on the choices made in initial

construction. If the MMS type of layshaft was fitted then the standard kit gear will not fit. RW Racing (see October issue) provide a full range of gears with centre hole sized to fit the MMS shaft and these are attached by three screws. Now it gets complex. Do you stick with 48 pitch or do you go for the quieter and more finely adjustable 64 pitch.

With 64 pitch gears having 50% more teeth than 48 pitch it is possible to tune gear ratios to 1/2 a tooth by using the fine pitch gears. The disadvantage is that the small teeth are easily damaged if you are not particularly careful to ensure the correct mesh.

EXPLODED VIEW OF KIT SHOCK ABSORBER.



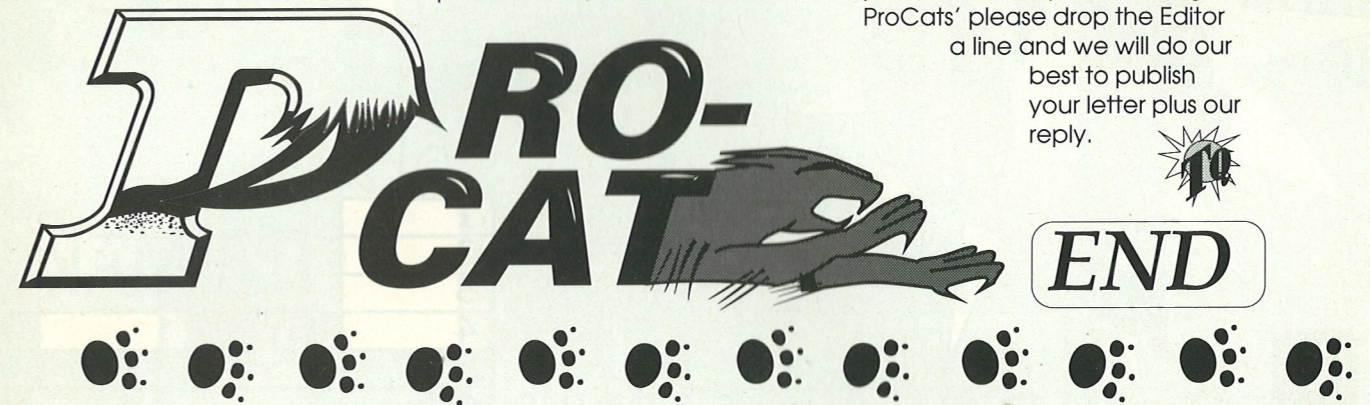
In the November issue of TQ we explained all about pitches and meshing so I will not dwell on it here (go and get a back issue!) but there is one other option relating to gears.

Schumacher introduced a device known as a "Slipper Clutch" just in time for the Australian World Champs. The idea was to create a slipping clutch connected to the spur gear that was adjustable under spring pressure such that under fierce acceleration or when landing after a jump, the vicious

effect of a hot motor would be lost in the slipping of the clutch for a brief period until the car stabilised and full power could be used. This effect stops cars hopping sideways after landing or fishtailing off the line at the start. It is interesting to note that many drivers using electronic torque limiters also confirm the need for a slipper clutch as the electronics cannot deal with jumps as well as the mechanical unit but is more advantageous at the start line. We use both on the TQ car and find track stability is superb (the driver's the problem -Ed!)

The Schumacher slipper clutch fits directly to the steel kit layshaft but if you have fitted the MMS shaft then you can't use it. The alternative is the WASP RACING version which is suited to this shaft. Both units require larger diameter centre holes in the spur gear (3/8") which is the same as Associated RC10. These are readily available in all pitches and are also now being made in white nylon by RW. We can confirm these are an improvement over the tufnol gears for slipper clutches.

If any of you have specific problems or enquiries relating to ProCats' please drop the Editor a line and we will do our best to publish your letter plus our reply.



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