

VID'S GUIDE:

Upgrading/Rebuilding Flippers

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"Most flippers on old games suck. Only the cool kids rebuild them for top performance." – Vid1900

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<https://www.thisweekinpinball.com/pinball-u/vids-guide-rebuilding-flippers/>

Just got back from a collector's house and 75% of his flippers were weak. Games looked good and clean, but he had no idea how to set up his flippers. There were a lot of terrible flippers at the Michigan Pinball Expo a few months ago, too. Finally, NJGecko wanted to know how to upgrade his System 11 flippers to the newer springs of the Fliptronic era.

Some of this is going to be old hat to the more experienced collectors, but clearly there are a lot of people who need a crash course in the basics.

First, what is going to be wrong with your flippers? If you never rebuilt them, probably everything!

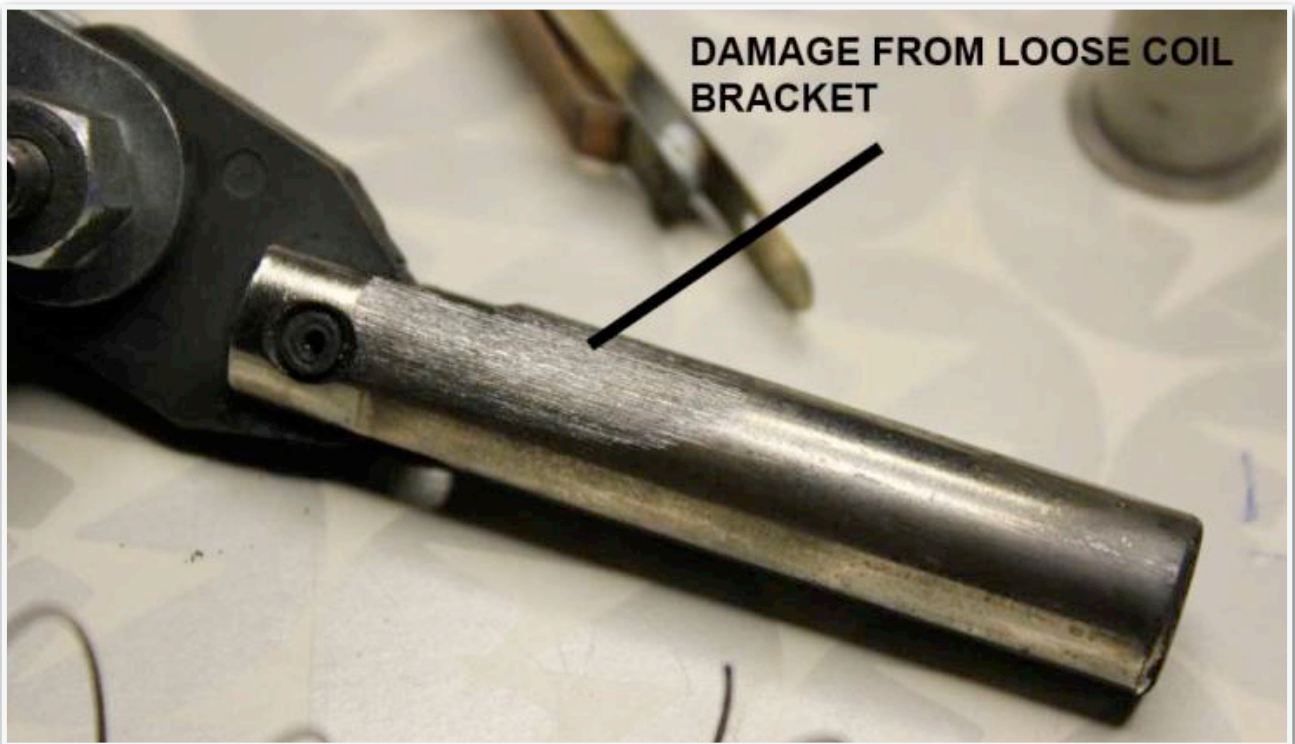


- The [plunger](#) will be worn, mushroomed at the tip, and have a lot of play in the links.
- Your return spring will be limp (or if it is a Sys 11, probably broken).
- Your EOS (End Of Stroke) switch will be pitted and corroded.
- Your Coil Stop will be concave, causing the plunger to become mushroomed.
- Your Coil Sleeve will be cracked or worn.
- Your coils might well be the incorrect ones.

The Coil [Plunger](#) needs to be smooth so it does not drag in the Coil Sleeve.

A common problem is that the tip will mushroom and bind in the sleeve. This will create drag or seize the flipper entirely.

Another problem is that if the Coil Bracket ever became loose, or a plunger spring ever broke, it can chew up the Plunger. This of course leads to the Coil Sleeve becoming chewed up.

