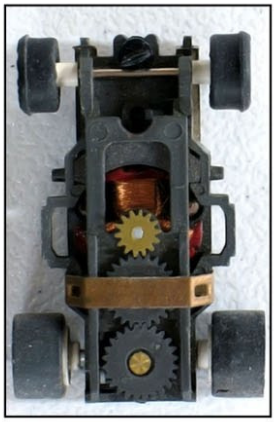
How To in HO
By
Paul Shoemaker

TUNING THE PANCAKE PART 2

After a very long hiatus getting various projects completed, I have finally managed to get some time to address the second part of "Tuning the Pancake". Many thanks to all of the reader's appreciation for the first part of this series and your infinite patience waiting on me to get this next chapter together. So let's get started. In this chapter we will be looking at the third generation pancake designs of AFX Magnatraction and the newer Auto World offering of that design. For the sake of our newest members to this great hobby, we will focus on the Auto World version, since it is the easiest to get your hands on. And before anyone gets their wheels spinning, I will circle around in another chapter and cover the 2nd Gen. pancake design, the first AFX chassis, also called the Non-Magna-Traction Chassis. Most of what can be applied to the Thunderjet design fits there but we will go back and look at the unique features of that design in our next chapter. Also, we are going to cover the 4-Gear chassis in chapter 4, sounds like I planned that didn't it? So enough about what's coming up, let's get going on this chapter!

Aurora AFX
Magna-Traction Chassis
Bottom View



Aurora AFX
Magna-Traction Chassis
Top View

Aurora Released the AFX Magnatraction Chassis in 1975. This was the direct replacement for the AFX Chassis, what we now refer to as the Non-Magnatraction Chassis (NMT). Not too imaginative but it works to describe the difference. This was the evolutionary step in the existing design, following the technological leaps die-hard racers were making in their customized competition racers in the last couple of years back then. Aurora, wanting to keep up, made a few changes in the chassis, electrical system and magnet size and took the pancake from an aging form to a new level of Zoooooom! Cornering and speed were the immediate benefits and it didn't take long for the racing communities to take this design to all new heights, pushing the envelope much further out.

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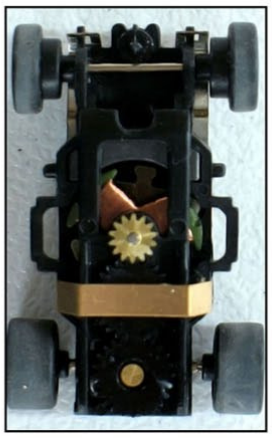
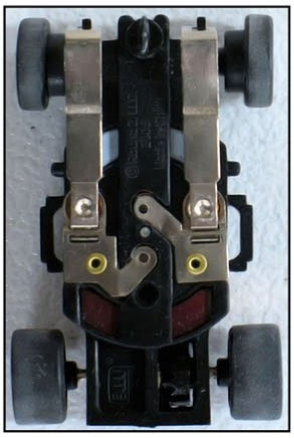
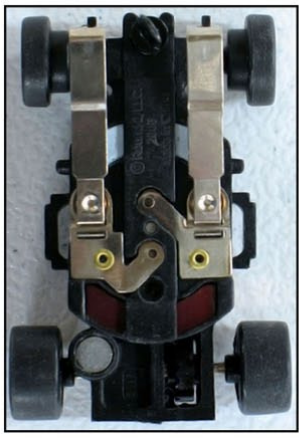


Auto World
X-Traction Chassis
Top View



Auto World
X-Traction Chassis
Bottom View

Auto World
X-Traction
Ultra-G Chassis
Top View



Auto World
X-Traction
Ultra-G Chassis
Bottom View

Starting in 2005, Round 2/ Auto World took over production of the Playing Mantis version of the X-Traction Chassis. Based on the AFX Magnatraction design, the Auto World version became it's own design with some unique features including the introduction of a separate traction magnet, improving the handling characteristics even more.

We will be basing our modifications on the newest of the Auto World pancake designs, the X-Traction Ultra-G Chassis. These are currently being manufactured and are readily available at your local hobby store or Internet retailer or Auto World's site. These modifications can be applied to any of the original Aurora AFX or Playing Mantis chassis as well.

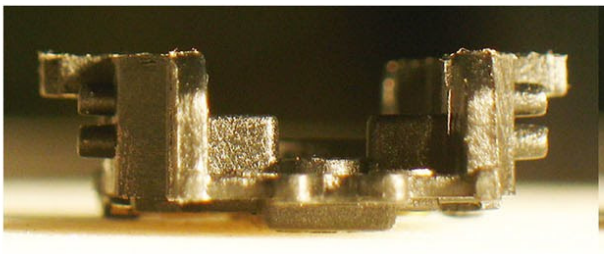
What are we working with....

When Aurora redesigned the original AFX chassis, they based the changes on what competition racers were doing across the country at the time. Magnets were being added to the chassis in various numbers and locations, or the motor magnets were lowered through the bottom of the AFX NMT or Thunderjet chassis to be used as a down force source. As the magnet designs took hold and started winning races, the brass weights that were accompanying the new mods were being phased out. Seeing this, the Super II concept suddenly looked very dated and a new path to speed and handling was the target. Magnets were the future. So the obvious difference was larger motor magnets that were visible from the bottom of the chassis, increased ventilation to the armature (as was used with the AFX NMT design) and a complete reworking of the electrical system with flat conducting plates at the bottom of a slightly larger brush cup. This component was all one piece, plated in silver. Coil springs replaced the leaf springs in the brush cups of the previous design. The comm brushes were also reworked, slightly smaller in height with a retainer "button/nipple" that rested in the coil spring and helped keep the brush centered in the cup. The idler gear (the center gear on the gear plate) was changed from brass to plastic to save weight above the center line. All of these components are present in the Auto World version along with the addition of a single traction magnet located on the left side of the bottom of the chassis (when viewed from the bottom). This will be the chassis we will tune for better and more consistent performance. Now for the legal disclaimer! If you race in a club, organization, etc., please verify that any of these modifications are allowed in your race rules before you set off to alter your best racer. You do not want to find out during tech-inspection that sanding the bottom of your chassis or shimming magnets will get you disqualified!

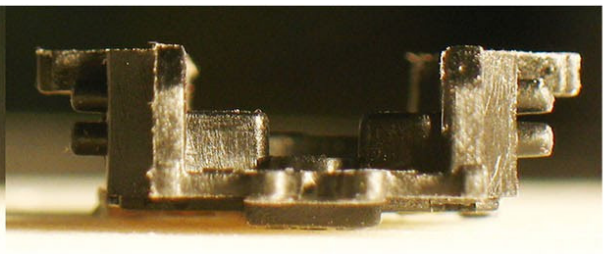
Tuning The Pancake Part 2

Start With the Basics...

Now it's time to pick a volunteer to work on. Examine a couple of chassis and look for ones that are straight along the sides, top and bottom. Some minor twisting can be fixed, but on the first ones you try, pick out the best of best until you are comfortable with all of the procedures. Do the same when choosing a gear plate. You may need to swap some parts around to get everything you need in these first few chassis you build. Make sure to remove the idler gear and check and make certain the gear plate lays flat. A piece of a mirror or glass is a good gauge to see if the parts and really laying down correctly. The bare chassis and the gear plate are the two most important pieces to have correct right off the bat. If either of these are sub-par anything that attaches to them will be also. So make sure your foundation is made up of your best available components. Let's take a closer look at the bare chassis.

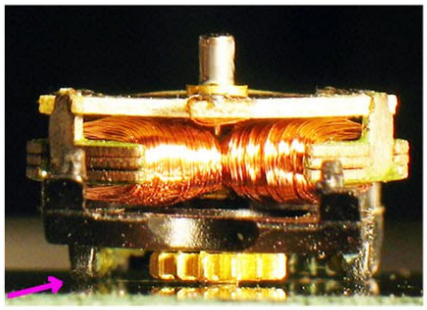


XT Bare Chassis on glass
Twisted Less than perfect

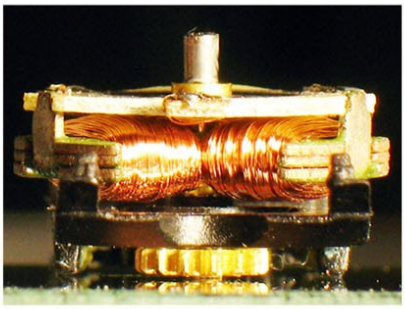


XT Bare Chassis on glass
Better Choice

The chassis on the left does not lay flat on the glass and would need some additional work before we would start the modification process. We'll look at that process later in the article. The chassis on the right is not perfect, but is much closer and we can work with this. Just make sure the chassis can lay flat without having to push or hold it down.



XT Bare Gear Plate
Twisted Less than Perfect



XT Bare Gear Plate
Better Choice

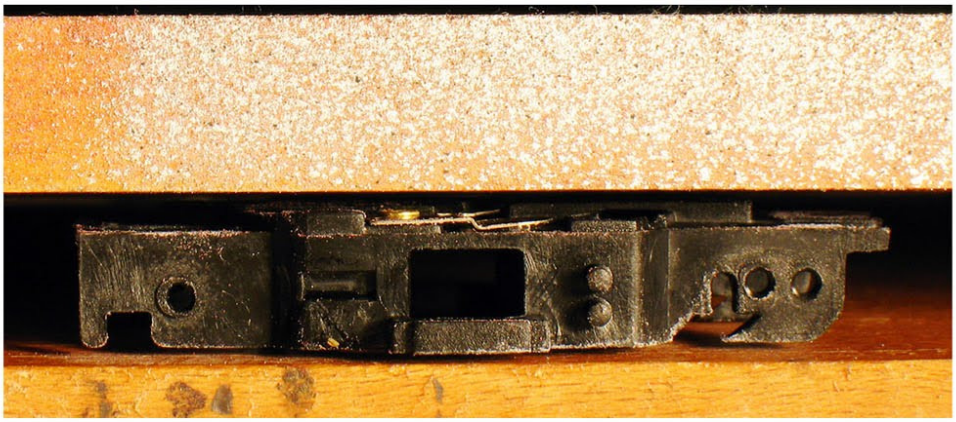
Using the same process with the gear plate, as we just did with the chassis, will help eliminate problem spots before we start building onto these foundation pieces. Make sure the gear plate rests flat. Any distortions can lead to gears binding, robbing speed and adding heat to the process.

Tuning The Pancake Part 2

In case you do not have any spare chassis or gear plate parts lying about, here's one method you can use to help get them a bit straighter. You will need to be able to heat up the plastic in the part you want to straighten. This can best be accomplished by using hot (near boiling) water or a hot air source like a blow dryer or heat gun. Use caution with any of these methods. Do not try using any direct flame based source like a propane torch, candle etc. The chassis material absorbs heats quickly and those types of heat sources can damage the plastic very quickly.

Find two pieces of metal or wood that are flat and square. Avoid using glass, since we are using pressure to keep the plastic parts flat until they cool. You will also need some clamps or weight to hold pressure on the part until it cools. I will be using hot water and hard woods along with a couple of clamps to straighten out a twisted chassis. Have your boards and clamps ready and sitting close to your hot water bath. I use a plastic bowl with microwaved hot water. Be careful using this method. The water may appear still, but can be very hot and can boil up when something is added to it. Use protective eye wear and use tongs to drop the chassis (stripped bare except the electrical plates on the bottom) into the hot water. Let it set long enough for the plastic to get to the same temperature of the water. Once it has gotten hot and softened up, remove it from the water (use the tongs!) and place it flat on one of the pieces of wood. Quickly place the second piece of wood on top and clamp it down. You need to do this quickly before the plastic cools. Let the plastic chassis cool for about 15-20 minutes. After releasing the clamps the chassis should be a bit straighter. Don't expect it to come out perfect, this won't do it. But it will get it closer. This is how the hot air process works. Clamp the chassis between the two boards. Now, using the blow dryer or heat gun (set the heat gun on low) force the hot air between the boards and onto the chassis. Check often to see if the plastic is getting hot. If you get it too hot, the chassis can be damaged. Once you have the chassis heated for 5-10 minutes, set it aside to cool completely. Once cool you can release it from the clamps. You should be able to correct a majority of twists or bows using this process as well. You will not get a perfect chassis, but those are a rarity anyway. This will get you a workable chassis that can be made competitive.

