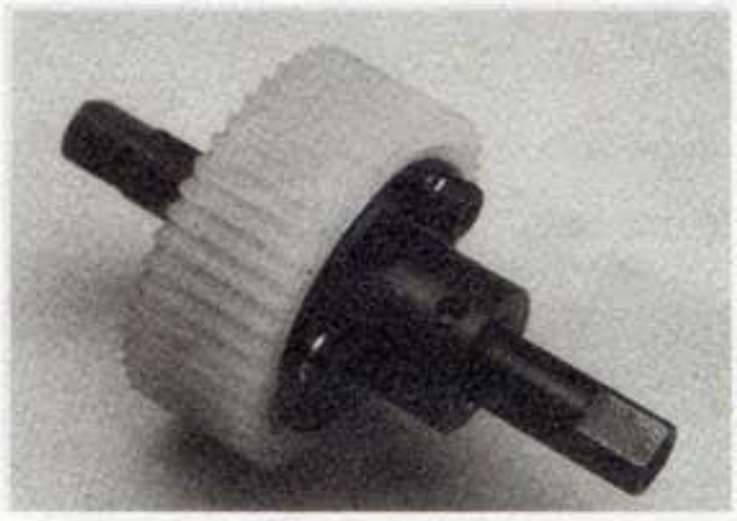
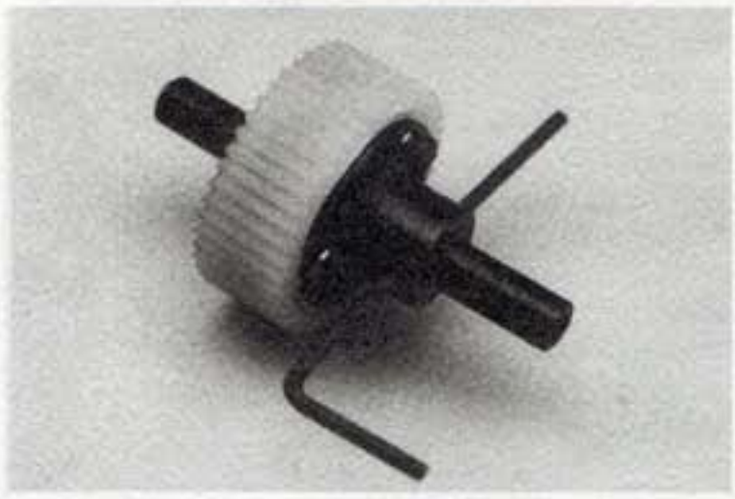
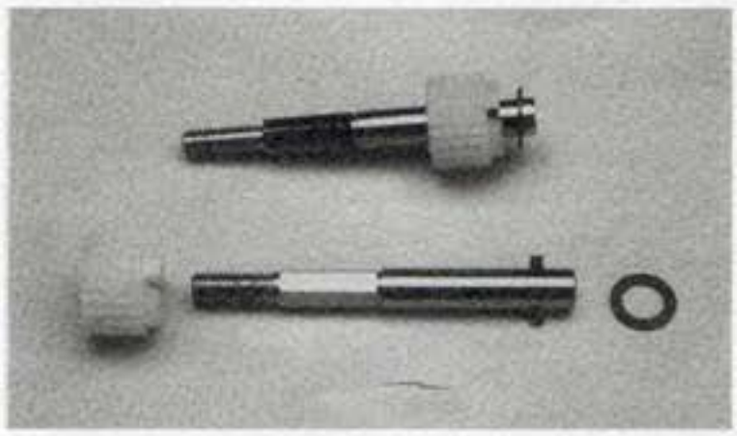


STEP 1:
Your ball differential has been assembled at the factory in order to insure proper tolerances and fit. The parts have been coated with a preserving oil to protect against corosion. The diff must be disassembled and the coating removed with alcohol or similar cleaner. The diff must then be reassembled using the lubricants supplied with the kit.

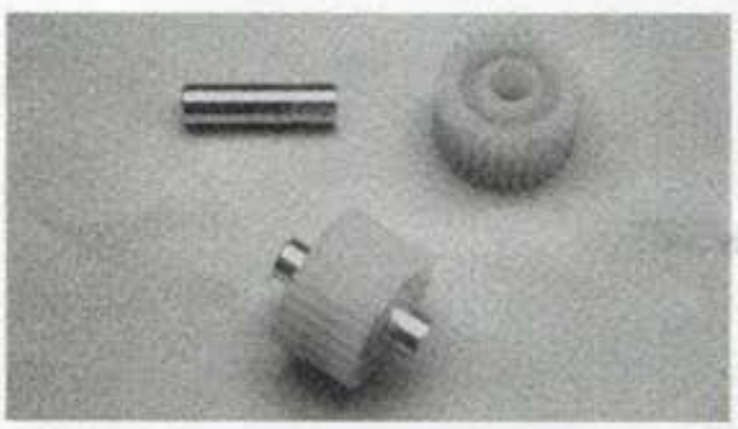


STEP 2:
Take a moment to study how the external adjusting mechanism works. Focus your attention on one of the small holes in the side of the left output shaft. Hold the left output shaft and spin the gear until a clear pathway can be seen through the hole. Insert a 1.5mm allen wrench into the hole. This locks the diff so that it can be adjusted. To change the adjustment, turn the right output shaft. Once the diff is installed in the car, you will be turning the right rear wheel to make this adjustment.