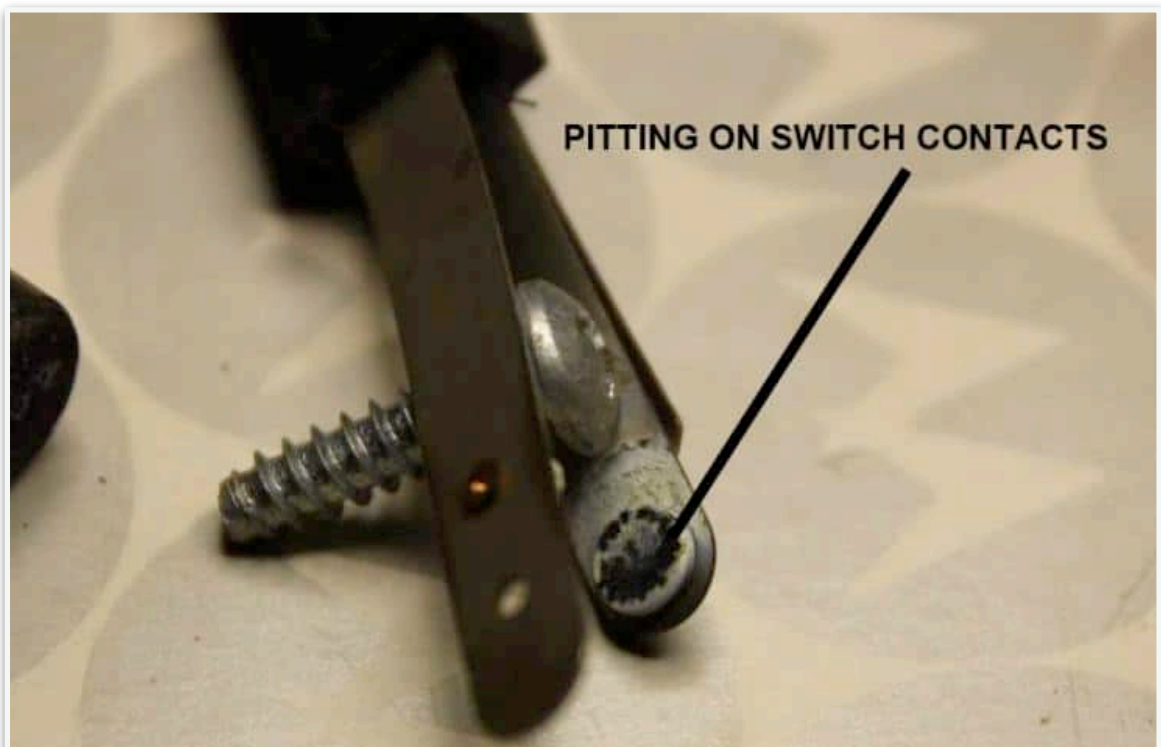




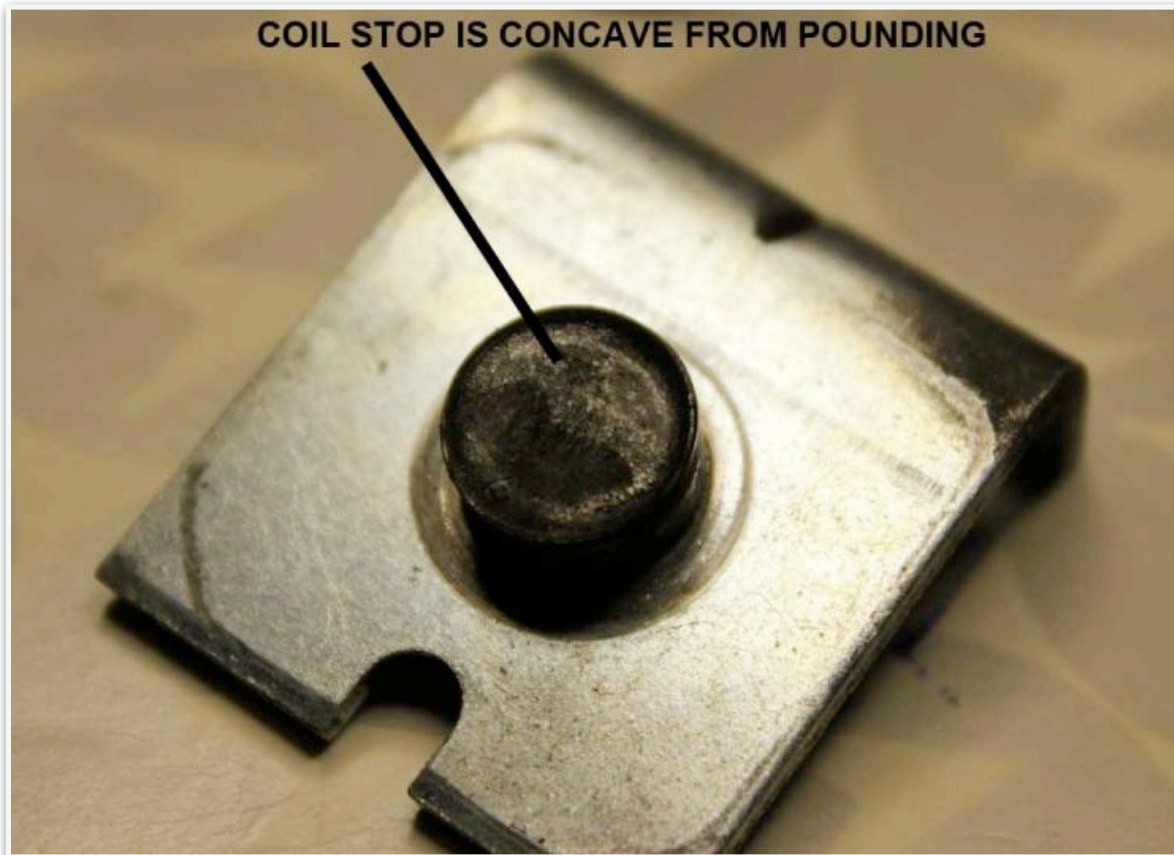
The EOS Switch needs to make solid electrical contact, or the flipper will be very weak.

If the contacts are all pitted and corroded, you can't get good contact.

If the gap between the contacts is not correct, you will have weak flippers (more on this latter)



The Coil Stop takes a constant beating. As the plunger hammers away, it becomes concave and helps shape the plunger into the dreaded mushroom shape.



So, how do we fix all these common problems? We throw all that junk away and get a rebuild kit.

I know, there are people who file the mushroomed tips, clean dirty sleeves and re-stretch springs, but the flippers are the most important part of the whole game. You spent thousands of dollars on your game and now you are going to try and save \$20 on a kit??? Your game deserves to play at factory (or better) condition.

You can get a kit from Pinball Life, or any other mail order place. Don't expect to get a genuine Bally/Williams kit in the little plastic box. Nowadays, the patents have run out, so you get an overseas made kit.

If you have a System 11 game, get the newer (Williams reference #A-13524-8) kit anyway. It will have the much desired stronger return spring, and only requires a small (one time) modification to install it. Also get a pair of high voltage EOS switches (Williams reference #03-7811) as the ones included in the kit are for low voltage games:

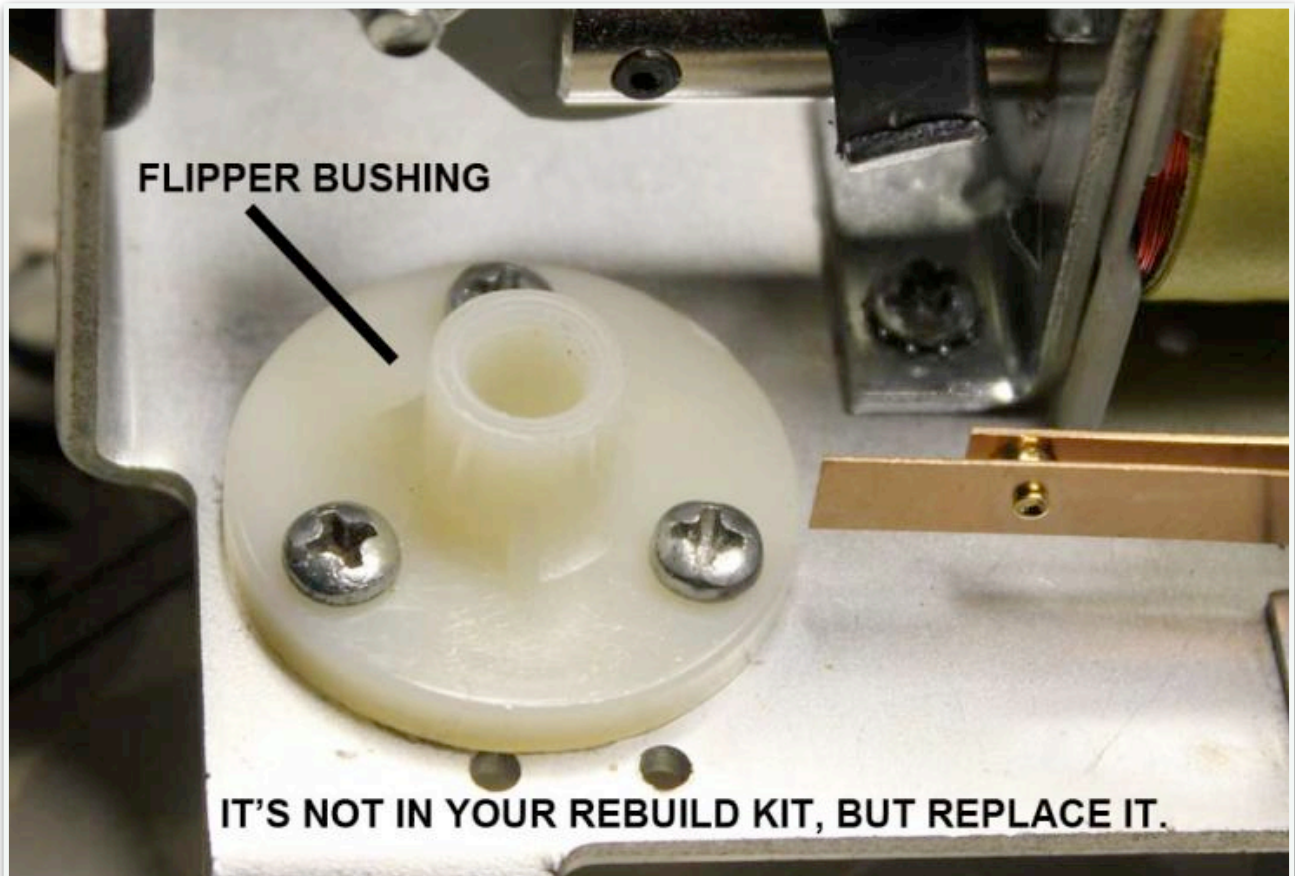
<http://www.pinballlife.com/index.php?p=product&id=983&parent=172>