There are also some manufacturers the make chassis jigs for this same purpose. The jigs are usually made from machined steel or aluminum and can be expensive. However, the chassis jigs are a good investment if you plan on dialing in several chassis.

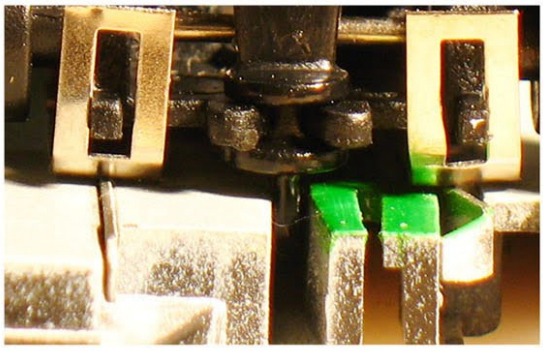


Here is a chassis clamped up for straightening. I use this method whether I'm using hot water or the heat gun to warm up the chassis material for the straightening process. This same clamp is used on the gear plate, once the gears and armature are removed. There are some manufactured jigs that force the chassis straight with rods running through the axle holes. These types of jigs also help align the axles as well as straightening the chassis.

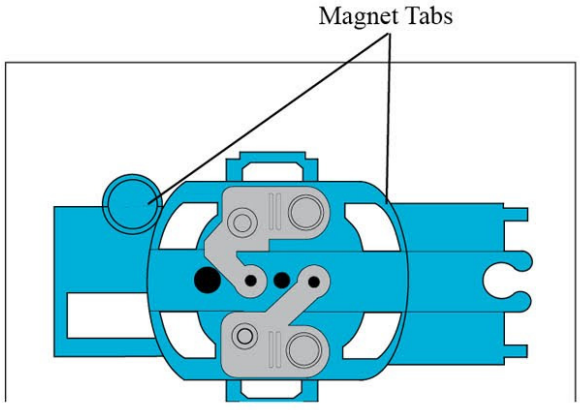
Tuning The Pancake Part 2

We Have Clearance, Clarence...

So now that we have the chassis and gear plate pieces either cherry picked or straightened to acceptable specifications, it's time to start building up the car. Take the bare chassis and add the front and rear axles, rims and tires. You can leave the crown gear off for this phase of the project. We're basing all of this on the box stock parts. Once you have the rolling components, add the front and rear motor magnets and the guide pin and set this assembly on a short piece of track. Make sure to use the same type of track that you will be racing on. Different brands can have unique rail heights or slot depths. Check the guide pin and make sure it is not resting on the bottom of the slot. You should have about .005" to .010" clearance between the bottom edge of the guide pin and the bottom of the slot. This will prevent the guide pin from catching on the joints between track sections and prevent excessive drag which will slow your car down. Very lightly sand the guide pin down to the desired height. Make sure you do not remove too much material. If the pin becomes too short, you will deslot easier once the G-force in turns becomes stronger, as the car becomes faster. Hitting the happy median is the ideal target. Now that the pin is adjusted correctly, take a look at how much clearance is between the bottom of the chassis and the track rails. With box stock tires you will see lots of daylight and lots of dark spots. The dark spots are areas that will drag the track when the cars is running. We want to get rid of these. Here's where that legal disclaimer comes in. Many racing organizations do not allow for the sanding of the bottom of a chassis, so make sure this is allowed before you proceed to alter your competition cars. The "dark spots" are a combination of flash from the chassis mold, or actual ridges in the design of the part. Either way, these can snag a rail when entering or exiting a turn and can cause the bane of our existence: the flying deslot! So here's how we cure that. Once again, remove all of the pieces from your chassis. Taking a fine grain sandpaper, 320-400 grit, secure it flat on a smooth surface. Take the chassis, bottom side down, and make figure 8 motions across the sandpaper. The figure 8 motion will help ensure that you are getting an even pattern of wear across the bottom of the chassis. Work a few turns and then check to make sure the chassis is sanding evenly. Once you see the burrs, flash and low spots wear away, wipe off the chassis with a damp cloth soaked in alcohol. Once clean, install the axles, wheels, tires, guide pin and magnets and set it back on the track section. Check the clearance again until you see a nice even spacing of daylight. Make sure to do this in small increments! You can't put back chassis material once it's sanded away. Also take precautions with the small band of plastic that holds the motor magnets in place. Unless you are gluing the magnets in place, you will need these to hold the magnets in the chassis and not have them fall through the chassis to the track rails. The biggest benefit from this modification is that you get an evenly spaced gap between the chassis and track. That will be an advantage when you go to lower wheel or tire height, knowing that you will not have a section of chassis dragging here or there. This also helps prevent the chassis from snagging on high rails or uneven sections of track surfaces.



Guide Pin Clearance



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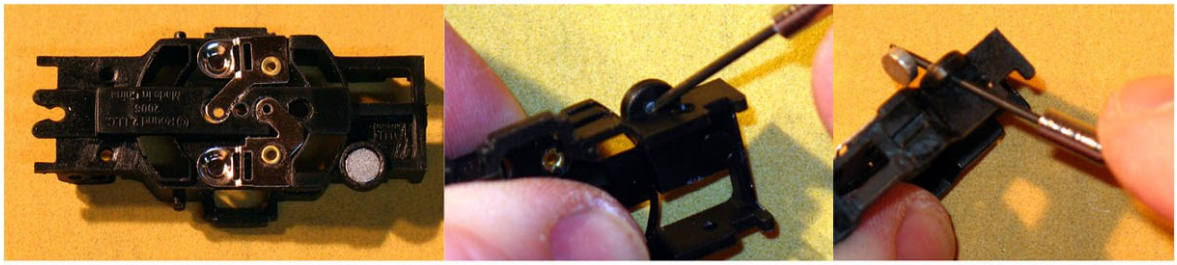
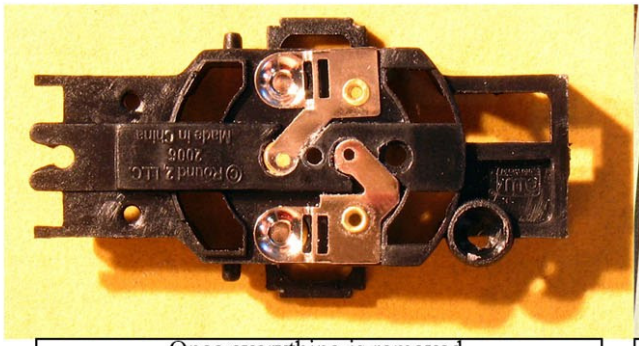
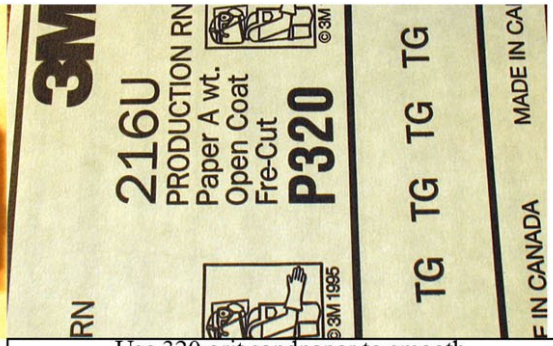


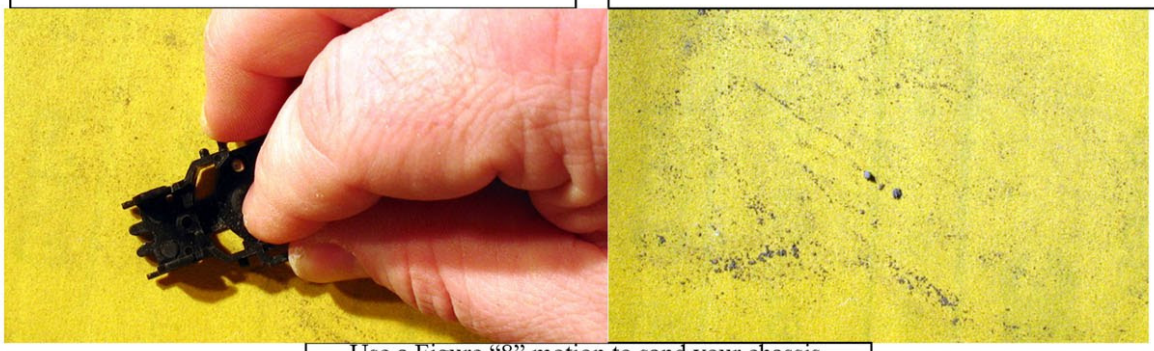
Make sure to remove all of the magnets and other items from the chassis before sanding. The Ulta-G traction magnet can be pushed out from the top of the cavity it sits in.



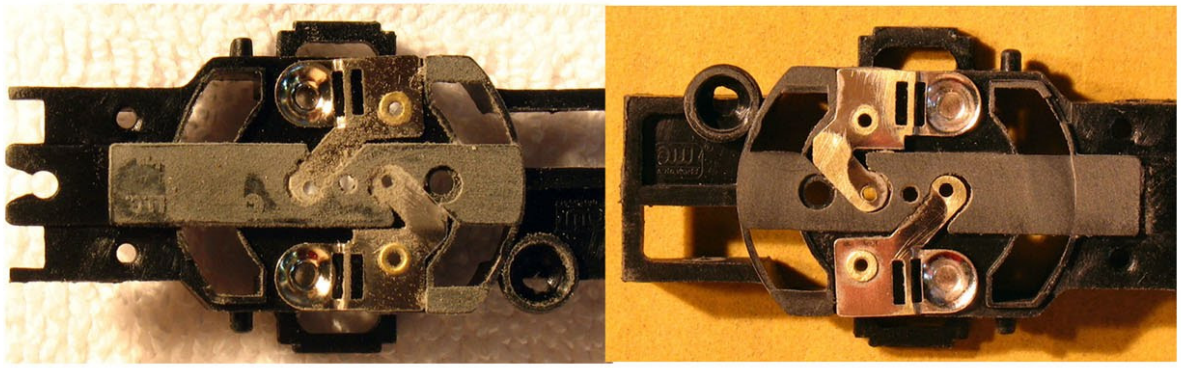
Once everything is removed, we are ready to start sanding.



Use 320 grit sandpaper to smooth out the bottom of the chassis.



Use a Figure "8" motion to sand your chassis. This will help sand the bottom evenly.



Tuning The Pancake Part 2

Remove material in small increments. You can't put material back once you sand it away.
Check your progress frequently. The chassis on the left shows progress at about the half way point.
The one on the right shows the finished job with all of the high spots removed.

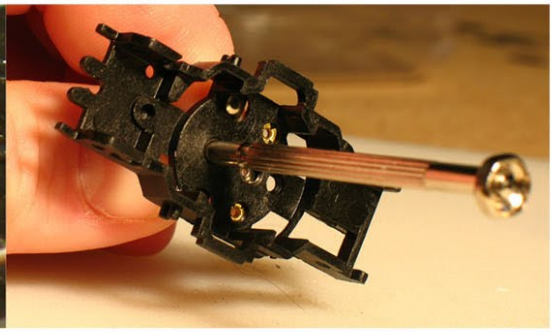
Electricity...The Shocking Truth

When it comes right down to it, the electrical connection is the most important part of any slot car. Weight, magnets, tires go nowhere until that motor starts turning. After completing phase one, we have a nicely leveled chassis and hopefully a straight and square chassis and gear plate combination. The electrical pieces are our next focus. Starting with the pieces that are attached to the chassis seems the logical jumping off point. These units are the metal pieces that are riveted in place on the bottom of the chassis. They have two major purposes, holding and springing the pick up shoes and being the level foundation for motor brush springs and transferring the electricity to the motor brushes. It is very important to keep these pieces clean and crud free. You will also notice that as you sanded the chassis bottom, chances are, you sanded down some of the rivet heads that hold these parts in place. That's a good thing. The rivets can be the lowest piece on the bottom of the chassis. Just make sure you did not sand all the way through one. If these are still a bit high, you can take a metal jeweler's file and grind off a bit more material for that extra bit of clearance.