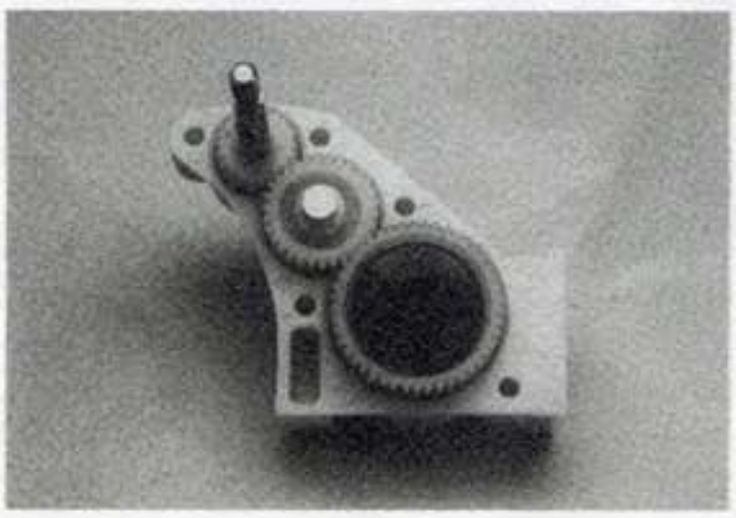


STEP 3:
Locate the slipper shaft (1993), the 9.5mm roll pin (1993), the 21-tooth slotted top gear (2795), and a 5x8mm fiber washer. Insert the 9.5mm roll pin into the hole on the end of the shaft. Use a small hammer or a pair of pliers to push the roll pin through. Be careful not to scratch or damage the shaft. Slide the top gear onto the shaft until the notch in the face of the gear bottoms against the roll pin. Place a 5x8mm fiber washer over the end of the slipper shaft. Note: do not use a metal hammer to tap the shaft through the gear as it will damage the shaft.

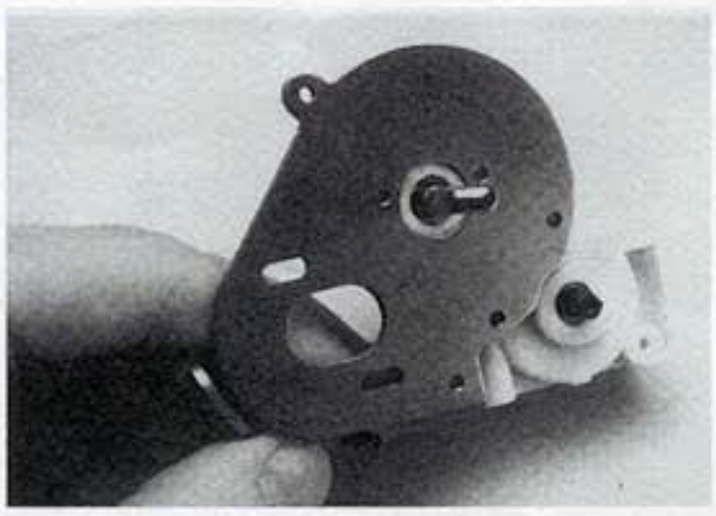
STEP 4:
Locate the left and right gearbox halves (2791). Insert three 5x11mm ball bearings (4610) into each half, as shown.



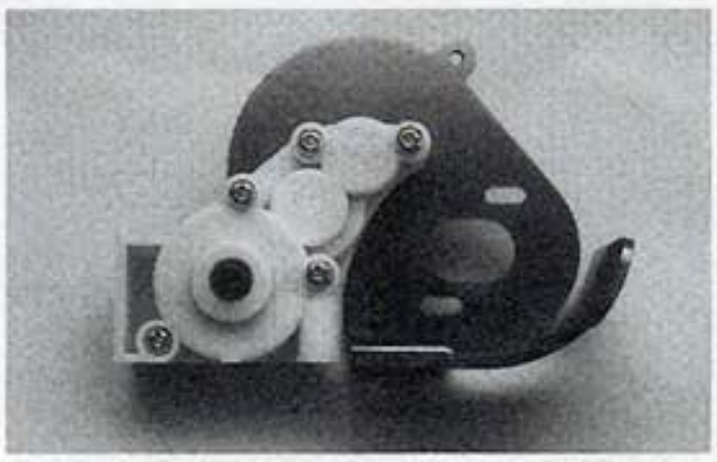
STEP 5:
Locate the 30-tooth idler gear (2796) and the idler gear shaft (2796). Note that one face on the idler gear has been marked with 6 small dimples. Insert the idler gear shaft, grooved end first, into the side of the gear marked with the dimples. Push it in until you feel the groove snap into the boss inside the gear. When the groove is snapped in properly, the gear will be centered on the shaft.