<http://www.pinballlife.com/index.php?p=product&id=262&parent=58>

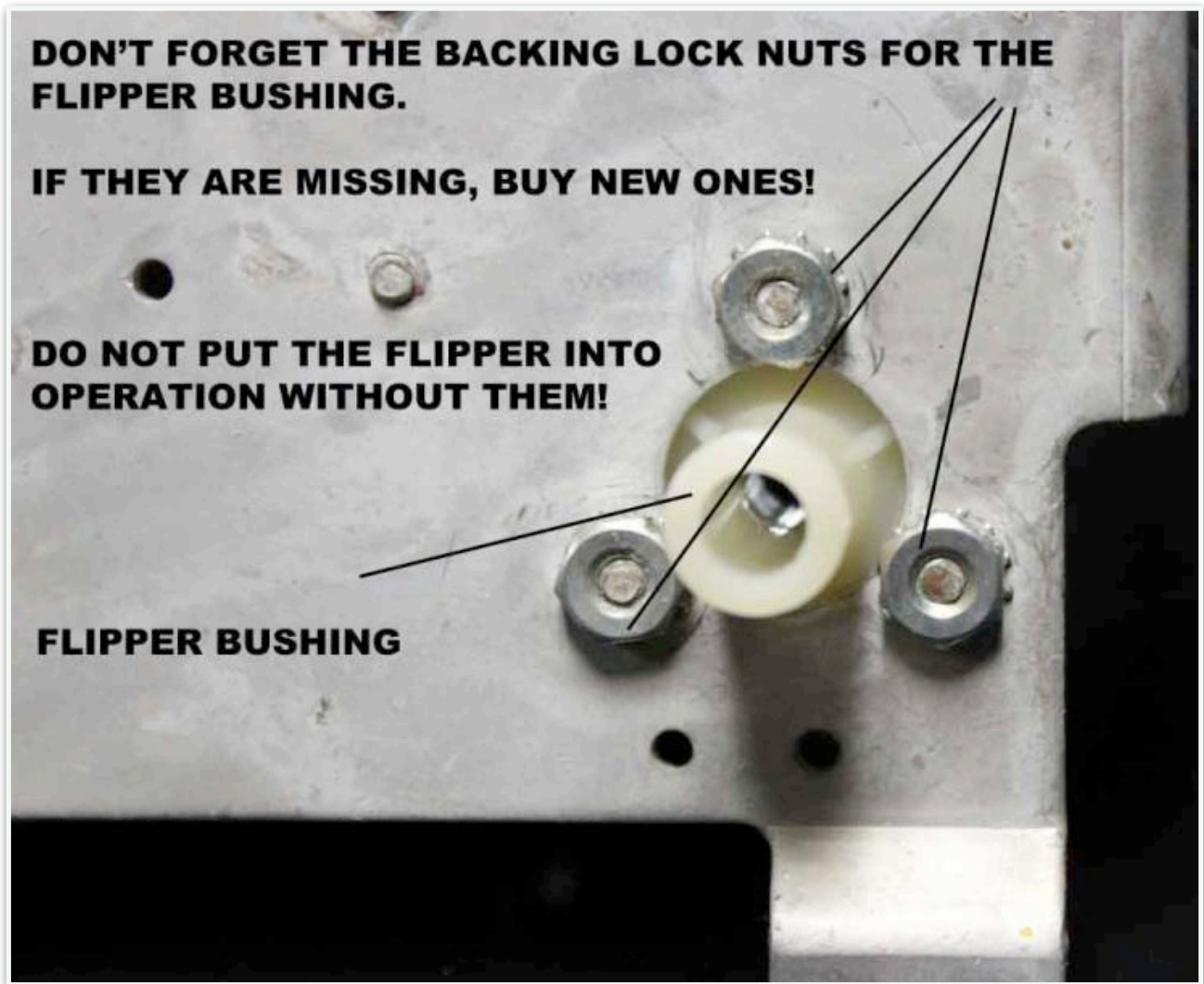
Before you order, check page 2 of your owner's manual and make sure that the correct flipper coils required for your game are installed. 50% chance if your game was once on route, at least one of them will be wrong. Sometimes the wrong coils were installed at the factory (like many F-14 Tomcats), so you really need to check this.

Finally, you need to order some flipper bushings. These are very important if you want to keep the flippers from cutting into your playfield, or creating unnecessary airballs. They don't come in the rebuild kits, but you absolutely need them for a rebuild.

<http://www.pinballlife.com/index.php?p=product&id=270&parent=60>



Start by labeling the wires that go to the flippers, you can use Blue Painter's Tape. Then label the coils themselves. You can write on the coil plastic with a Sharpie (it cleans off with alcohol). Now you can put the game back together again without blowing anything up.



Unsolder your now clearly marked wires with a 25w soldering iron. If you don't have one yet, your going to need one constantly to maintain a pinball game. Don't buy one for less than \$20, trust me on this.

If there are any "lane change" switches and wires ganged up with the EOS switch, label and unsolder those too. Unlike the EOS Switches, the Lane Change switches usually do not need to be replaced, only cleaned. Just pull a crisp \$100 bill through the held together contacts, until the bill pulls through cleanly. The first pull will be very black with carbon.

Loosen the flipper nut, and carefully pull the flipper bat out from the top of the playfield.

Next, get out a 1/4" nut driver and remove the hex head screws from around the flipper bracket. Take the whole assembly out of the game and onto a well lit workbench covered with newspapers. If you don't cover your workbench, you will soon be sorry as the whole bracket will be covered with black carbon and iron dust.

The dust comes from the metal on metal pounding between the Plunger and Coil Stop. Some more dust comes from the spark that occurs at the EOS Switch. It's filthy.

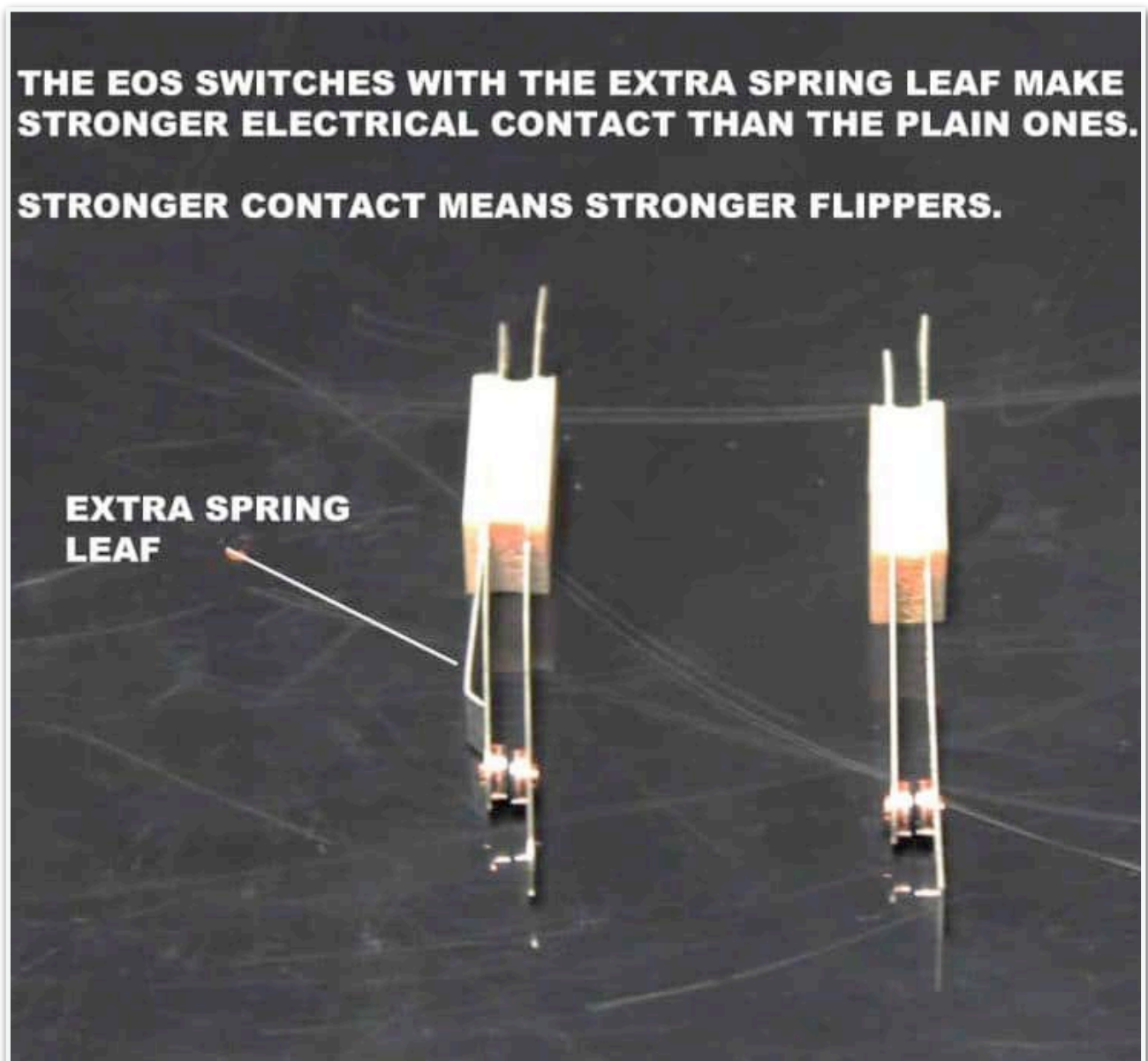
Unsolder the EOS Switch Capacitor, and put it aside.

Take the old Coil Sleeve out and discard it. If the sleeve is tight, press evenly on the bench to get it out. If it is absolutely stuck, the coil may have overheated at some point. Replace the coil, they are only \$10.