Examine the part of this component that fits inside the brush cup. That's the hole in the bottom of the chassis where the motor brushes and springs hide. The metal tab should be flat and level with the bottom of the chassis. This part often gets bent in the production process and will need to be tweaked a bit. You can use a pair of small jeweler's screwdrivers to act as leverage points against one another, bending the tab straighter or flatter. The closer to level you get this, the less likely the motor brush will bind in the cup or ride unequally on the armature's commutator.

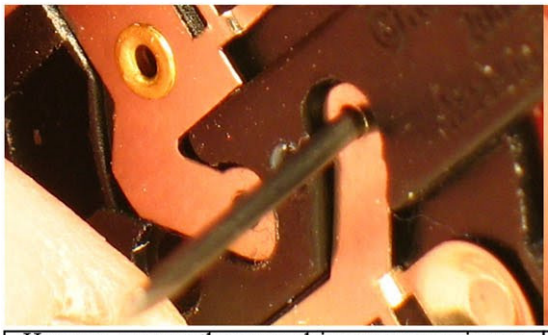
Both of these scenarios rob power and speed from the car. Once the brush tabs are flat and level in the brush cups, make sure the slots where the pickups attach are not bent or crimped down and that the pick up shoe hinge moves freely. The cup-like depression that holds the pick up spring should also be clean and tarnish free. Both of these areas transfer electricity on to the motor brushes, so keep them clean and bright.

A bit difficult to see at this angle, but the brush cup tab on the right is bent inward toward the armature side of the chassis. This needs to be flattened to improve performance.

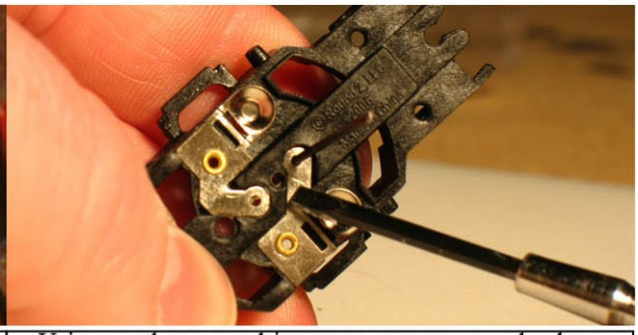


We will insert a small rod, in this case a jeweler's screwdriver in the brush cup hole to use as leverage to straighten the brush cup tab.

Tuning The Pancake Part 2

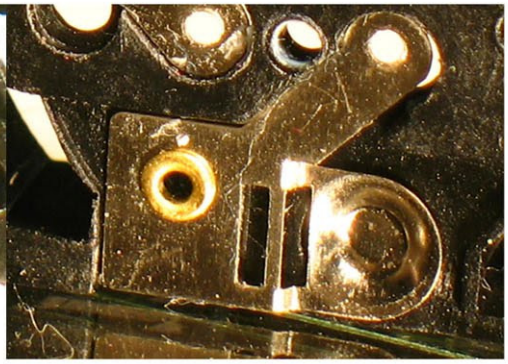


Here we can see the screwdriver we are using as our leverage point to flatten this brush cup tab.



Using another screwdriver, you can pry or push where necessary to flatten the brush cup tab.

The brush cup tab is now flat and parallel with the chassis. This will make tuning the brushes much easier and consistent.



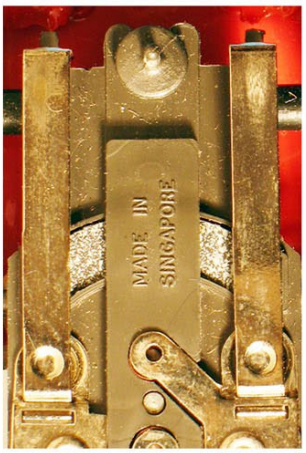
The assembly that passes electricity from the pick up shoes to the motor brushes. Keep this area clean and bright.

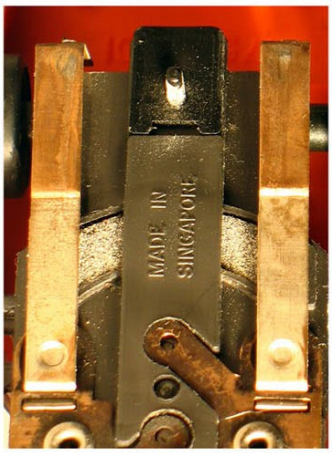
Pick Up Shoes, Long Step, Short Step, No Step, Wide and Ski Shoes...Nike, Converse...????

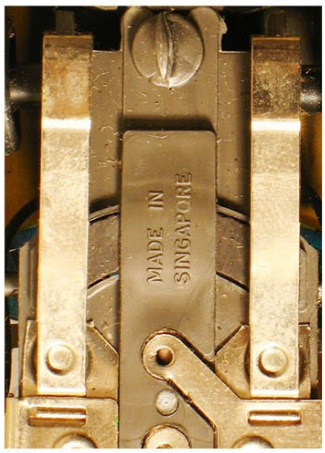
Next in the electrical system line are the pick up shoes. These are the most abused part of the car and the first component in getting power to the motor. There are a wide variety of designs to this version of pancake car. We will be using the stock Auto World pieces here, which are a long step and wide design. There are many theories on which is best and why. They all need adjusting in one form or another and racers will swear by one type or the other. It's just like someone saying "I'm a Dodge or Chevy or Ford fan". None of that is bad or wrong, just what they like. Same with pick up shoes. We are taking the easy way out by choosing the most readily available product and staying out of the controversy by using the box stock items! But the same techniques used on this particular type of pick up shoe will work on all of the others as well. That aside, let's see what we are working with. You want the pick up shoes to ride flat with enough travel left in the up and down range of motion so as to absorb some shock when hitting an uneven rail or high or low spot in the track you are racing on. You also want a firm connection to the track rail so every little bit of power gets to your motor. Once you have made sure the hinge does not bind (previous step from above) check the shape of the pick up shoe. Make sure they are not bent or twisted along its length. The hinge should be flat and square with the length of the shoe. The retaining tab should be 90 degrees with the bottom surface of the shoe. If you need to flatten the shoe along its length, a small pair of flat edged pliers will do the trick nicely (see photo). Now let's check on the pick up shoe springs. These are copper coiled units and should be fairly soft in their tension. You can change the tension and make them stiffer by cutting a coil and stretching the coil out a bit. If this is needed, do so with caution. Making the coils too stiff can add bounce to the ride and create a deslotting issue.

Tuning The Pancake Part 2

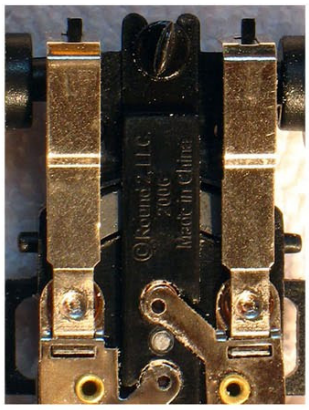
So how do you know if you need more tension? Assemble the pick up spring and shoes with the chassis. This is best done with whole chassis assembled so you get the entire weight of the chassis during your analysis. Once assembled, set the chassis on a section of track you can hold up level to your eyes. Look at the chassis head on as if it would be coming toward you. Where do the holes in the pick up shoes rest on the chassis tabs (see photo)? They should be somewhere in the middle with a bit of travel available in either direction, If the ride at the top of the hole you have too much tension from the pick up spring or the hinge is sticking not allowing the shoe to swing properly. If the hole is riding on the bottom, you do not have enough tension and any shocks from high or low track rails will transfer the shock to the chassis as a whole and cause deslotting. Removing or adding tension is a simple matter of switching springs or removing coils (removing tension) or stretching the coils (adding tension). Do this in small increments and check the position of the pick up shoes after each change until you have them where you want them. Pick up shoe wear patterns are a great indicator of where the shoe is hitting the rail and if the shoe is making full contact with the rails. You want the shoe to wear as near the middle of the length as possible with most of the "step" in contact with the rail. You also want the shoe to ride as evenly as possible but slightly biased toward the front of the shoe. Make sure to keep this area clean to ensure the best electrical connection possible. A pencil eraser or very fine sandpaper will clean these up nicely. Unless I'm in a timed competition, I remove the pick up shoes when cleaning them. This prevents the debris from winding up in the motor brushes or worse.







Pick Up Shoe Variations: Left: Aurora AFX "No Step" Pick Up Shoes.
Center: Aurora AFX "Long Step" Pick Up Shoes. Right: Aurora AFX "Short Step" Pick up Shoes.



Current Auto World Pick Up Shoe: Wider shoe, long step and more contact area to the track rails.

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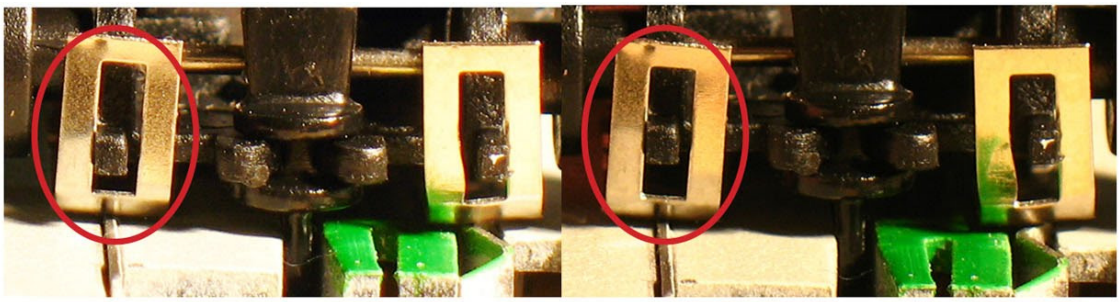
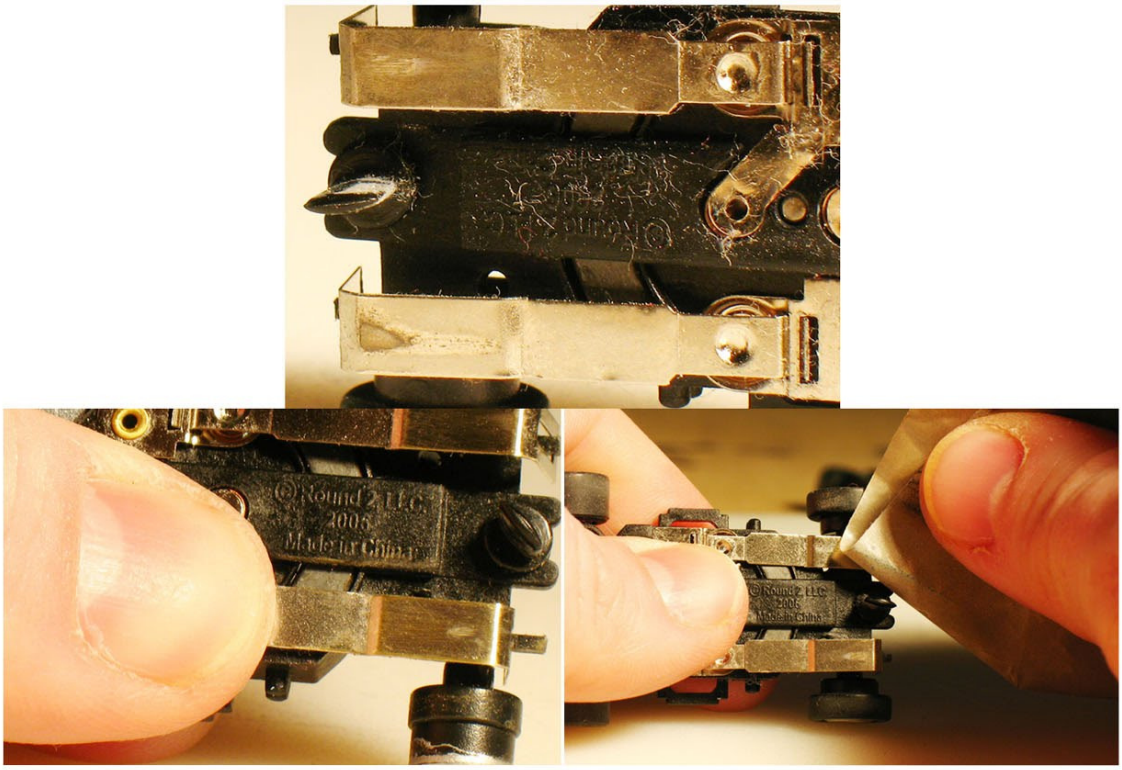


On the left we have a set of pick up shoes that are bottomed out. So if it hits any high or low rail it is going to jar the chassis, most likely out of the slot. On the right we have a shorter spring with a tiny bit of extra tension, but soft and springy. This leaves a little play in the pick up shoe travel. Think of this as a suspension point on the chassis. Always keep contact with the rails, but with enough play to absorb the slot car equivalent of a pot-holes.