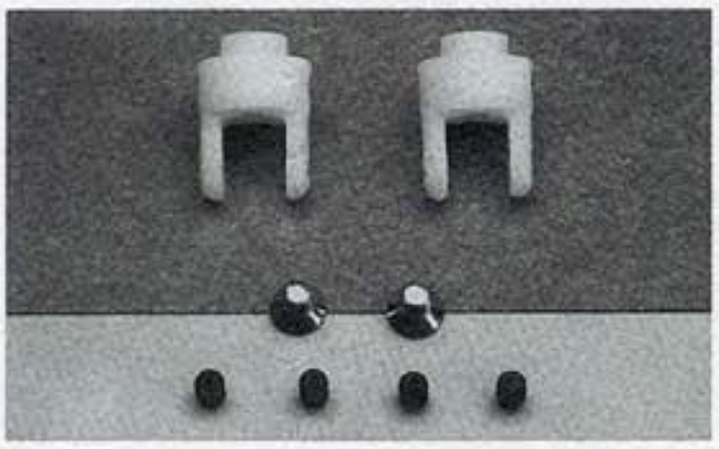
STEP 6:
Locate the slipper shaft assembly and insert it into the gearbox with the pinned end going into the left gearbox half. Now, insert the idler gear assembly into the left gearbox half. Finally, locate your completed ball diff assembly and put it into the gearbox with the left output shaft (adjusting side) inserted into the left gearbox half. Locate the right gearbox half and carefully guide it over the slipper, idler, and ball diff shafts. Hold the gearbox together tightly with your fingers and then spin the slipper shaft to insure that all the gears are spinning freely. If there is a problem, check for dirt or mold flashings inside the gearbox.



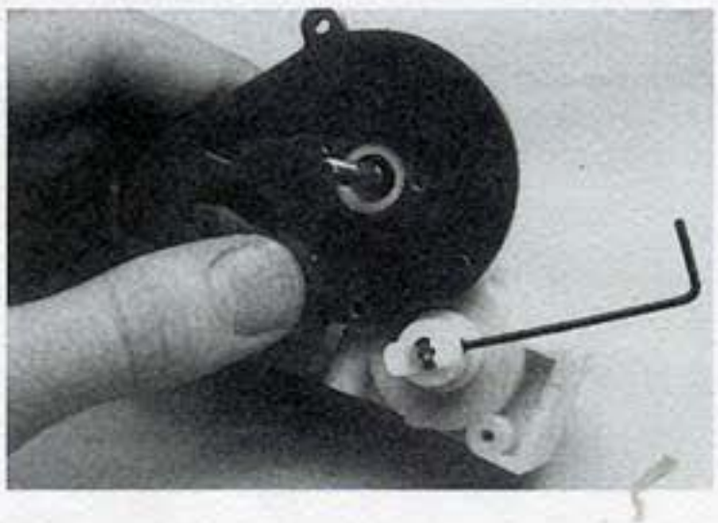
STEP 7:
Fit the aluminum motor plate (2790) to the right side of the gearbox. The center hole of the plate should snap over the boss around the slipper shaft.



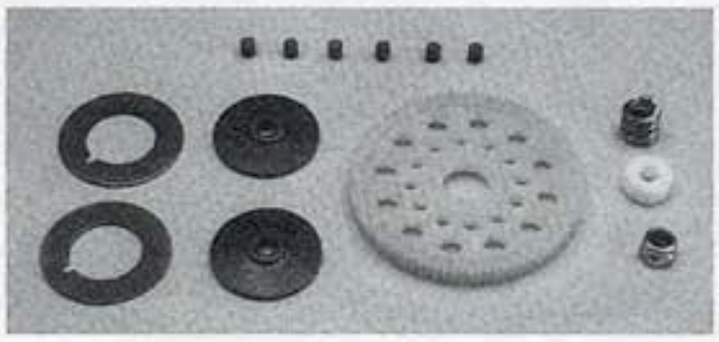
STEP 8:
Install a 3x25mm roundhead machine screw in each of the two locations indicated by the #1 arrows in the photo, and a 3x30mm roundhead machine screw in each of the locations indicated by the number #2 arrows. Install a single 3x20mm roundhead amchine screw into the hole designated by the #3 arrow. DO NOT use a powered screwdriver for these screws. An electric screwdriver could cause you to damage the threads which are tapped into the aluminum motor plate.



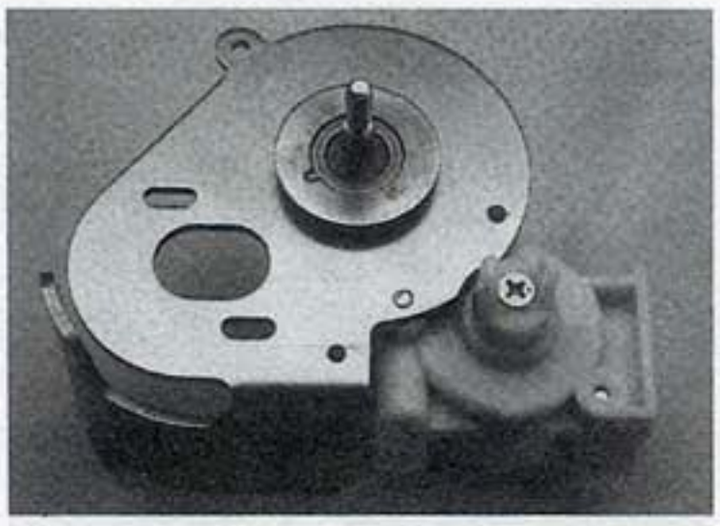
STEP 9:
Locate the two ball diff yokes (4628), two 3x5mm countersunk machine screws, and four 3mm grub screws.