Discard the old Coil Stop, the Spring, the Plunger/Link assembly, the Bushing, and the EOS Switch. No reason to save them as spares, because once you play on a game with new flipper mechs, set up correctly, you will never even think of reusing that old junk.

Take the saved parts to the sink and scrub with Fantastic cleaner (or any other degreaser) and a toothbrush. Don't get the coil label wet or it will fall off. Just use the damp toothbrush and clean the coil inside and out.

Don't put the metal parts in a tumbler for too long or with high abrasives. The parts are zinc plated and the tumbler could remove this protective plating. When you see restored games where the hardware is completely covered with white corrosion, you know somebody tumbled off all the coatings. If you, or someone before you already did this, tumble again and spray with a light coating of clear Polyurethane



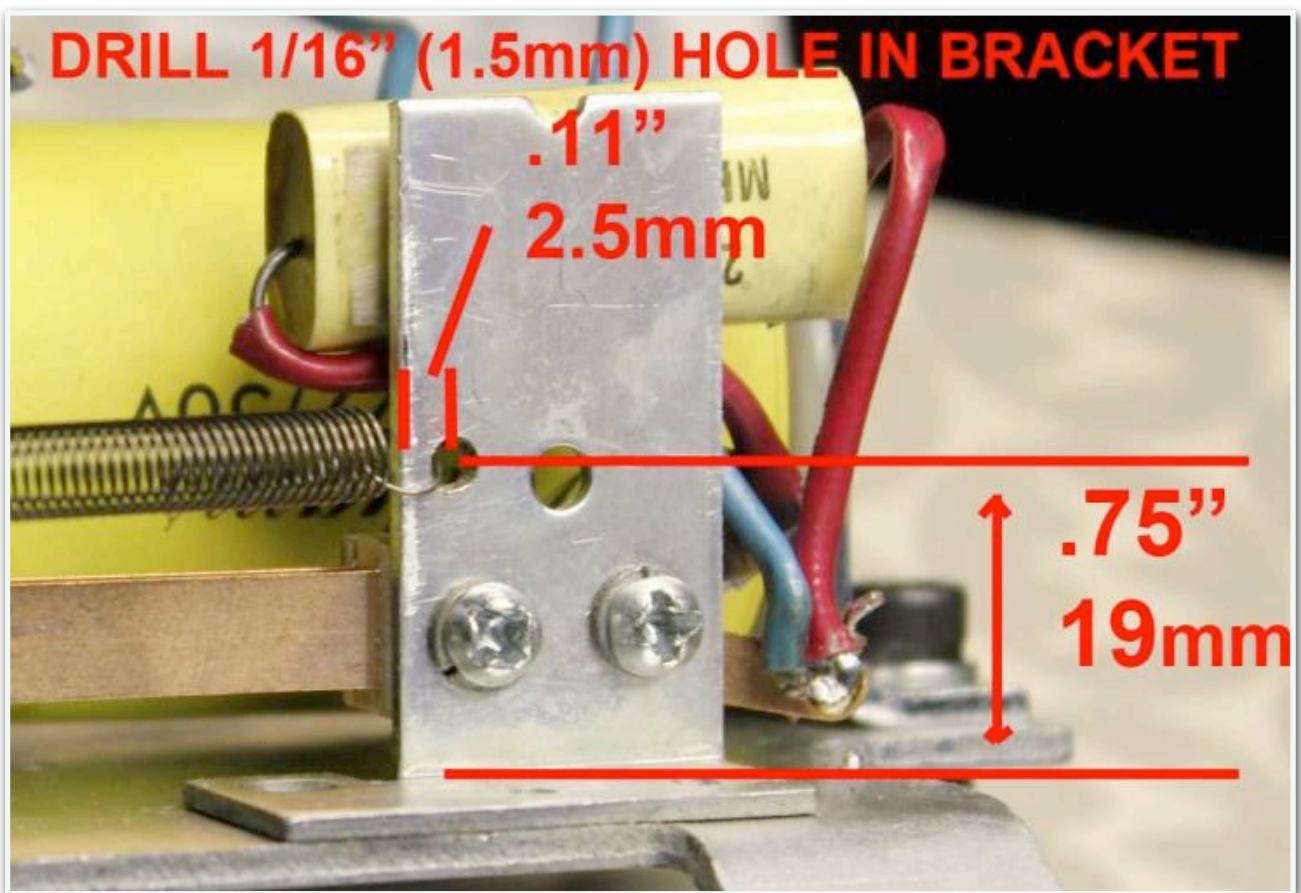
System 11 owners update:

Unless someone really took care of your game before you, you have the awful, conical spring that rides around the outside of the plunger. This spring is usually weak, broken and corroded. It is simply a poor design choice as it chews up the Plunger Link and sometimes the Plunger itself.

No doubt you have noticed the “snap” of the newer Fliptronic games and now you can have their superior snappiness too.

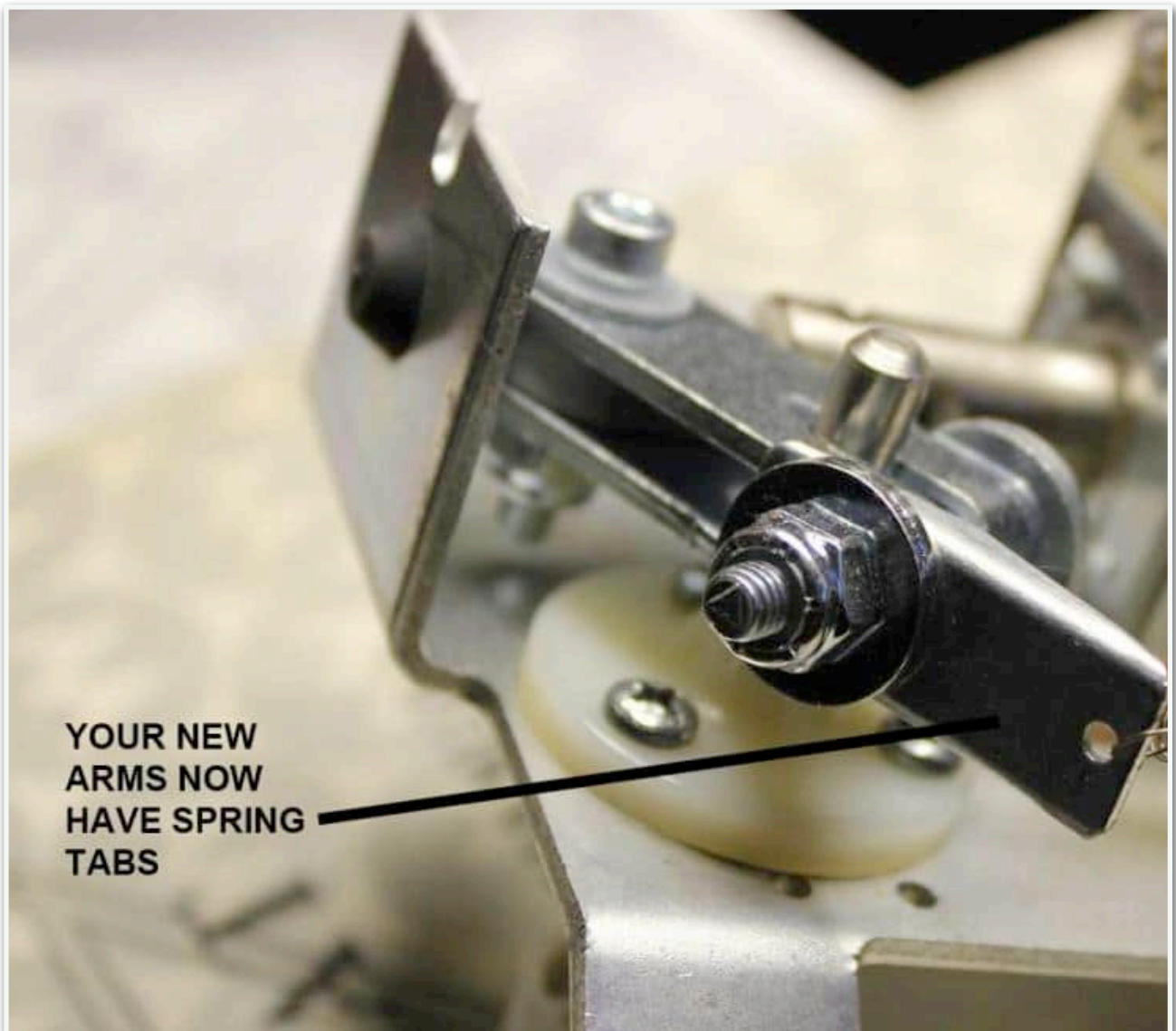
You will need to drill a 1/16" (1.5mm) hole in the Capacitor Bracket. Don't drill through the Capacitor itself (you removed it in the last step, yes?).