Clean Shoes Are Happy Shoes: The top center photo shows typical pick up shoe wear. This car was running on a banked oval, so the right shoe tends to wear or get dirty faster. Notice the wear is even across the length of the step or contact portion of the shoe. That's exactly how you want to see the pattern develop. Wear on the very front or rear of the step means the shoe is not flat on the rail surface and cause chattering or bouncing as the car accelerates. The picture on the left shows how to keep the pick up shoe in place while you clean it on the chassis. This ensures that you don't have the shoe pop off and lose the spring underneath. Use a very fine sandpaper (800-1200 grit) or an abrasive erasure to clean the pick up shoes and even out the wear patterns. Always replace shoes that have worn through or have deep grooves that severely hampers top performance.

Tuning The Pancake Part 2

Sometimes the pick up shoe springs are too stiff or long or a combination of both and cause the shoes to bounce or bottom out on the chassis. If replacements are not available to sort through, I remove a single coil from the spring and stretch it very slightly. Place the cut side of the coil away from the pick up shoe (toward the chassis). The cut side can "thread" around the edge of the pick up shoe and come out.

Motor Brushes...The Make It or Break It Part

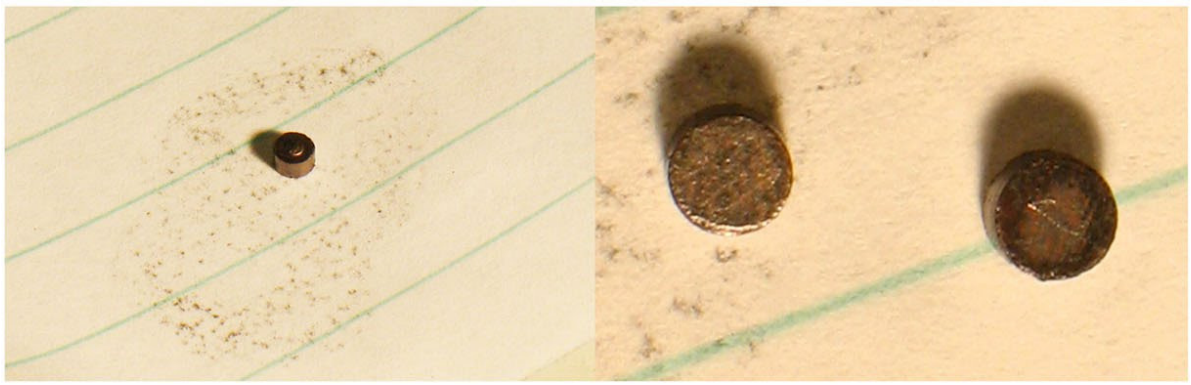
The motor brushes are the hardest part to adjust. Maybe because they are hidden away under the armature and gear plate, or because all those pieces are so tricky to get re-assembled without changing your changes! The motor brushes and their springs are the last component in the transfer of electricity to your motor. The springs are coiled units, similar to the pick up shoe springs, but are shorter in height and much softer in tension. The brushes are a compound of either copper or silver along with a carbon material to bond it all together. Most of the newer chassis, Auto World's included, use the silver material in their motor brushes. There are some after-market and older parts out there using copper as the conductive base. Here's the skinny on the whole advantage/disadvantage over copper and silver motor brushes. Silver conducts better, but is a softer compound which leaves more residue (the black bands) on the bottom of your armature's comm. Copper leaves less material behind, but does not conduct or transfers the electricity as well. Silver content wins out hands down. Now there are other options out there, but as to how available they still are, I'm not too certain. I have some gold motor brushes for this era of pancake design. They are a much higher conductor of electricity, but they wear very quickly and leave the comm a mess. Great for, let's say, drag racing, but not any duration of lap racing. For our purposes we'll continue to stick to the box stock Auto World components.

You want the motor brushes to "float" in the brush cups. Make sure there are no burrs or distortions in the brush cups molded into the bottom of the chassis. You can very gently ream these with a jeweler's file or hobby knife. Remember, remove very small amounts and check the fit often before removing the next bit. And again, check with your local racing rules about this modification as it is not allowed in many rule sets. Once you have the brush moving freely in the brush cups, look and see how high the brush sits in the cup with the springs in place. This is another one of those delicate balancing acts. Too much pressure and the brushes drag against the comm slowing the motor and building heat. Not enough and the motor runs slower from lack of electrical transfer. Re-assemble the chassis with the pick up shoes, springs, magnets, brushes and springs, gear plate armature and gear plate clamp. Leave the idler gear, crown gear, axles and wheels off for this stage. Now, using a 9 volt battery or other power source that will allow you to flip the chassis upside-down, power up the car. The armature should be spinning free with no load on it. With the chassis upside-down, using a small jeweler's screwdriver, very gently apply pressure to the motor brush through the hole in the electrical plate at the bottom of the brush cup. If you do not have enough tension on the motor brushes, you will hear the armature's RPM rise. If there's too much, it will slow. So now what do we do? If you need more tension, you have two things to check on. If this is an older chassis, the brushes may be worn down and not making full contact.

Tuning The Pancake Part 2

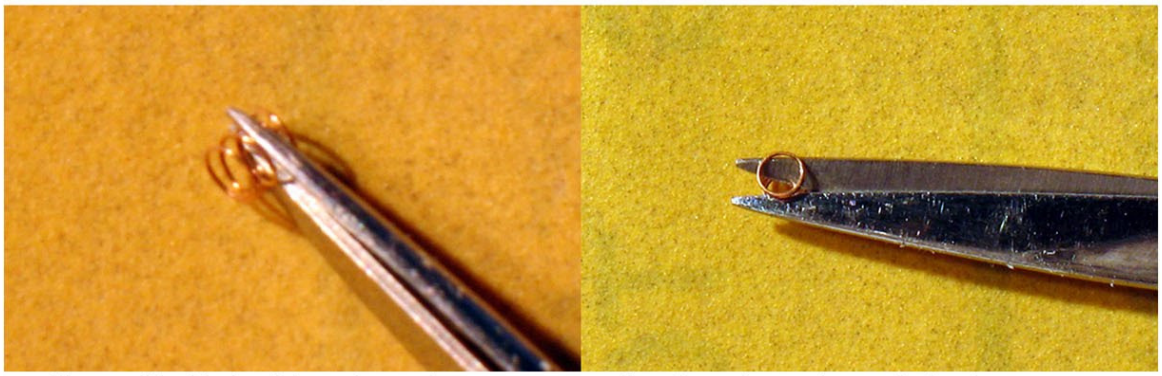
You may want to replace the brushes depending on how much they are worn. If the chassis is new or the brushes are not worn away, you can stretch the brush springs a bit to add tension. I have also used pick up springs that were clipped down. If you use that method, watch for excessive heat from the armature. The pick up springs do not tolerate heat well and will collapse easily. If you need to reduce tension, simply remove about 1/2 of a coil (a single loop) at a time until you get the desired tension. Motor brushes are sponges for lubricating oil. Make sure to keep them clean. It can easily be done by gently rubbing them across a piece of plain paper. Avoid cleaners or electrical sprays, they work well, but soften the carbon material over time.

Stock Auto World Motor Brushes and Brush Springs.

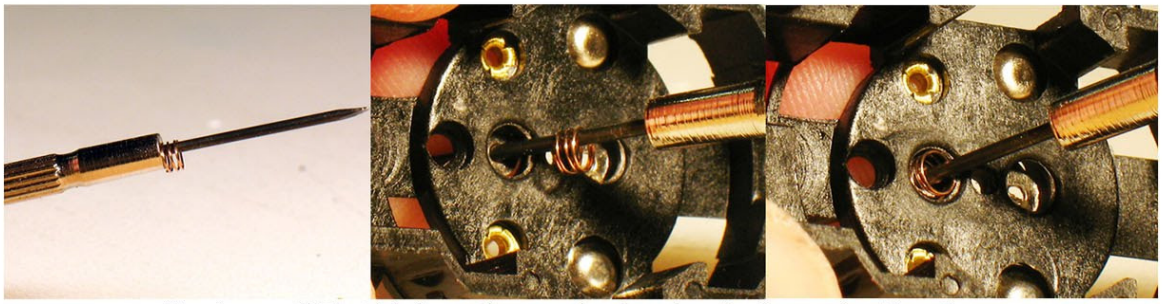


Clean the oxidation and oil build up from your motor brushes. The quickest and easiest way is to rub the motor side of the brush (the flat side) in a figure "8" pattern on a piece of paper. You can see in the left hand picture how the dirt and oil are left behind on the paper. The picture on the right shows a clean motor brush (left) and a dirty motor brush (right).

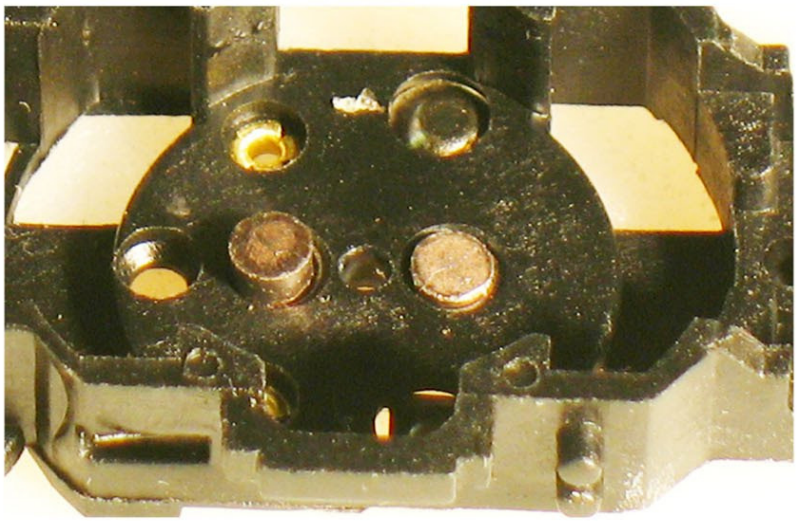
Tuning The Pancake Part 2



Just like we did with the pick up shoe springs, we want to adjust the spring tension on the brushes. You want the brushes to "float" in the brush cups. You want enough pressure to ensure the best electrical contact with the least amount of friction possible. Only remove about 1/2 to a full coil at a time and check how well the brushes "float", but still make full contact with the comm on the armature.