STEP 10:
Press the yokes down completely onto the ball diff output shafts. Match the flat areas on the shafts with the flat areas inside the yokes. Secure the yokes with a 3x5mm countersunk machine screw going through the center of each. Now, tighten two 3mm grub screws against the flat sides of the ball diff output shafts.



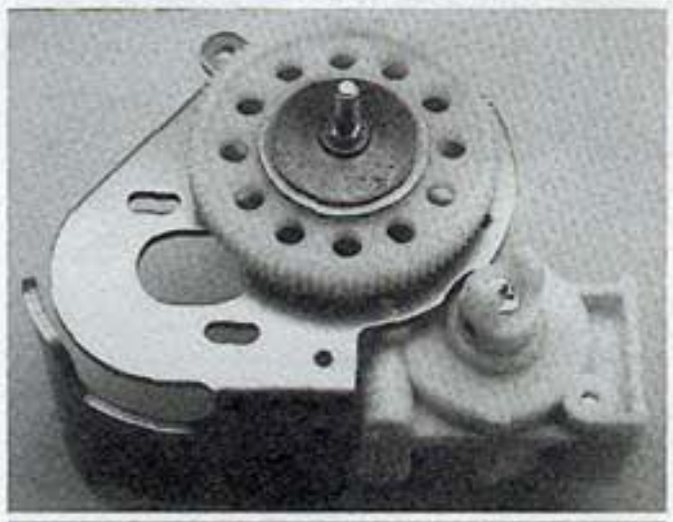
STEP 11:
Locate the bag containing the two notched slip rings (4622), the two slipper pressure plates (4625), 12 slipper clutch friction pegs (4685), one teflon spur gear bushing (1994), one coil tension spring(1994), either the 87 or 81-tooth spur gear (4687, 4681), and one 4mm locknut. Refer to the section in the tuning guide about motors and gearing to determine which spur gear you want to use. If there is any machining oil on the metal parts, remove it now with motor spray or solvent.



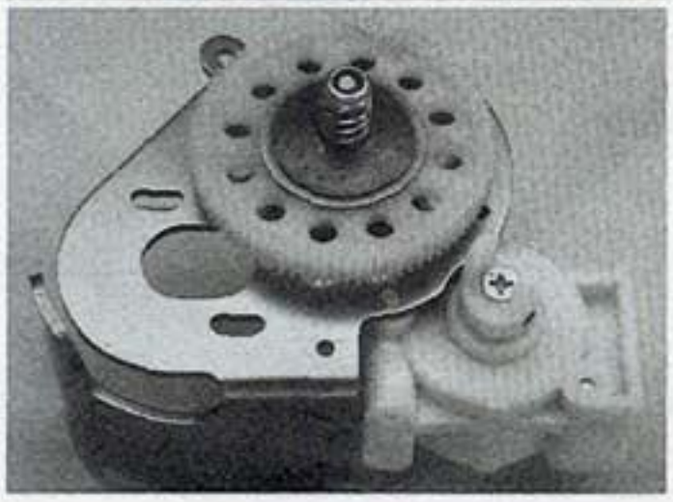
STEP 12:
Slide one slipper pressure plate (4625) over the slipper shaft, making sure it bottoms against the shoulder on the shaft. Now, place a notched slip ring (4622) on top of the pressure plate, lining the notch up with the boss on the plate (arrow).

RACER'S TIP: *Place a drop of very thin Super Glue between the pressure plate and the slip ring. This will make assembly and disassembly easier. Make sure that the glue spreads even and flat between the plate and the ring.*

STEP 13:
Push the teflon bushing (1994) onto the slipper shaft. Push it down until it stops against the pressure plate (arrow). Next, locate the spur gear and install it over the bushing. Now, insert the 12 slipper clutch friction pegs (4685) into the holes in the gear. Keep the transmission up on its side in order to keep the friction pegs from falling out.



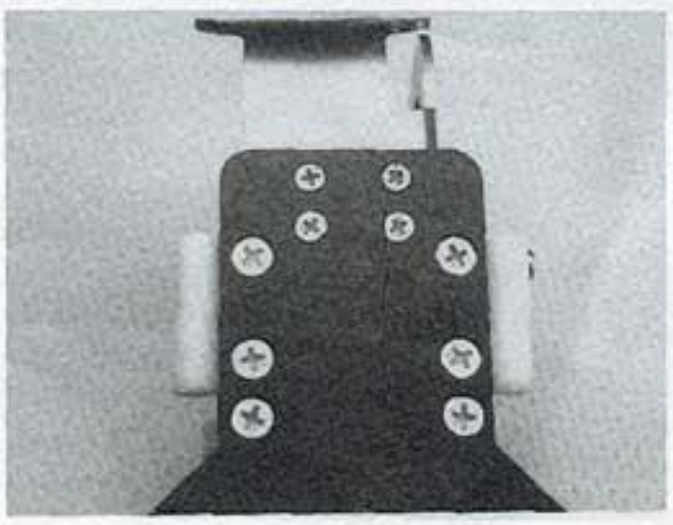
STEP 14:
Place the remaining notched slip ring over the slipper shaft, followed by the other remaining pressure plate. It is a good idea to glue the slip ring and plate together here, as referenced in step B-15. If they are not glued, it is very difficult to get the ring centered and installed on the slipper.