Measure from the picture below. Use a punch to keep the drill bit from walking around. Once you drill the hole, file off any sharp edges on both the front and back.



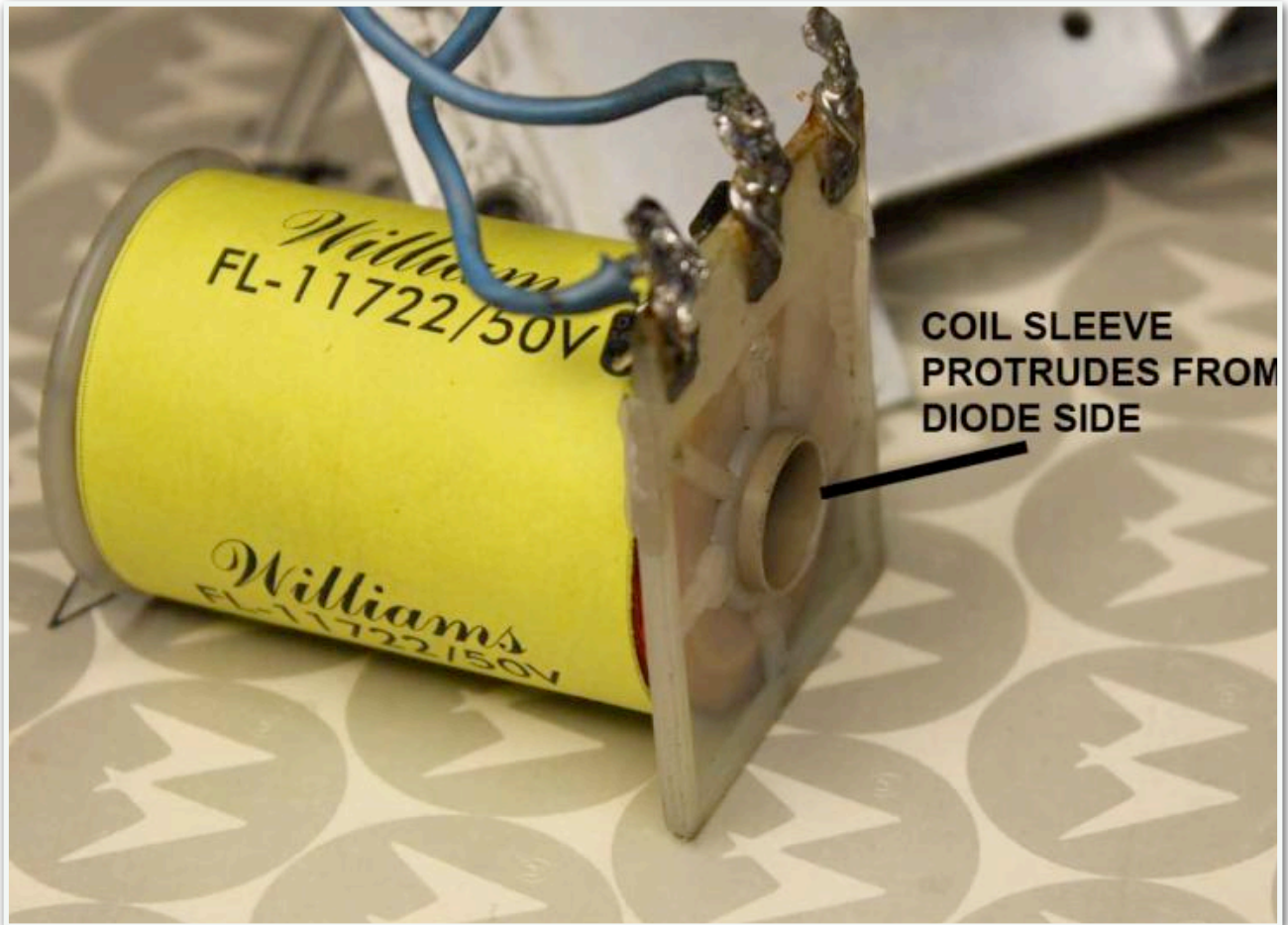
System 11 owners update part 2:

You will note that your new “Fliptronic” arms have spring tabs on them. Never again will they suffer with conical springs.



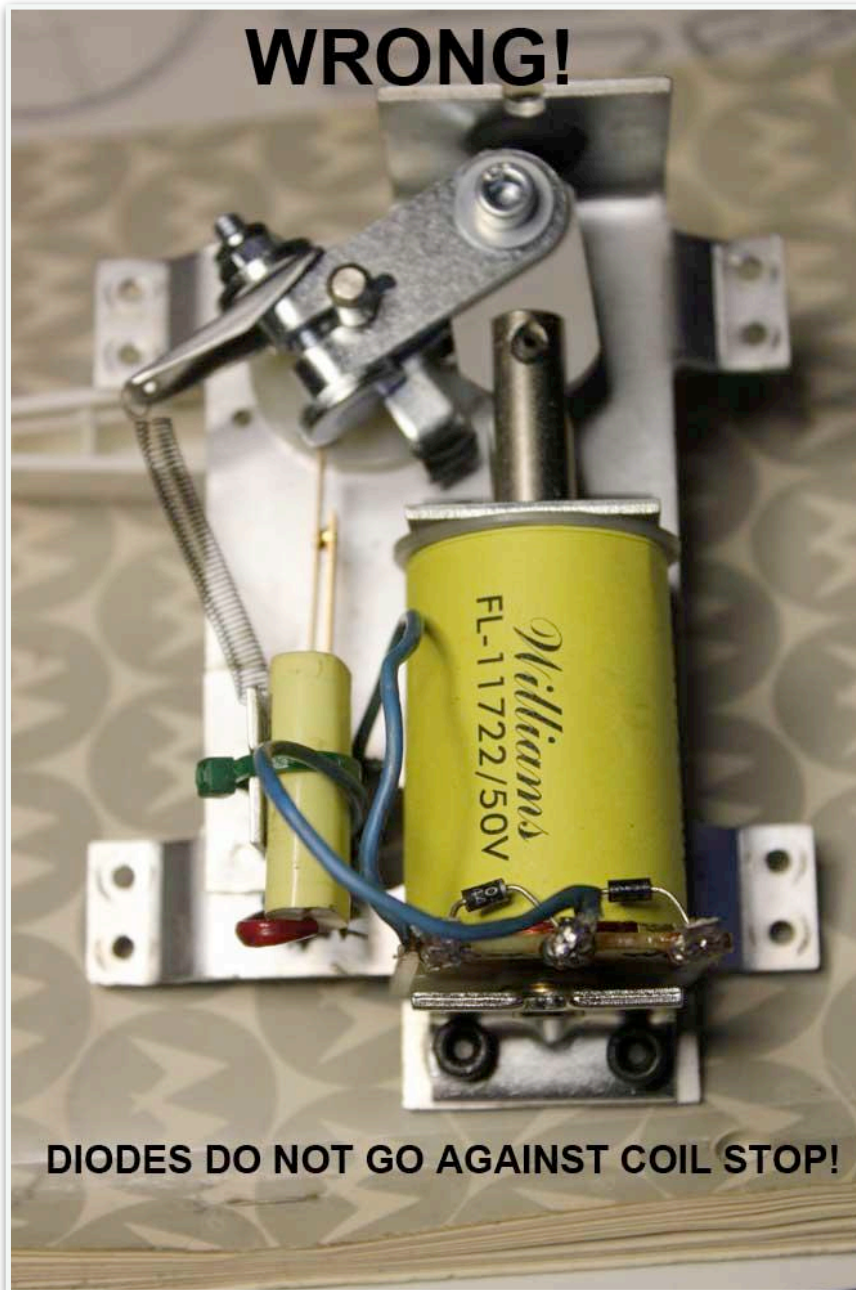
Now it is time to reassemble.

Put the new Bushing in the flipper bracket. All three nuts on the topside have to be tight, or your playfield can become damaged.