Here's a neat little trick for getting your brush springs in place and not lose them.



The chassis above shows a "floating" motor brush on the left and one that is bound up on the brush cup sides on the right. The one on the left is actually above the cup rim in this shot, but is at the level it should sit at, fully rested on the spring. The brush on the right will not make good electrical contact, if any at all, with the armature.

Tuning The Pancake Part 2

Pancake Armature..You Spin Right Round Baby, Right Round (Okay, I'm Old)

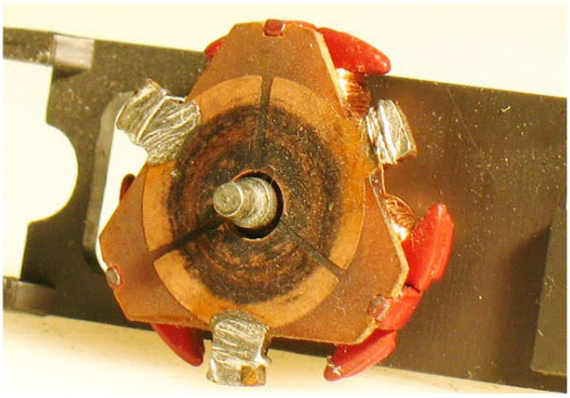
We have covered all of the electrical transfer components, so where does all that power go? Right to that little widget under the gear plate, our friend, the armature. The Armature is made up of 4 pieces:

1) ***the commutator*** which collects the electricity from the motor brushes and sends it to
2) ***the winding wire*** that can be single gauge or multiple gauges of wire wound around
3)***the armature poles***, which are a magnetically attracted metal that ride on
4) ***the armature axle*** on which all this spins between the gear plate and chassis.

Most of what you will see in the box stock armatures will be a 37-37.5 gauge wire and a copper commutator (comm). Very rarely you may catch the comm being advanced, meaning the electricity will transfer to the wire just ahead of that pole hitting the magnetic field that spins the armature. Most timing is set to 0 degrees. By advancing the timing 5 degrees ahead you can add RPM, decreasing the timing by 5 degrees will reduce RPM but add a bit of torque. Both processes add heat to the armature. For the purposes of tuning, we will assume a 0 degree timing as box stock and look at armature rewinding and comm timing in another article in the future.

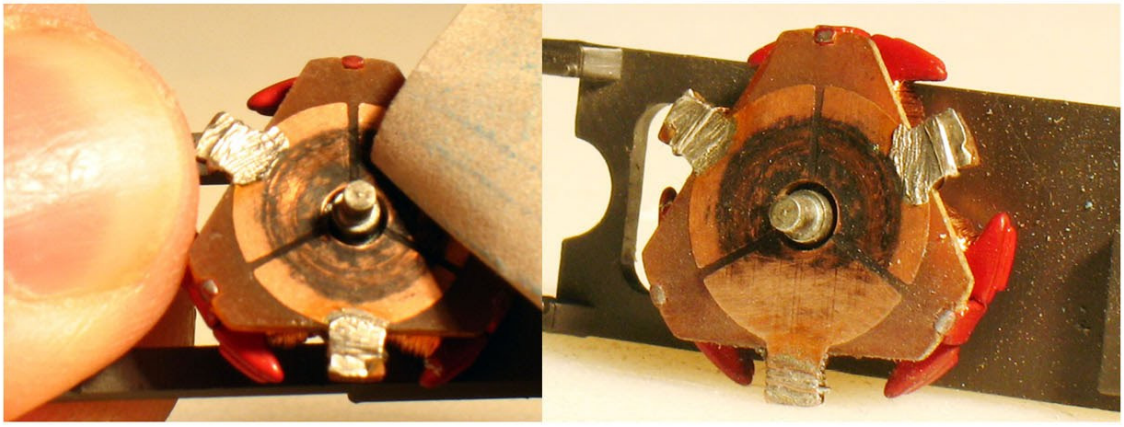
Keep that comm clean. Using an eraser or very fine sanding film (2000 grit or finer) you can clean the comm. If using the eraser, make sure to wipe the comm down with a soft clean, lint-free cloth to remove any residue the eraser may leave behind. Use the sanding fine sparingly. Even with super fine grits, you are removing some portion of the copper material and eventually wear it away. Check the wiring wraps on the poles and the point where they are soldered to the comm. Look for dark patches in the windings where heat may have caused some damage. You also need to check the solder points and make sure there is no excess of solder that may be causing friction with the chassis. You can gently file any excess away. Use caution so as not to damage the small wires that are attached. Also check the axle area to make sure there are no burrs or distortions of the axle or the plastic hole (bushing) they ride in. The less play in these connections the better as that reduces vibration and loss of power. But make sure they still turn freely.

Use oil very sparingly on the armature shaft at the gear plate and especially at the bottom of the chassis. Remember the motor brushes drink oil up and quickly turn it into the crud that slows you down. Check out the first chapter of "Tuning the Pancake" for armature balancing and fine tuning techniques that can be applied on this chassis design as well.

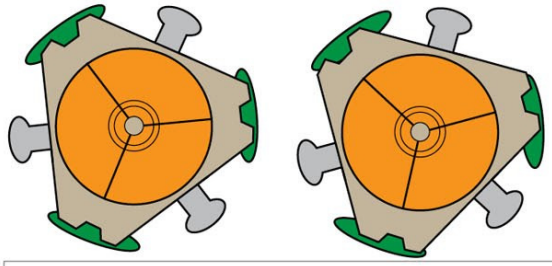


Here is a pancake armature with typical wear and dirt.

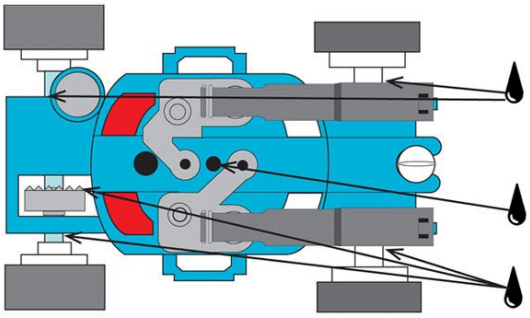
Tuning The Pancake Part 2



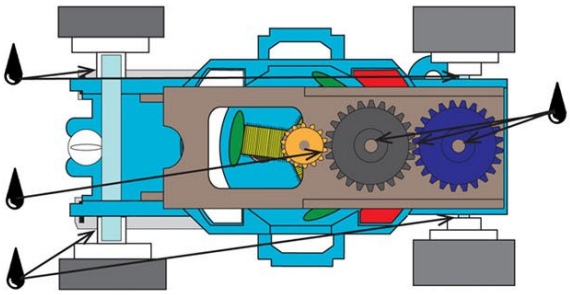
Clean the armature with some ultra-fine sanding film (1200 grit or finer) to polish the arm. You can also use erasers but make sure to wipe the residue from the comm. The residue does not conduct well and will hamper performance.



(Left) Zero Degree Stock Armature Timing
(Right) Ten Degree Advanced Armature Timing



Oiling Chart - Bottom View

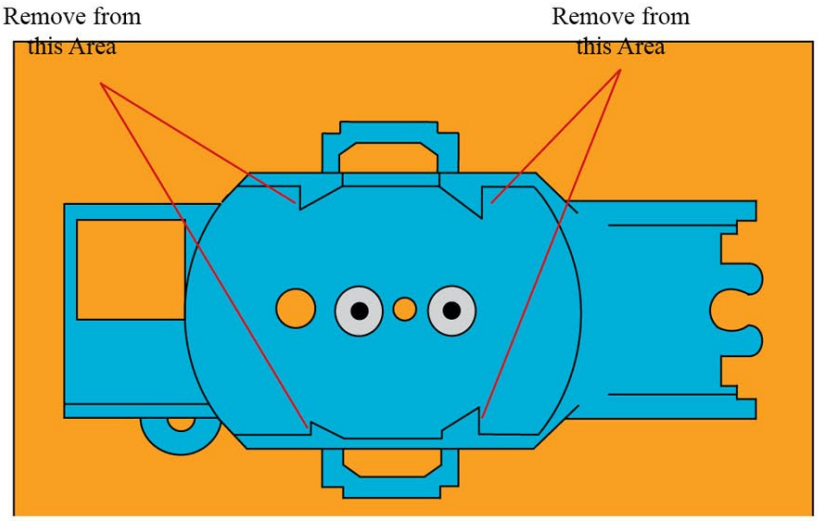


Oiling Chart - Top View

Tuning The Pancake Part 2

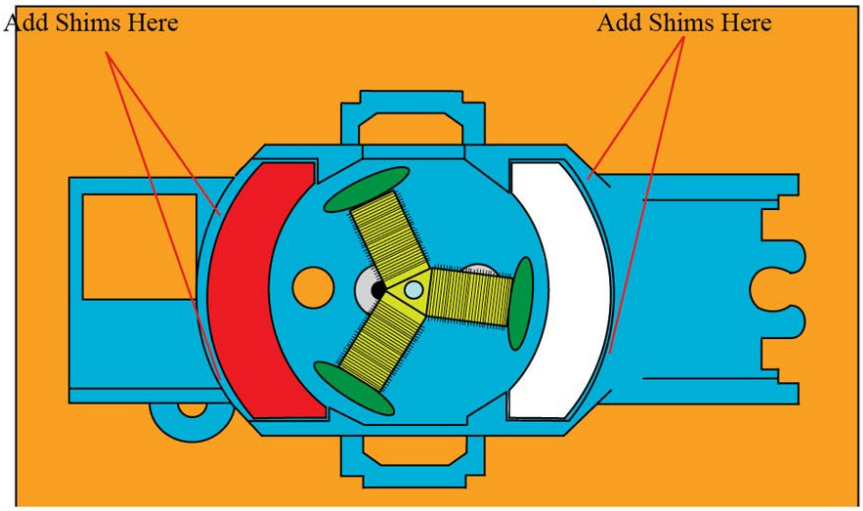
Opposites Attract...Or We Wouldn't Go Anywhere!

So now we have followed the power from the pick up shoes, through to the motor brushes, to the armature. So how does this make the car go anywhere? Positioned on either side of the armature are two magnets of opposite polarity. When the electric current runs through the armature wire, we create a coil effect. That effect "pushes" the armature pole through the magnetic field of each of the magnets. As power is switched on and off of the armature poles, they either coast to the next magnetic field or are in the process of being pushed. The more current running through the wire, the higher and harder the push becomes. Larger wire with less resistance can increase the "push" as well, but at the cost of greater heat. So now we know that the magnets are pushing the electrically charged armature in a circle and we harness that spin through gears to our slot car's wheels. What can we do to get more out of this? The easiest and first step to take is to get the magnetic field stronger. Since we are going to stick with the stock magnets in this article, we are going to accomplish this by moving the magnets closer to the armature poles. Also, while we get them closer, we are going to shim them with a ferrous (magnetically attractive) piece of metal. In this case, a piece of track rail that has been filed down to fit. Now it's time to bring up the rule books again. Not all classes of racing allow this type of modification. Some allow shimming, but not with a magnetic type of material. Now you are asking "Why not?" The magnetic shim is called a flux collector. Magnets give off a field or magnetic wave around all of its sides, top and bottom. A flux collector can re-focus one side of these fields to increase the power on the opposite side. This gives a little boost to the magnet's side facing the armature pole. So you not only get it closer, you can make it a bit stronger. This modification improves acceleration and braking (if you use dynamic braking on your track). So how do we go about this modification?