STEP 15:
Install the coiled tension spring (1994) over the slipper shaft and secure it with the 4mm locknut. Tighten the locknut only enough to barely load the spring. The slipper adjustment cannot be made accurately until the car is fully assembled. Before continuing carefully inspect your transmission at this time to be sure all of the parts rotate freely.
NOTE: It is normal for the spur gear to slide back and forth on the pegs. As the pegs wear, this movement will decrease.

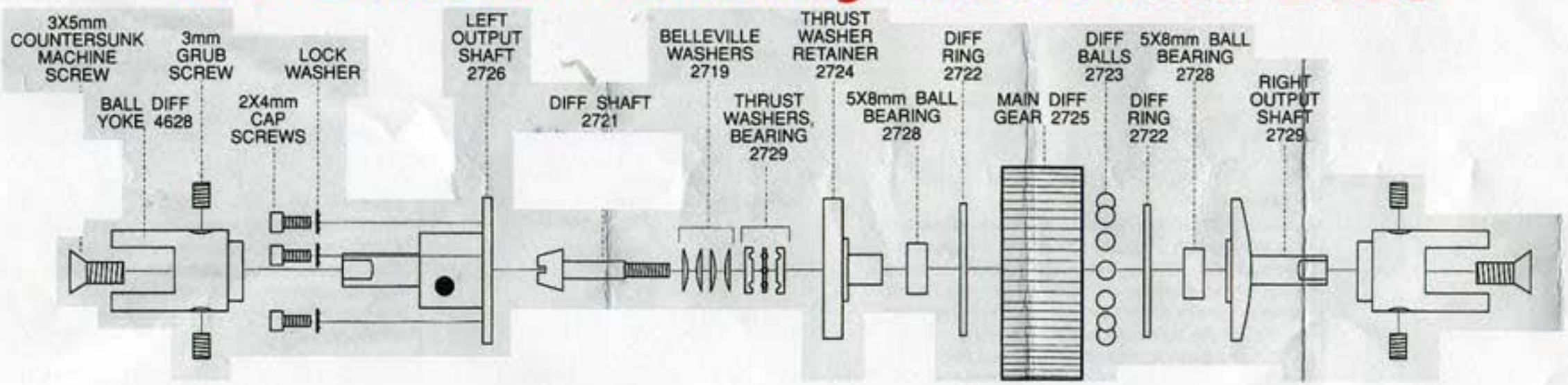
STEP 16.
Locate the transmission bulkhead (1992)and slide it onto the front of the transmission until it locks into place. The fit between the bulkhead and the transmission will be very tight.

STEP 17:
Locate the two zero-degree rear suspension arm mounts (2797), four 4x12mm aluminum countersunk machine screws, and the two 3-degree caster wedges (1934). The zero degree suspension arm mounts will have no affect on the rear toe-in adjustment. The other set (marked with a + and -) will add or subtract one degree of toe in, depending upon how the blocks are arranged. With the pluses forward, 1 degree of toe-in is added, with the minuses forward, 1 degree of toe-in is subtracted. Position one of the three-degree caster wedges underneath one of the rear suspension arm mounts so that the thickest part of the wedge is closest to the front of the car. Fasten this assembly to the chassis with two 4x12mm countersunk machine screws. Repeat for the opposite side.



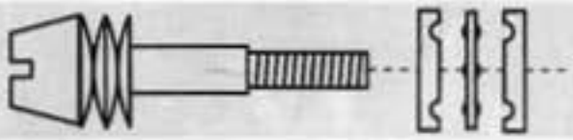
STEP 18:
Attach the transmission assembly to the chassis with the following screws: Arrow 1, two-4X12mm aluminum countersunk machine screws; Arrow 2, two-3X10mm countersunk machine screws; Arrow 3, two-3X5mm countersunk machine screws.

Transmission Assembly Inrs. Model 2720



BALL DIFF ASSEMBLY SEQUENCE

1. Pack the holes in the main diff gear with the diff lube. Use something soft like the end of a pen cap to push the 12 balls into the holes in the gear.
2. Press one of the 5x8mm ball bearings into the center of the main diff gear.
3. Slide the belleville spring washers over the diff shaft. Arrange the washers as shown in the above drawing.
4. Smooth a thin layer of thrust bearing grease into the grooves on both of the thrust washers. Slide the thrust washers and bearing onto the diff shaft, following the sequence in the drawing.



5. Insert the threaded end of the diff shaft assembly through the center of the flat side of the thrust washer retainer.
6. Locate the 19mm diff rings and note that one face on each of the rings has a rounded edge. Place one diff ring onto the extruded face of the aluminum thrust washer retainer so that the rounded edge will face the gear.