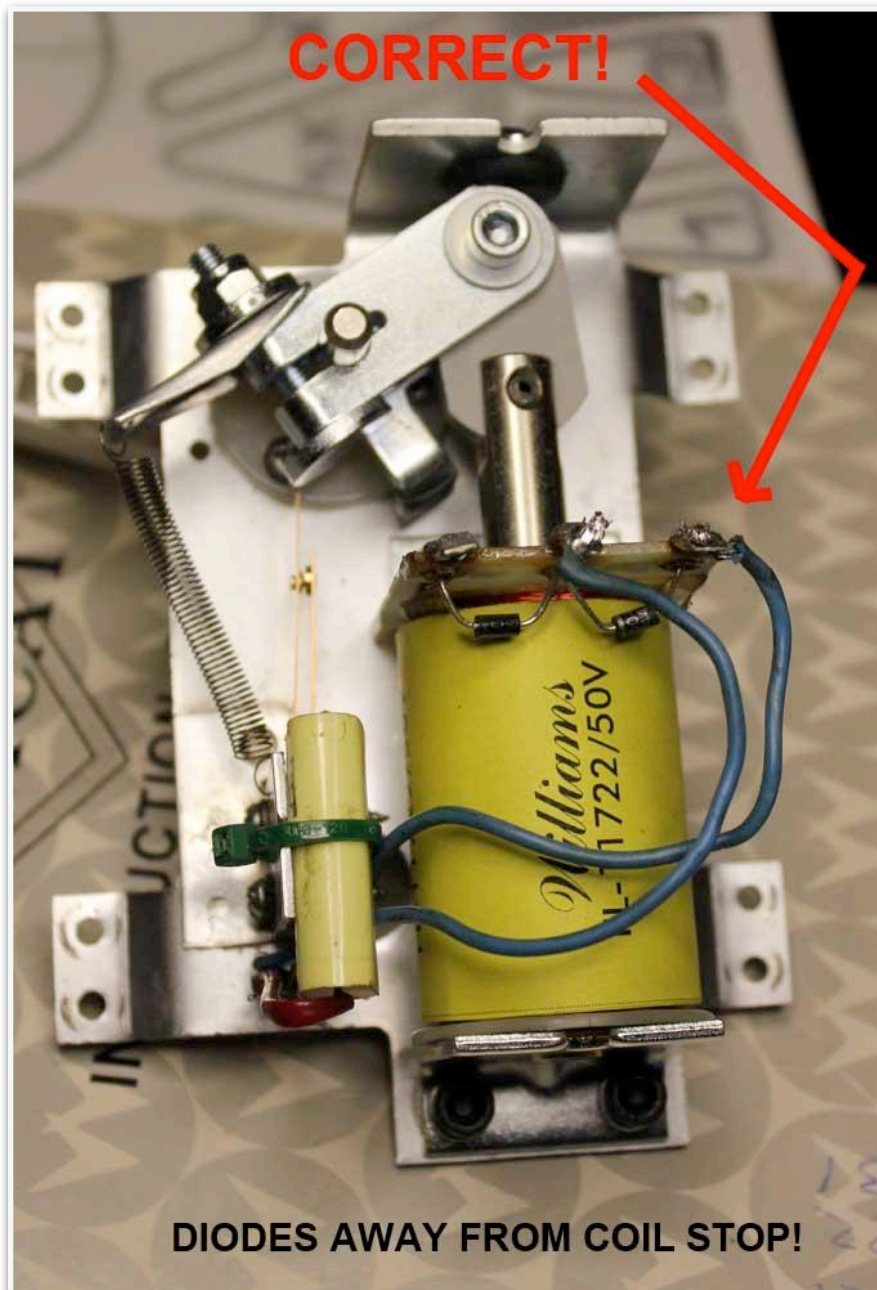


Put the new Coil Sleeve in the coil. This is where it helps to have a bag of Sleeves, because sometimes one will fit where none of the others will. If none of them fit, the coil may have overheated and really (I know, you don't want to spend another \$10) should be replaced.

The Coil Sleeve protrudes from the Diode side of the coil. Don't put it in backwards.



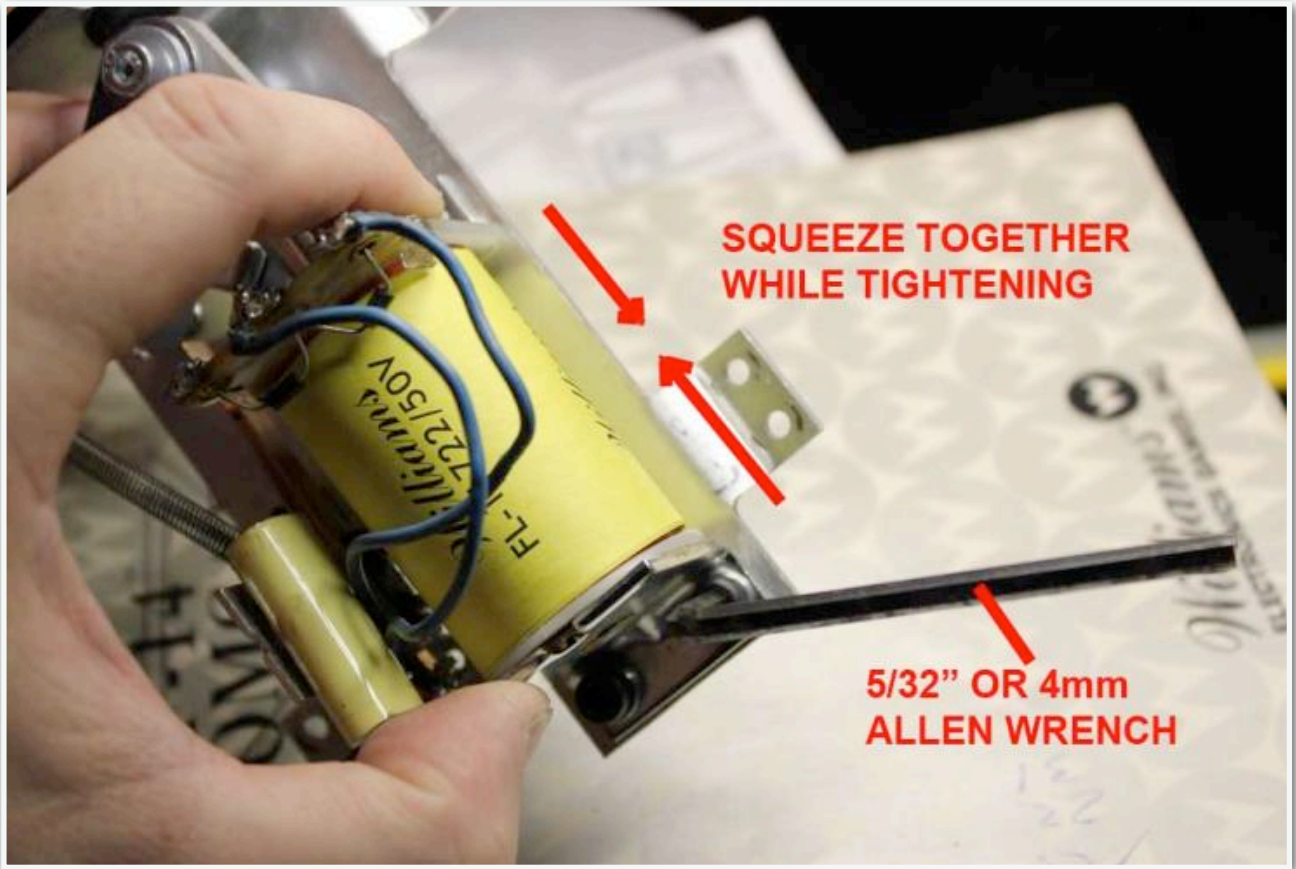
Make sure the coil gets installed the correct direction. The Diodes or even the Coil Tabs tend to break if you put them next to the Coil Stop.



This is the correct installation of the Coil; Diodes safely away from the Coil Stop. It matters, do it right.