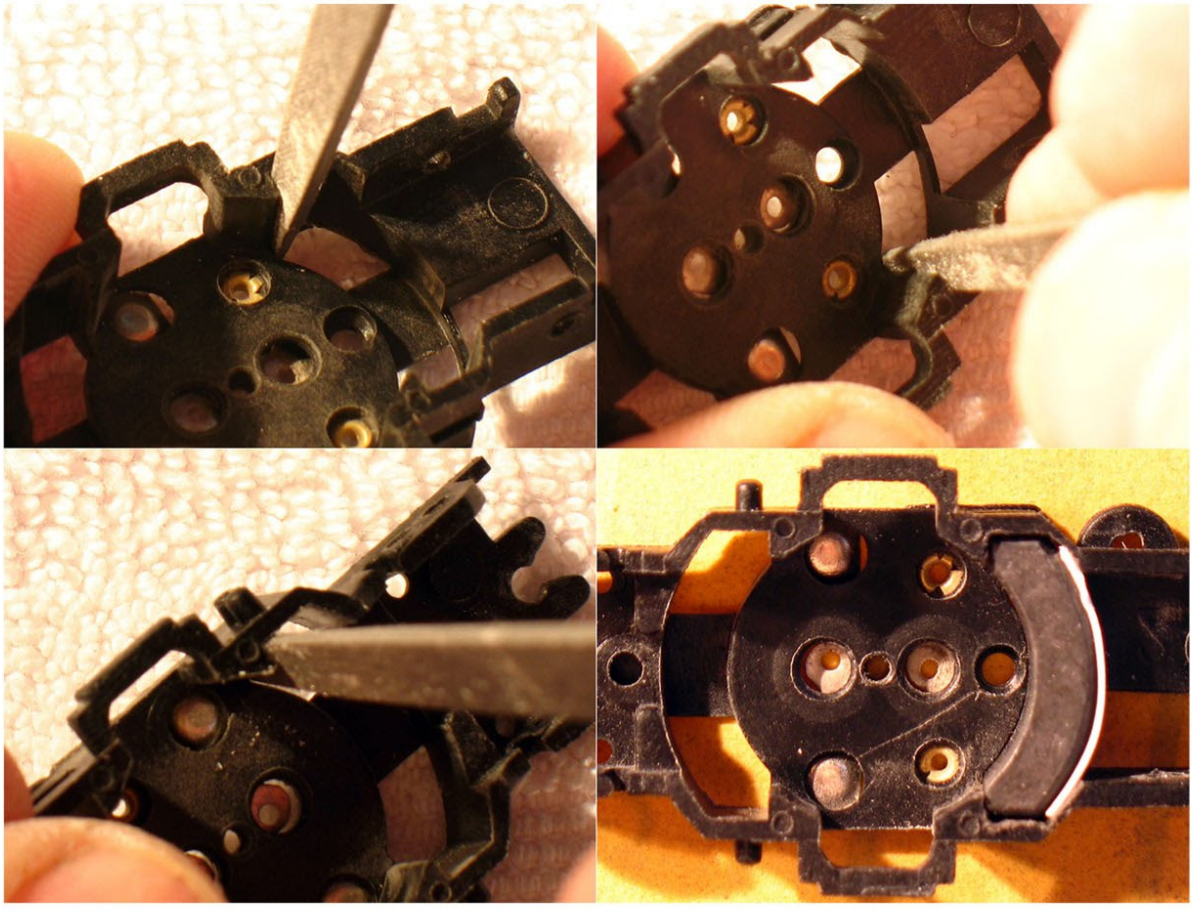


Take about .005" from the areas pointed out above. These tabs hold the magnet in position. Be careful not to remove too much, otherwise the magnet's face will contact the armature poles.

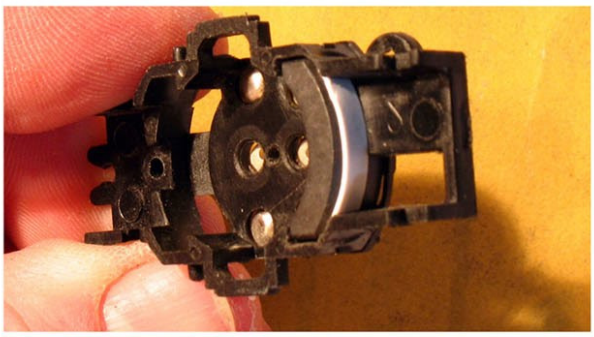
Tuning The Pancake Part 2

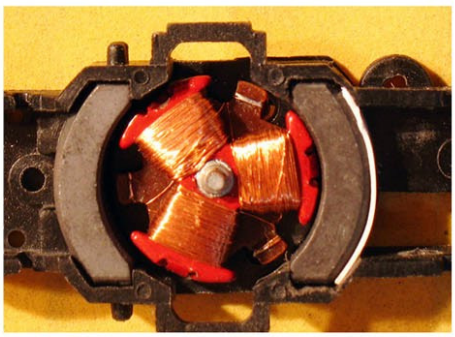


Push the shim material in behind the magnets in the locations pointed out above.
Make this a nice tight fit without distorting the chassis.
The closer you get the magnets to the armature, the greater the torque you can generate.



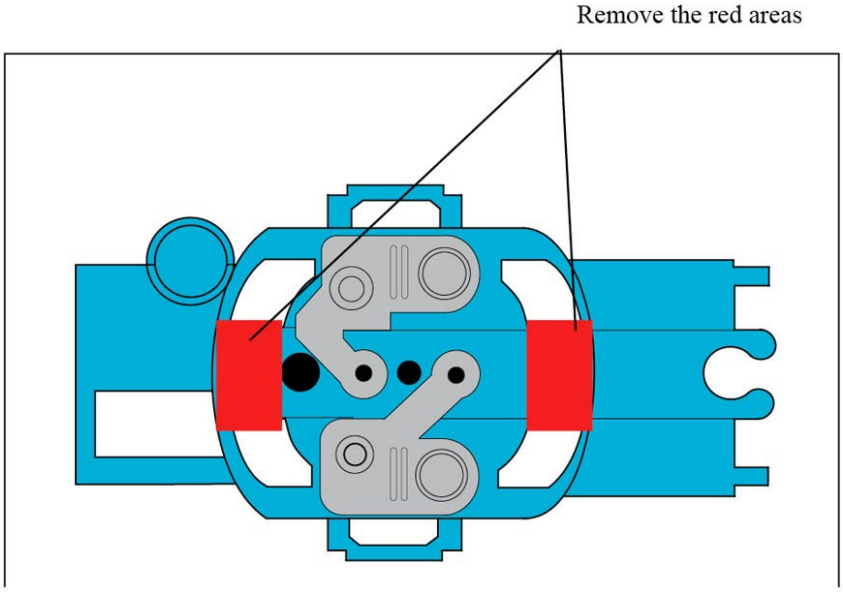
Tuning The Pancake Part 2





The pictures above show the sanding and shimming process to move the motor magnets closer to the armature. Take care to remove small amounts of plastic from the chassis and test fit frequently to make certain you do not remove too much material. The last picture on the right is the finished shim for that magnet.

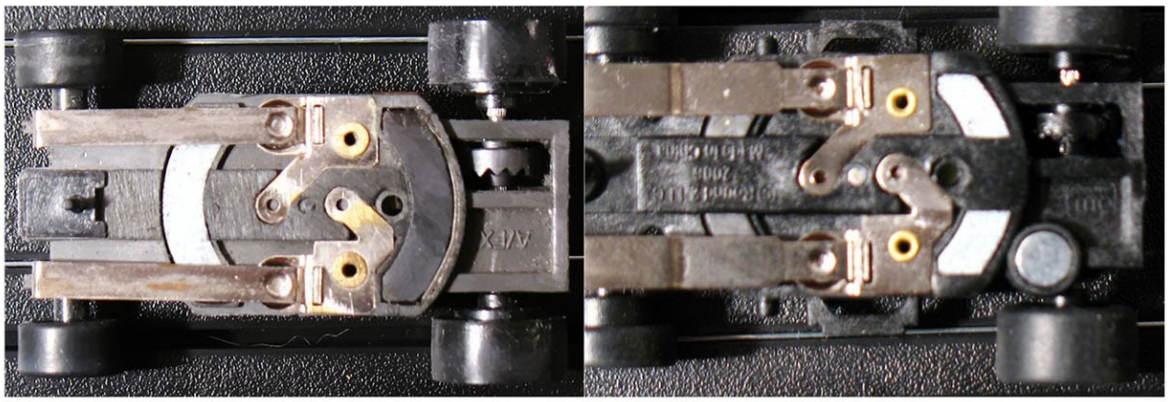
Stronger magnets are another way to go. There are several manufacturers that offer re-zapped magnets or magnets made of stronger material like neodymium. You may also want to lower your magnets through the chassis to make them ride flush with the bottom. Once again, check your rules if you race in a club or organization as to whether this modification is allowed.



By removing the areas in Red, you can drop the magnets flush with the bottom of the chassis. This will give you even greater traction. You will have to glue the magnets in place, or they will pull through, to the rails of your track. Use an epoxy or other strong, heat resistant glue. After the magnets set up and the glue is cured, sand the bottom of the chassis again using the figure 8 method shown earlier, to even things up.

Since we're sanding the bottom of the chassis again, it would be best to level out the traction magnet at this time too. The traction magnet can be pushed out from the top using a small jeweler's screwdriver. It may be glued in place, so you may need a bit of force to get out. Avoid prying it out from the bottom as this can distort the cup it rides in or may do other damage to the chassis by creating a high or low spot. Once removed, clean the socket it rides in of any glue. Press the traction magnet back up into the cup and use a flat surface to press it in flush with the bottom of the chassis. You may want to secure this with the same type of glue you used for the motor magnets.

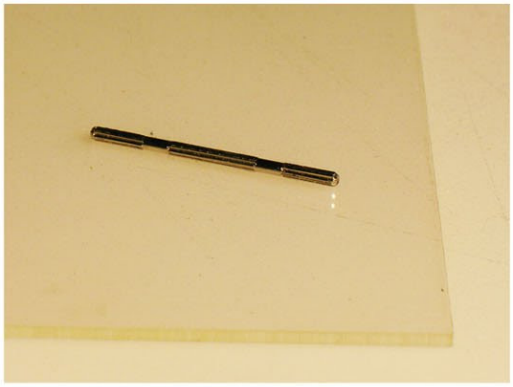
Tuning The Pancake Part 2



The left side image shows the motor magnets lowered flush with the bottom of the chassis. These are glued in place to keep them in this position. The right side image shows the Auto World X-Traction Ultra-G traction magnet lowered flush with the bottom of the chassis. It was .005" further up in the holder prior to this change.

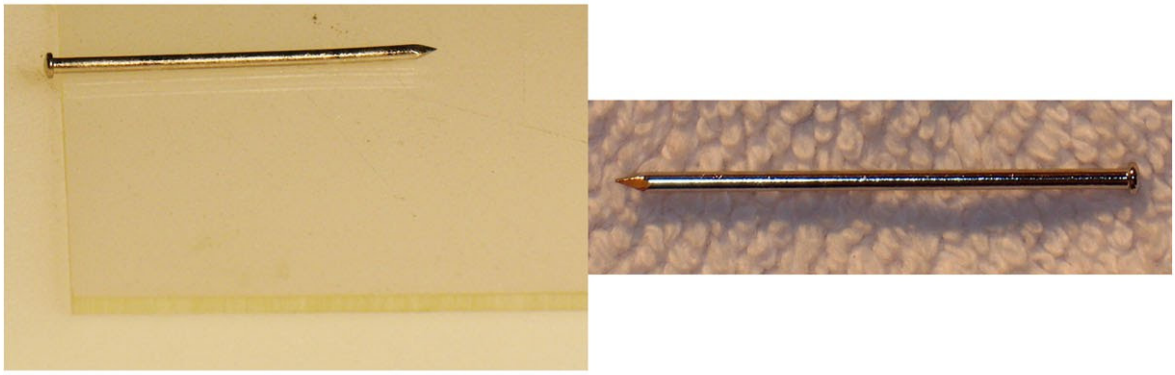
Axles, Rims and Tires...Weebles Wobble But Your Wheels Shouldn't!