7. Press the remaining 5x8mm bearing into the back of the right output shaft. Now, superglue the remaining diff ring to the back of the right output shaft (rounded edge towards the gear).
8. Insert the thrust washer retainer assembly into one side of the main diff gear.
9. Screw the right output shaft onto the diff shaft. Tighten until the screw stops and then back off 1/8 to 1/4 of a turn.
10. Fasten the left output shaft to the thrust bearing retainer using the three 2x4mm cap screws and lock washers. Place a small drop of thread-locking compound on each of the cap screws. Do not overtighten.

MOTORS & GEARING:

One of the more significant advantages you have with the TRX Pro-Series car transmission is the extremely wide range of available gear ratios. It can be geared low enough to run the extremely hot (fewer number of turns) modified motors. Modified motors should be geared lower (smaller pinion gear) than stock motors, because they reach their maximum power at higher RPMs. A hot modified motor, geared at an incorrect ratio, may actually be slower than a correctly geared stock motor. Because of the extreme variations in track designs and motors, it is impossible for these instructions to give specific recommendations for motor and gear ratio selection. Keep in mind, as a general rule of thumb, that modified motors should be geared 3-5 teeth (48-pitch) lower than stock motors. The best advice is to follow the motor manufacturer's recommendations. Some motors may have a sheet telling you what overall gear ratios should be used to suit a particular motor's power range. If the motor you are considering does not have any such information, then ask a knowledgeable hobby dealer to recommend the correct gear ratio range for the motor. If all else fails, contact the motor manufacturer for this important information.

If you are worried that you might be under or overgeared, check the temperature of the batteries and the motor. If the batteries are extremely hot, and/or the motor is too hot to touch, then your car is overgeared. Also, if you are not able to make the full four minutes of race time, then you should go to a lower gear ratio. If the motor and batteries are just slightly warm, you may be able to increase the gear ratio slightly. The temperature test described here assumes that the car is close to minimum weight and spins freely with no friction, dragging, or binding (these factors also affect motor and battery temperature).

The chart on this page shows the overall gear ratio you have with each pinion gear. A low ratio is 15.51:1 and a high ratio would be 5.56:1. Try to find out what overall ratios the fastest drivers at your track are running. This will give you a good starting point for experimenting with your car. The slipper mechanism on your transmission will accept all standard 3/8 inch I.D. spur gears although they may need to have the ball holes enlarged by hand with a #30 drill bit. This is so that the slipper pegs will fit into the gear. The 87 and 81 tooth gears have been included in your kit. If the spur gear size you are using is not listed on the chart, use the following formula to calculate your overall gear ratio. **RATIO= # SPUR GEAR TEETH** divided by **# PINION GEAR TEETH** multiplied by **2.1429**. A very typical final drive ratio for use with stock motors would be between 7.0 and 8.0:1. This could be achieved by either using the 81-tooth spur and a 23-tooth pinion, or the 87-tooth spur and the 24-tooth pinion gears.

ADJUSTING THE BALL DIFFERENTIAL:

This section describes the mechanics of how to externally adjust the ball differential in the transmission. How loose or how tight to run the differential is covered in the next section.

One very important thing to remember about adjusting the ball differential is to be sure to turn the car off before inserting the adjustment tool into the transmission. You may even wish to disconnect the battery as a further precaution. This is to prevent the receiver from picking-up a stray signal, thus causing the motor to turn while the adjustment tool is inserted in the transmission. This could result in serious damage to the gears and other components inside the transmission.

Another important point to remember is that because the differential is adjusted with the rear tire, tremendous leverage on the adjusting nut is available. Do not overtighten the adjusting nut. Just a small turn of the rear wheel (one or two degrees at a time) is all that is necessary to change the adjustment.

1. Insert the pinon wrench through the hole in the top of the gearbox case. Rotate the left wheel until you feel the wrench drop into the hole in the side of the left output shaft. If the pinion wrench now only appears to be partially inserted, apply slight pressure to the wrench and slowly turn the right wheel until the wrench drops into place. Rotating the right wheel moves the adjusting nut and positions it so that the wrench can be inserted completely through the ball differential left output shaft. You should NOT have to apply excessive force in order to insert the wrench.
2. Once the wrench is engaged, simply turn the right rear wheel to change the adjustment (forward to tighten and backward to loosen). With practice, you will be able to qickly adjust the diff.
3. Remove the wrench and insert a short 2.6mm self-tapping screw into the adjustment hole in order to prevent dirt from entering the transmission case.

BALL DIFFERENTIAL AND SLIPPER ADJUSTMENT

The only way to truly learn how to set up your slipper clutch and ball differential is through experience with it on the track. The settings will naturally have to be changed depending upon the track surface, the tires, and many other variable factors. The basic initial setup tips provided here will apply for most conditions. The most important thing to remember is that the slipper clutch should always be set looser than the ball differential. The ball differential should not slip.