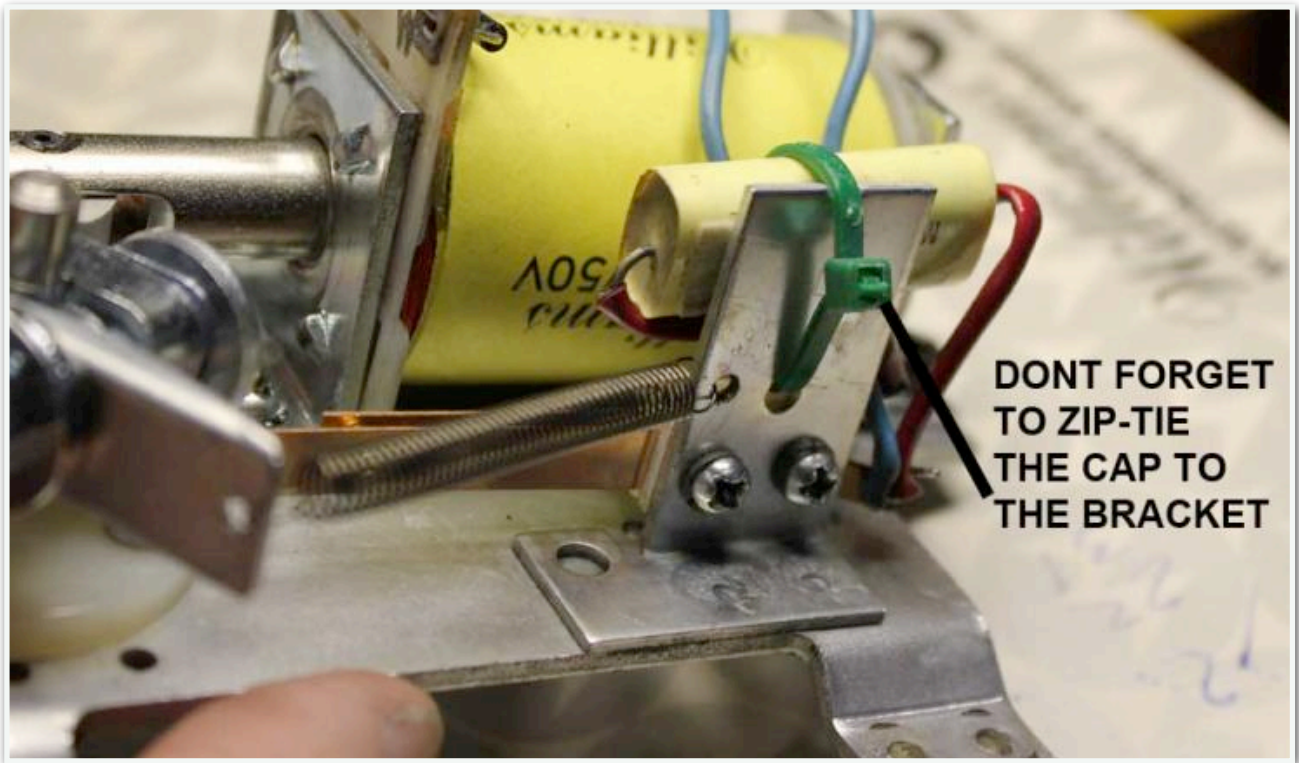
Some Coils were installed backwards at the factory, so you may have to pull a little slack wire from the harnesses to reach the proper position. Don't worry if you have to clip a few nylon Zip Ties to produce the slack you need.

If there is a little plastic nipple on the coil, you can cut it off, or cut a little notch in the coil bracket with a Rat Tail File or Dremel.



When installing the Coil, squeeze the brackets towards each other as you tighten the cap head bolts.

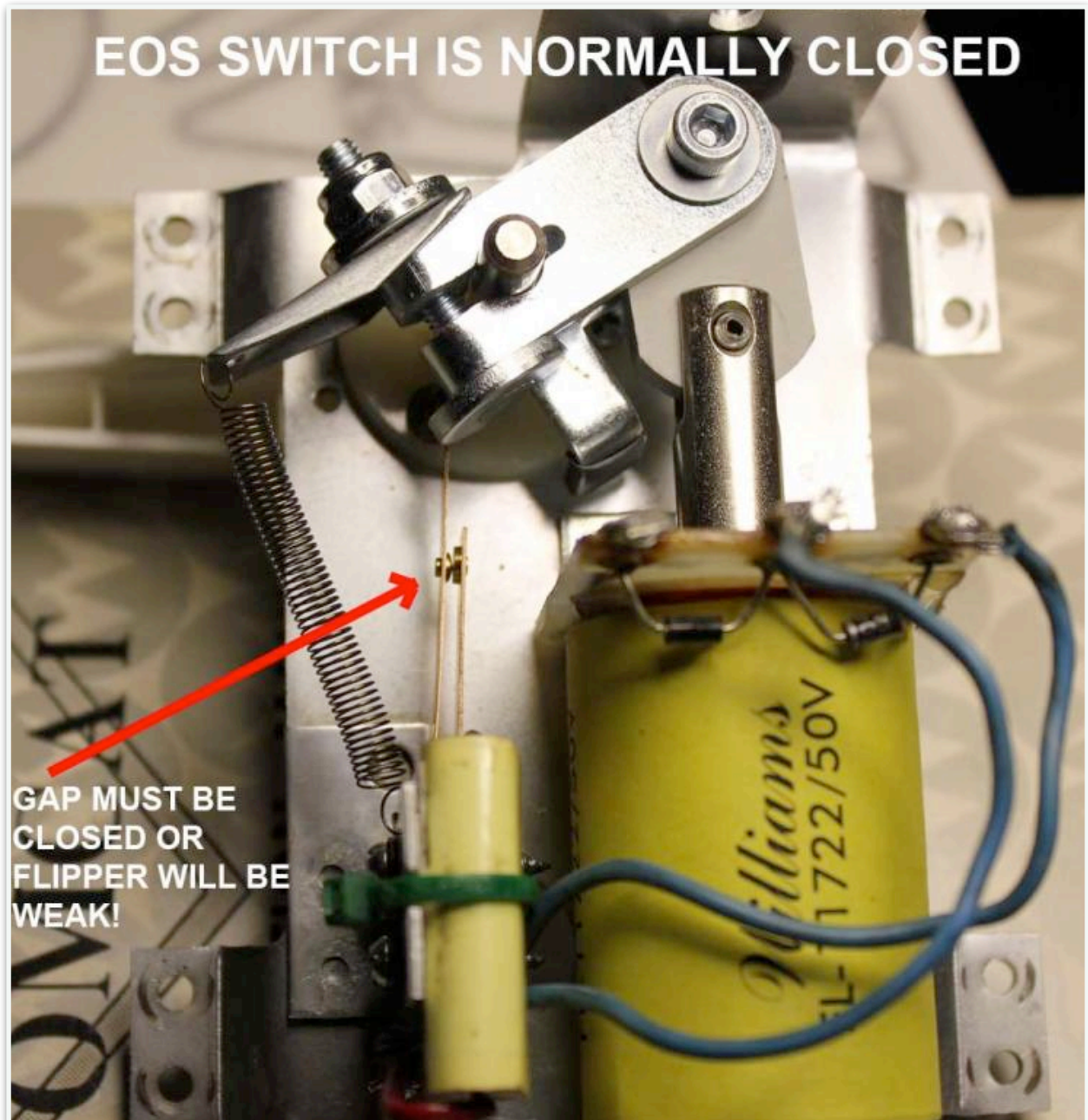
You don't want the coil moving around robbing your game of power. Tight is what you want, no play, no slop.



It's not in your kit, but remember to zip-tie your Capacitor to the bracket.

Now solder the Capacitor to the new EOS switch. The Capacitor has no polarity, that is a fancy way of saying that either lead can go to either terminal of the switch.