So now we're at the point where the rubber meets the road, literally. And this also happens to be the one part that has the fewest options on improvement or fixing. Basically you need straight axles, no bends or warps. Place the axle, front or rear on a flat surface. A piece of glass or mirror is ideal. If you see the axle wobble, set it aside and don't use it. It has now become shelf queen status: good for show but not for go. There's no real way to fix these so replacement is the only option. Once you have two good straight axles let's look at the rims. Make sure the axle holes are clean and that the edges are crisp without any worn or wallowed out marks. You don't want a rim to wobble or work its way loose while you are racing. Also look at the surface of the rim where the tire rests. Is it smooth without any bumps or mold marks? If it's not smooth, take one of those warped spare axles and some fine sandpaper (400 grit) and lightly smooth out the rough places by spinning the rim on the axle by hand. Remember to remove a small amount at a time and check the rim by sliding on a tire each time. If you have a Dremel or similar tool use a straight axle and mount up the rim and under low power, sand the rim lightly checking the tire fit often. Do this for the front and rear rims. Once you have the axles, rims and tires re-assembled on the chassis, make sure to lubricate the bushings where the axle passes through the chassis.

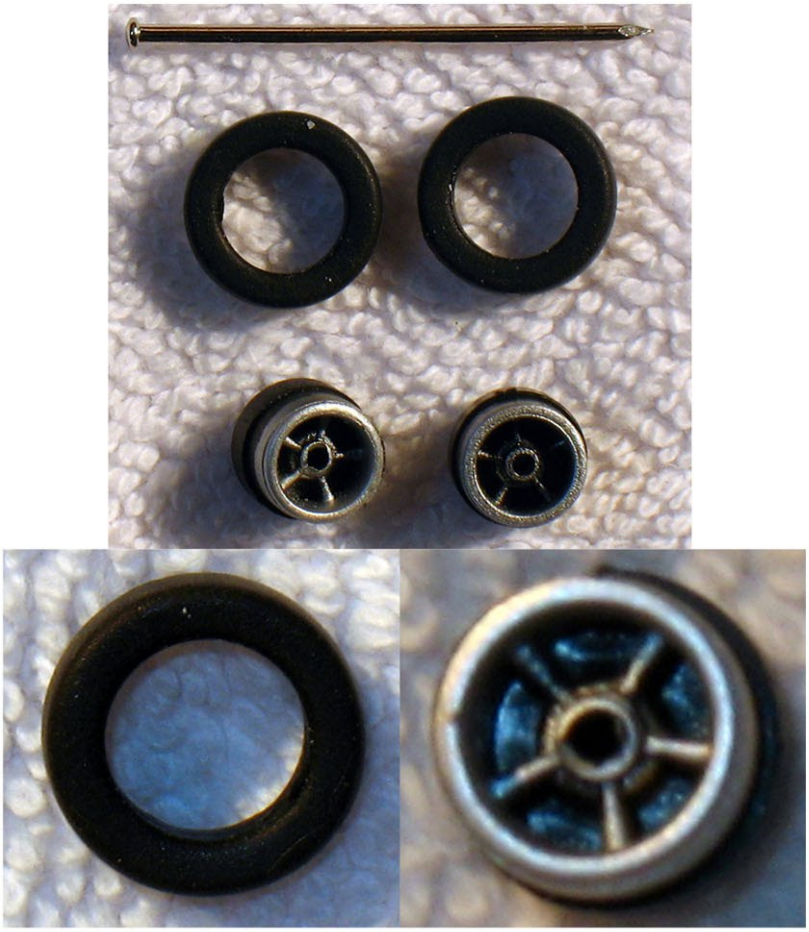


Here is a rear axle placed on a piece of glass. The smooth and level surface of the glass will easily show any bends or abnormalities with the axle. A mirror can be used for the process as well. This one is straight and is ready to go back on the chassis.

Tuning The Pancake Part 2



The front axle on the left, sitting on the glass, is slightly bent. This is easily seen when rolling the axle across the glass. This is not something that can repaired easily and should be replaced. The axle on the right is a new, straight component. It's a good practice to roll test new axles on a glass surface, just to make sure they are straight.

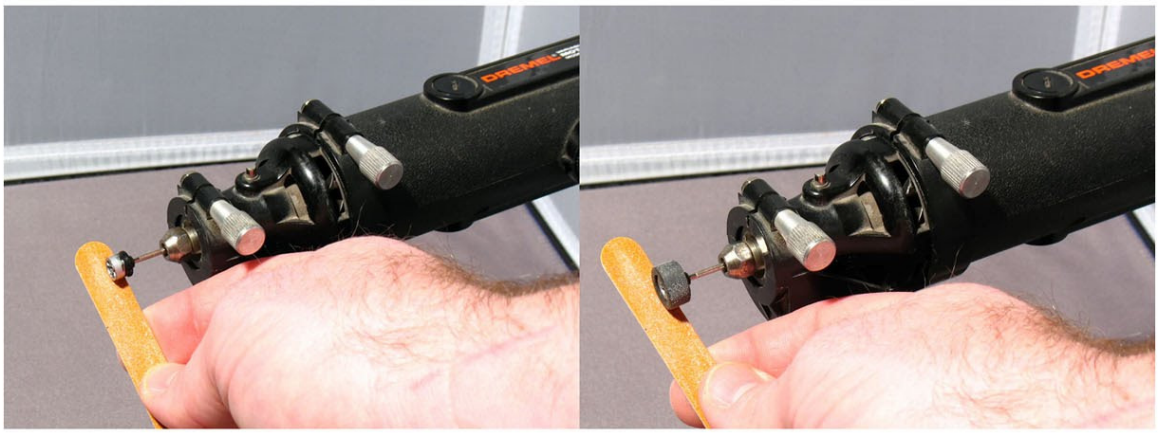


The front axle assembly is made up of 2 rims, 2 tires and one axle. One rim spins free on the axle, the other fits tight on the axle. This allows each rim/tire to spin independently of each other. Make sure to remove any burrs or imperfections on the rim and tire surfaces, as these will lead to bouncing or chattering and cause deslotting.

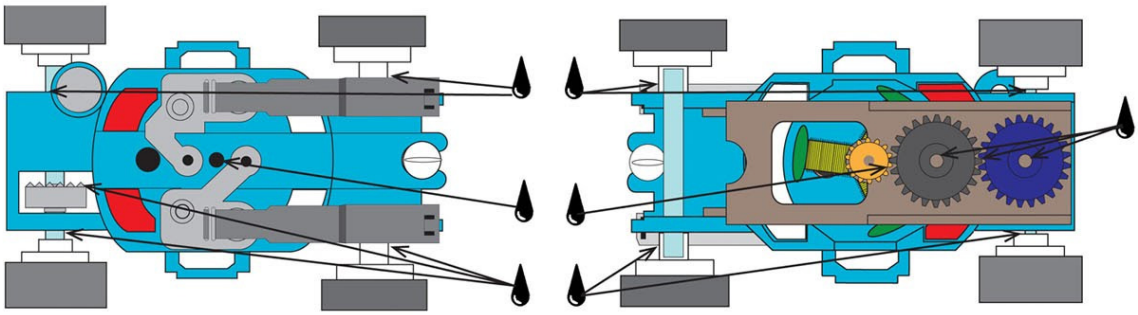
Tuning The Pancake Part 2

Just like the front rims and tires, you want to make sure the surfaces where the tire is mounted, is free of burrs and imperfections. You should also remove any bumps or imperfections from the tires surfaces.

Tuning The Pancake Part 2



I use 320-400 grit sandpaper or sanding board to de-burr the rims and to make certain everything is round and smooth. I use a finer grit (800) on the stock tires and remove only enough material to make sure they are round and level.



Oiling Chart - Bottom View

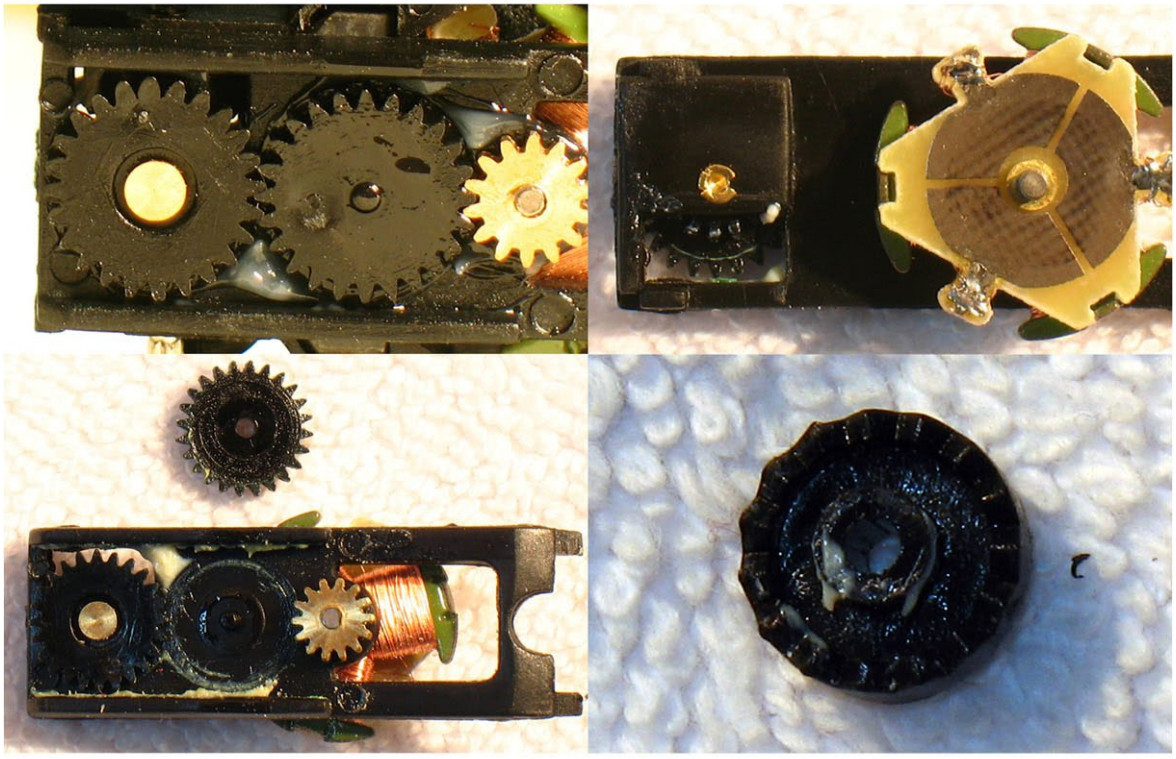
Oiling Chart - Top View

Here are the places to lubricate around the axles and gears.

Tuning The Pancake Part 2

Oil, Grease and Lubrication: If a Little is Good....That's All You Need!

On most new HO scale slot cars you get today, the gears and every other friction point, is covered in a pasty lithium grease. The grease serves two purposes, initial lubrication and the protection of metal parts while the car is in storage or transport across the ocean, to warehouses, to stores and eventually to your home. That's a good thing when it comes to protecting those parts, but the grease is a proverbial magnet for every kind of dirt, lint, hair or dust it can get in contact with. So when you get a new car (and all the brands do this practice at some level) manually turn the wheels slowly and check for binding or rubbing of parts. If all turns smoothly, then disassemble the chassis and wipe all of the grease from all parts with a lint free rag. Once you have all the grease cleaned from the parts, re-assemble the chassis and turn it by hand again to make sure there is nothing binding or rubbing and that it's still turning freely. But don't run it on the track yet! We have a couple of speed secrets left to go before we put power to those wheels.