Initial setup is performed as follows:

1. Tighten the slipper nut until the shaft comes through the nut by about 1/16th of an inch. This should be tight enough to completely lock the slipper.
2. Install a motor and fully charged battery as you normally would for racing. Reference the gear chart to determine which pinion you should use to achieve the desired ratio.
3. Set the car down on some type of short pile carpet and momentarily apply full throttle. You should hear only a slight amount of slippage from the ball differential. This is normal on a high-traction surface such as carpet. If the car is accelerating slowly, and excessive slippage from the ball differential is observed, then tighten the ball differential as described in the previous section.
4. Once the differential is set so that little or no slippage is observed, loosen the slipper nut by one turn (360 degrees) and test the acceleration again. You should now be able to hear the slipper operating. Note that the slipper makes a different slipping sound than the ball differential.
5. Place the car onto the surface that it will be raced on. Now, adjust the slipper so that the car accelerates as quickly as possible without spinning the rear tires or trying to travel sideways. Also, experiment with loosening and tightening the slipper to see how it affects your car's handling as you accelerate out of corners.
6. Once the slipper is set, the ball diff can probably be loosened slightly for smoother operation. The following instructions describe how to fine tune the ball diff adjustment. Hold the car in such a manner that the left wheel and spur gear cannot turn. One way to do this is to place the car on the table and with your left hand, hold the left tire down against the table and lock your left index finger over the spur gear. With the spur gear and the left

tire held stationary, use your right hand to turn the right rear tire. You should see the slipper shaft turning even though the gear is stationary. Now, release the car, use the pinion wrench to slightly loosen the ball diff, and then perform the above test again. Continue to loosen the ball diff in very small increments and retest. Do this until the slipper shaft stops turning when the test is performed. At this point, the ball diff will now slip before the slipper (which is unacceptable). Now, slightly tighten the ball diff and retest. If the slipper shaft now turns during the test, then your ball diff is adjusted to its optimum setting.

7. Once the optimum setting is achieved for the ball diff, it is usually not necessary to loosen the diff further if you loosen the slipper setting. Perform the slip test on a regular basis to ensure that the diff is not slipping before the slipper clutch.

Note: The friction pegs in the slipper may require a slight amount of break-in. You may notice that the slipper will have a tendency to loosen up during the first few runs. This is normal and should be watched for. If the slipper gets too loose, it will become extremely hot, causing possible failure and damage (melting the spur gear, for example). To find out if the friction pegs are fully broken-in, disassemble the slipper and examine the faces of the pegs. If both faces are worn smoothly and evenly on all the pegs, then the slipper is broken in. From here on, no further adjustment of the slipper will be necessary except to compensate for normal wear and varying track conditions.

The ball diff may also require occasional tightening to compensate for normal wear. Periodic removal and inspection of the ball differential is recommended to ensure proper operation. New balls and diff rings are usually all that is required to return the diff to peak operation.

Buggy Gears

Truck gears

22. P

60 S.

PARTS LIST

BALL DIFF COMPONENTS

2716-DIFF LUBE	3.00
2717-THRUST BEARING LUBE	3.00
2719-BELLEVILLE SPRING WASHERS (4)	2.00
2721-DIFF SHAFT	6.00
2722-DIFF RINGS (19mm) (2)	1.50
2723-DIFF BALLS (3/32") (12)	3.00
2724-ALUMINUM THRUST WASHER RETAINER/ SCREWS(3)/ LOCK WASHERS (3)	8.00
2725-MAIN DIFF GEAR (45-TOOTH)	2.50
2726-LEFT OUTPUT SHAFT	7.50
2727-RIGHT OUTPUT SHAFT	7.50
2728-5X8MM BALL BEARINGS (2)	12.00
2729-THRUST WASHERS(2)/ THRUST BEARING	10.00
2730-DIFF REBUILD KIT, CONTAINS: DIFF SHAFT/ BELLEVILLE SPRING WASHERS(4)/ DIFF RINGS(2) THRUST WASHERS(2)/ THRUST BEARING/ DIFF BALLS (12)	18.00
4628-BALL DIFF YOKES(2)/ 3X5mm COUNTERSUNK SCREWS(2)/ 3mm GRUB SCREWS (4)	4.00

TRANSMISSION GEARS

2795-TOP GEAR (21-TOOTH)	3.00
2796-IDLER GEAR (30-TOOTH)/ IDLER GEAR SHAFT	3.50
2725-MAIN DIFF GEAR (45-TOOTH)	2.50

SLIPPER COMPONENTS/SPUR GEARS

1993-SLIPPER CLUTCH SHAFT & ROLL PIN	3.00
1994-SLIPPER TENSION SPRING/ TEFLON SPUR GEAR BUSHING/ LOCKNUT	2.50
4622-NOTCHED SLIPPER RINGS (2)	2.50
4625-SLIPPER PRESSURE PLATE (1)	5.00
4685-SLIPPER FRICTION PEGS (12)	4.50
4678-SPUR GEAR, 78-TOOTH (48-PITCH)	3.00
4681-SPUR GEAR, 81-TOOTH (48-PITCH)	3.00
4684-SPUR GEAR, 84-TOOTH (48-PITCH)	3.00
4687-SPUR GEAR, 87-TOOTH (48-PITCH)	3.00

TRANSMISSION & HARDWARE

2720-TRANSMISSION, TRX-1 PRO-SERIES (COMPLETE W/ SLIPPER & BEARINGS)	120.00
2790-ALUMINUM MOTOR PLATE/ MOTOR GUARD	7.00
2791-GEAR BOX HOUSING (L&R)	6.00
1552-HEX MOTOR SCREWS(4)/ WRENCH/ WASHERS (4)	3.00
2788-DUST COVER & ACCESS PLUG	4.00
2797- MOUNTS, SUSPENSION ARM (R)(0 DEG)(L&R)	2.00
2798- MOUNTS, SUSPENSION ARM (R)(+/- 1 DEG.)(L&R)	2.00

The following template has been provided to make it simpler for you to install this transmission onto a custom chassis. If available, use carbide drill bits and countersinks on graphite chassis.

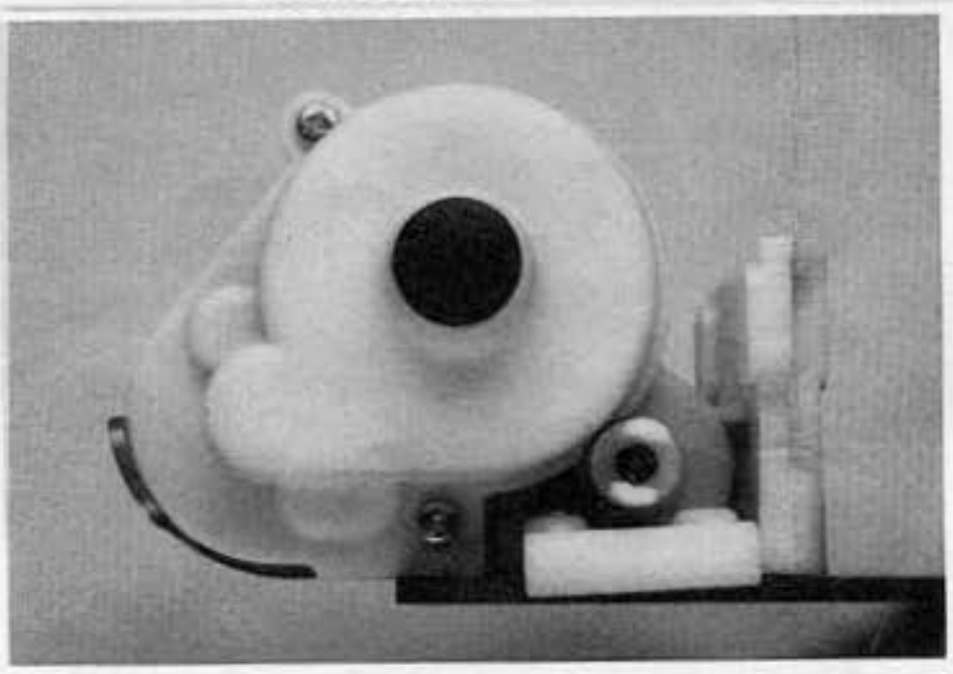
2.143 → 2.72

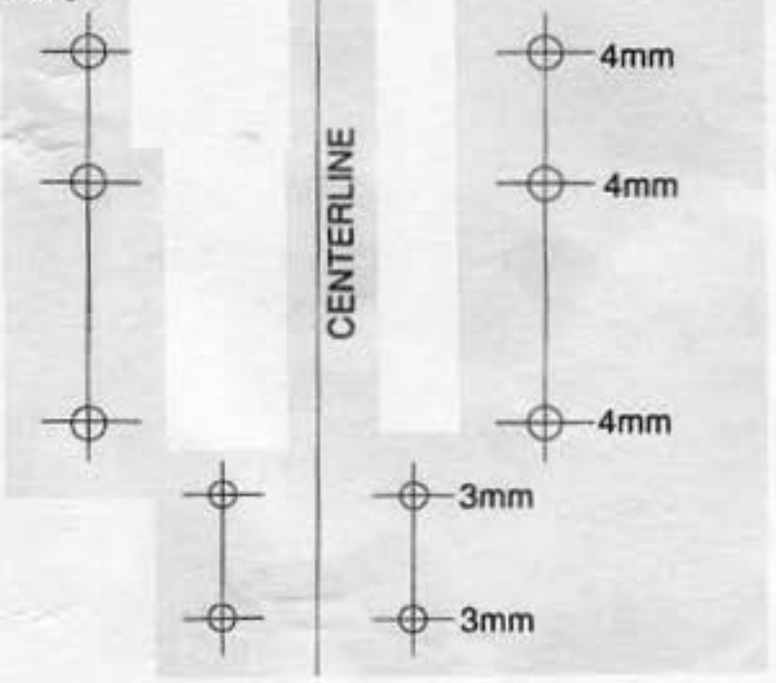
Pinions on High geared Trans

Pinions on Low geared Trans

PINION	SPUR 78	81	84	87	
12				15.51	18
13				14.32	19
14				13.29	20
15			11.98	12.41	21
16			11.23	11.63	22
17			10.57	10.96	23
18		9.63	9.98	10.34	24
19		9.12	9.46	9.79	25
20		8.66	8.98	9.30	26
21	7.94	8.25	8.56	8.86	27
22	7.58	7.87	8.17	8.46	28
23	7.25	7.53	7.81	8.09	29
24	6.95	7.22	7.49	7.75	30
25	6.67	6.93	7.19		31
26	6.42	6.66	6.91		32
27	6.18	6.42	6.65		33
28	5.96	6.19	6.42		34
29	5.75	5.97			35
30	5.56	5.77			36

Stock Motor- Mod Motor 3-5 Teeth Lower





Finial / Trans Ratio → Spur / ? = Pinion?