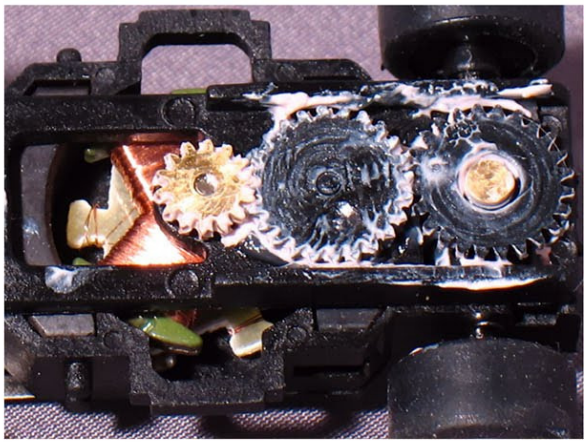


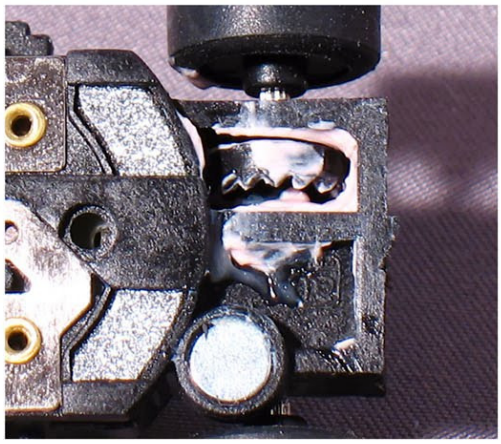
This Auto World X-Traction chassis was brand spankin' new out of the package. The gears were loaded up with an excess of grease to help protect the parts during storage and shipping. Now that it has found its home, it's time to clean all this extra grease up and start the final performance tweaks before putting this new road ripper on the track. Use a lint free cloth to wipe down all of the parts. Don't worry about oiling it yet. We have one more task before we are ready to apply the proper lubrication.

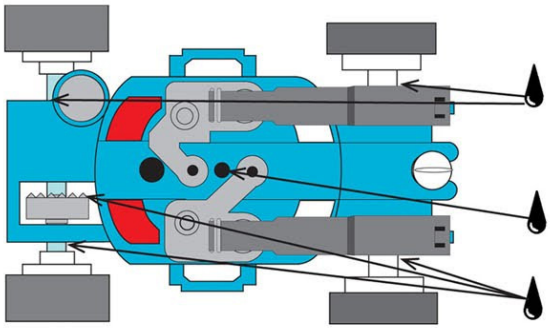
Tuning The Pancake Part 2

Lapping Gears So You Can Lap Your Competition...

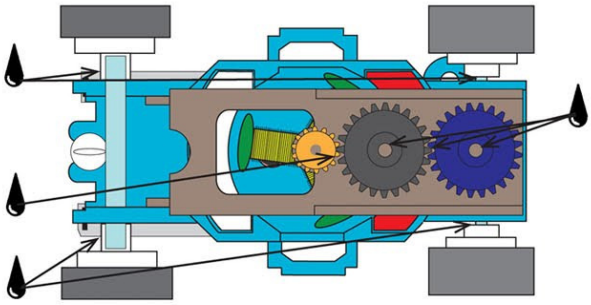
Now that you have everything cleaned up, let's lap those gears in. Gear lapping by definition, is the mechanical process of polishing the surface of gear teeth to ensure smooth, unbinding action with the intention of producing less friction. And that, my friends, is the key to speed in our little race machines. Friction is the big bad guy that robs our horsepower, so the less of it we have, the better off we are. In the case of the "Pancake" chassis design, we have a total of 4-5 (a cluster gear design variation adds 1 gear to the mix) interacting gears. That's a lot of teeth grinding away to make your car move. And we're going to brush them to make YOU smile. Yes you read that correctly. Gear lapping requires a mild abrasive to smooth out the little edges around the teeth on your gears. I recommend two products for this. Semi-Chrome polish (sold in motorcycle shops) and something easier to find...Toothpaste! A little dab of toothpaste between the gears and some on the crown gear will do the job. I have also seen this same process used on axles and the bushings they pass through. So once you have your toothpaste smeared in place, run your car at a very low speed holding the car in place with the rear wheels off the track. If you rev it up too fast, you will just fling the toothpaste everywhere but where you need it. Once the car is turning at this slow rate, let it run for 10-15 minutes. Once completed, disassemble the chassis and wipe everything down with a lint free cloth, making sure to remove all of the abrasive. Reassemble the car and turn it by hand slowly to see if it moves a bit more freely. Reapply the toothpaste as needed and repeat the last two steps until the gears are smooth and quiet. This lapping process works for all slot cars and gear types whether they are metal or plastic. Now that you have the gears lapped in and your car is minty fresh and cavity-free, oil the chassis according to the diagram in this article. Use a light oil like Labelle 101 or 106, or an oil specialized for slot cars or model trains. Use the oil very sparingly. Too much and we are back to that lint, dirt, dust and hair magnet status again.







Oiling Chart - Bottom View



Oiling Chart - Top View

Tuning The Pancake Part 2

Guide Pin, Guide Blade...Follow the Leader

Well, we have just about covered the current generations of "pancake" chassis, let's take a peek at one item that is another unique feature of the breed. The guide pins on most versions (there are exceptions) are a reversible design, having a guide "pin" on one side and a guide "blade" on the other. Now the big question is which one of these do I use??? They both have advantages and weaknesses. Let's look at each of these options a bit more closely.

The Guide Pin:

The pin side of the unit is just that, a single thin pin of plastic. If you are racing in competitions it has a couple of distinct advantages. First, it remains in the same position if you deslot and the car can be returned to the track more quickly. The turn marshall will not be fiddling around having to align anything before getting the car back in the slot. Second, because it's smaller and not as long as the blade side, it generates much less friction as it is pushed along the slot. Of course with good comes the bad. The smaller pin size is also more prone to lift from the slot on hard acceleration. The thinness of the pin can become fragile with wear and shear off in a turn or when being forced back onto the track during a race.

The Guide Blade:

The guide blade is much thicker, longer and wider in dimensions than the guide pin. The blade also swivels to add extra control win negotiating turns in the track. These advantages along with the wider and longer measurements allow the car to travel more quietly around sectional track. The guide blade is harder to make deslot, but when that does occur under racing conditions, a turn marshall may have to align the blade before being able to return the car to the track and get it into the slot. The guide blade's thicker base is stronger and less likely to wear quickly or break. The extra length is also beneficial when racing on banked tracks, keeping the blade in the slot on dished, banked turns. However, the that same larger size fits more tightly in the slot and generates a more drag and friction as the car travels along the track.

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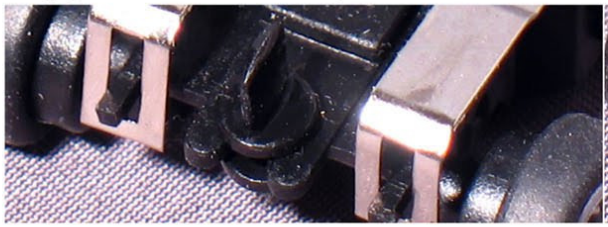
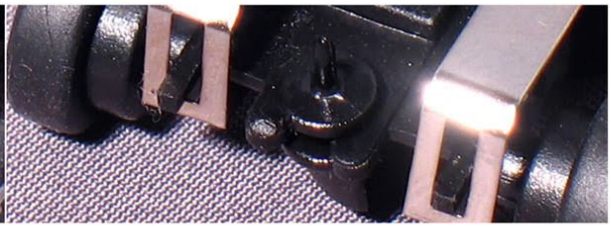
So which do you use, pin or blade? The answer is both given certain conditions. If I am in a competitive race or drag racing, the pin wins hands down. Less friction, quicker returns to the track if (when, in my case) you deslot. Just make sure that if you are in a competitive race or event, check your equipment and use new guide pins if available. But blades have their place too. If I'm on an unfamiliar track or racing on a banked layout, I will use the guide blade until I reach a comfort zone and become familiar with the track and what makes running on it unique. Another tip, if you drive better with the blade, and there are no 6 inch radius turns or 3" Hairpin sections on the layout you are racing on, glue the guide blade into place. Make sure it is parallel to the pick up shoes and use a cyno-acrylic (super) glue. The super glue will hold it in place, but won't bond to the nylon based plastic used on most of these chassis. That way if the guide breaks or wears out, you can pry it off the chassis and replace it.



Left: Guide Blade



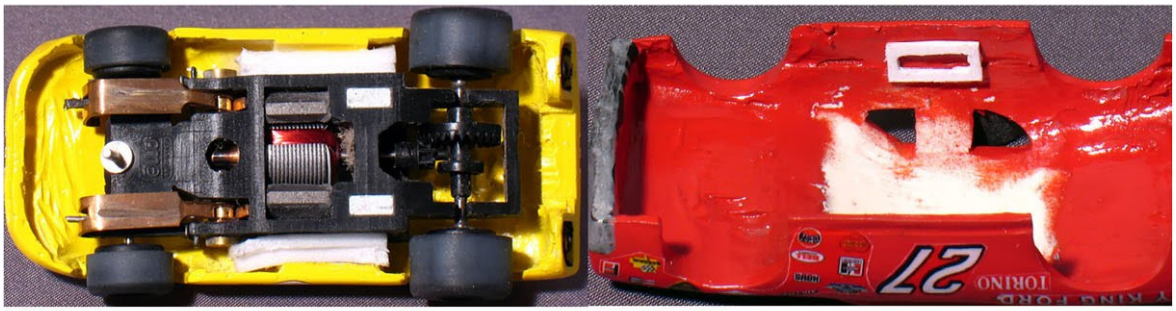
Right: Guide Pin

Tuning The Pancake Part 2

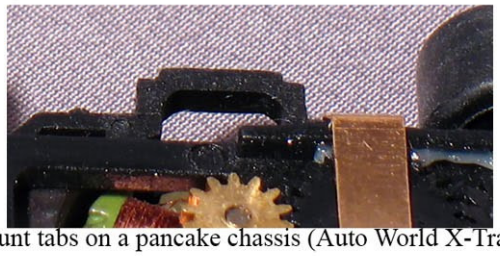
Body Mounts...Snap On/Snap Off

One of the major upgrades that accompanied this generation of pancake chassis was the quick removal of the body with snap on/off body clips. The old body post and screw down method was long gone. The need for fast access to the engine bits hidden under the body was the driving factor. Along with the body clips came a slightly larger scaled body, what we now call HO and is closer to 1/64th scale. With the bigger size came more detail, wider tires and various flavors of street and racing themes.

With the old body post mounting methods, it was easier to lower or raise a body on the chassis. You simply cut away some of the post or added a spacer and screwed it back on. The snap mounts however, are fixed into the body's mold and are a bit trickier to deal with if you want to do any mounting adjustments. The simplest way to accomplish this is to enlarge the "slot" the chassis tabs fit into, or remove them altogether and remount the body using double-sided foam tape. You can also remove the original mounts and glue in new ones made from scrap plastic. This takes a bit more effort, but can be done and you get to keep the snap on/off convenience of the original mounts.



Left: Although this is an inline chassis, it shows how you can use double-sided foam tape to mount up a body to the chassis. Right: By using some scrap plastic, you can make snap in slots for the pancake chassis body mount tabs (See below). Either of these methods will allow you to mount the bodies lower, dropping the center of gravity and improving handling characteristics.



Stock body mount tabs on a pancake chassis (Auto World X-Traction Chassis).

Conclusions:

The "pancake" chassis design is still my favorite type of car to race and mess around with. Because the design allows for many alterations and customizations it should continue to have a long life at the HO raceways around the world. This about wraps up the coverage for the standard "3-Gear" standard pancake chassis. The next round will be focused on the "Specialty" or what is now the "4-Gear" chassis, also a pancake design. We will take a deeper look at what is unique about the 4-Gear design and how we can keep it running along with our other pancake cars.

Tuning The Pancake Part 2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