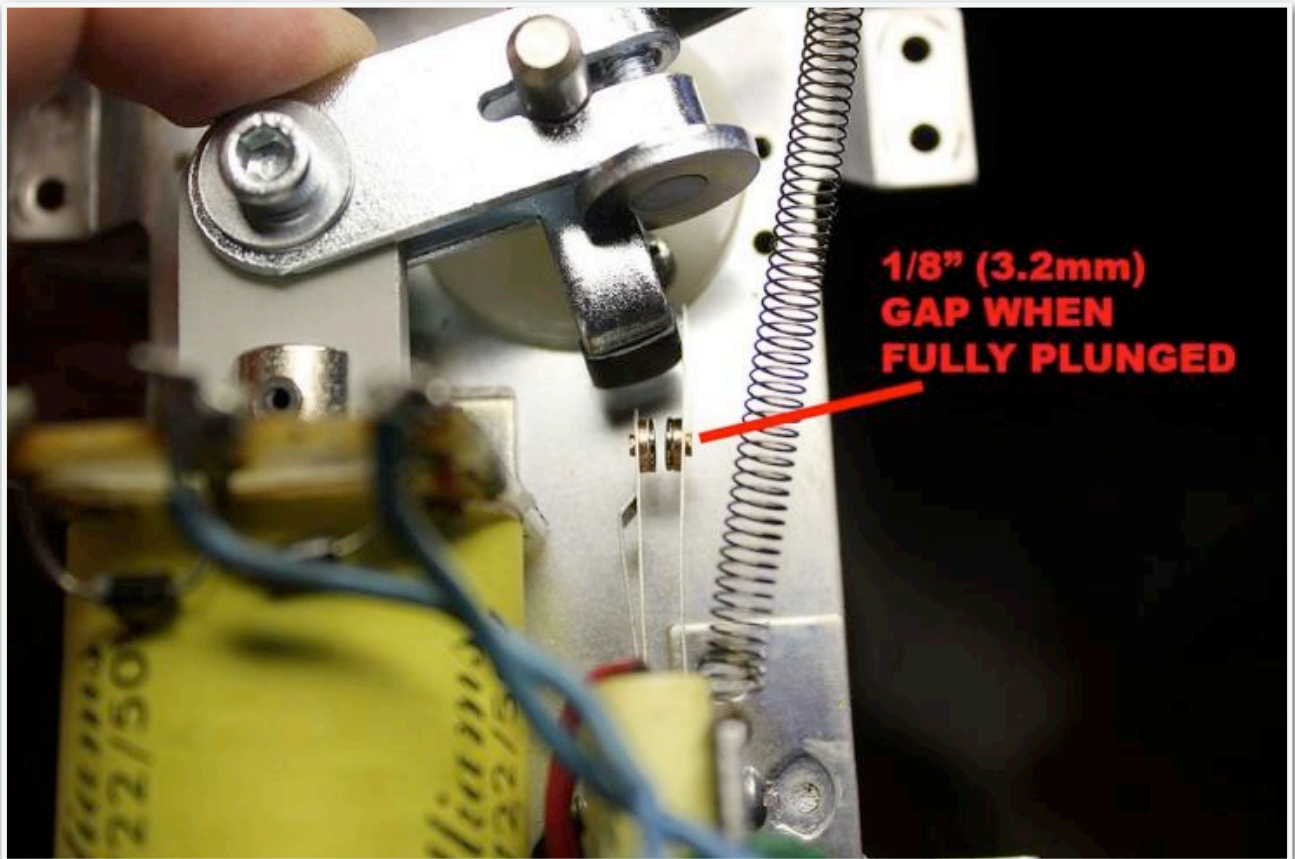
The Capacitor helps keep the switch from pitting as much. Yes, you should use it.



Now for the section that strikes fear into the newbies hearts = setting the EOS Switch gap!!!

When the flipper is not energized (in its relaxed state), the EOS Switch needs to have solid contact.

So gently bend the leafs of the switch so that they are nicely sprung together. Not just barely together, but actually making good contact.



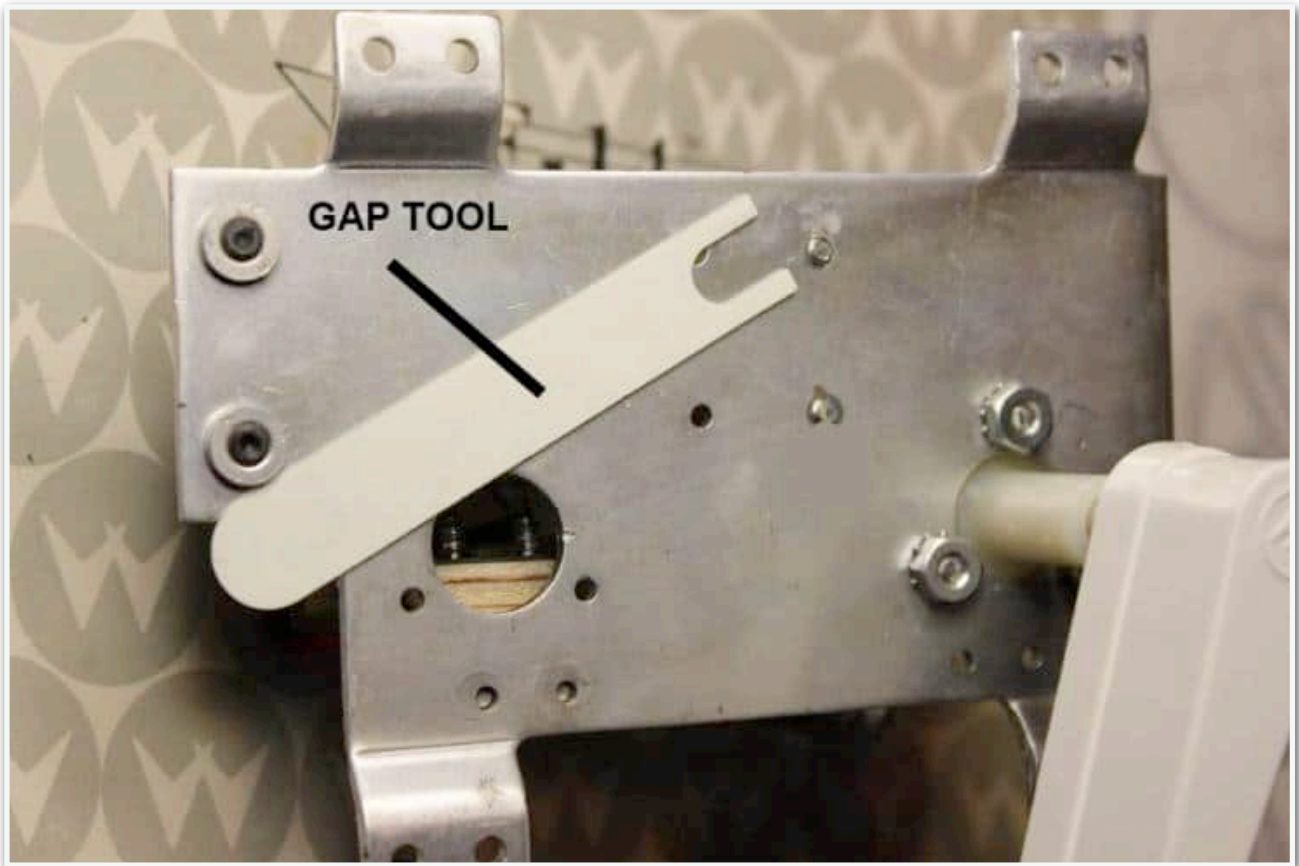
Now when the flipper is energized (the plunger all the way into the coil), we need the EOS Switch to open or the coil will overheat.

Press the plunger down all the way till it stops with your finger, and make sure the switch gap opens to EXACTLY 1/8" (3.2 mm). Not more, not less. (there are a few System11 games that want less than a 1/8" gap, check your manual)

You may have to fiddle with the leafs to get them touching when relaxed and 1/8" gap when plunged, but it is a lot easier to do on the bench than installed in the game. You will get the hang of it, take your time and get this exactly right.

A Leaf Adjuster tool makes setting switch gaps and tension a breeze. If you own a pinball game, you should have one in your tool box:

<http://www.pinballlife.com/index.php?p=product&id=1518&parent=0>



In your goody bag, you got a little Gap Tool (sometimes called a fork or by Williams official name "Flipper shaft end play spacing gauge"). Many people do not even know why they have it.

I'm not sure anyone sells them anymore, but the Williams part number was 03-8194.

I measured a few of them and they are consistently .7mm, so maybe someone wants to make a knockoff.

After you put the flipper mechs back on the playfield, you need to set the gap between the Flipper Bat and the top of the Flipper Bushing.

I'm showing the Gap Tool on the Flipper Bushing NOT installed in the playfield, just for clarity.

I can hear some of you moaning that you did not get a tool with your game. Lucky for us, most credit cards are about .7mm thick. Cut a notch in your card and make your own. Don't cut through the magnetic strip or the embossed numbers, if you ever want to use the card again.



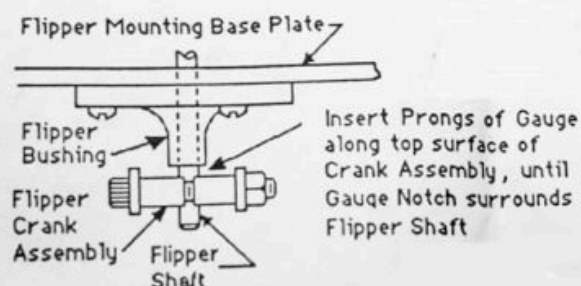
The original Williams instructions show the tool being used between the Crank and the Flipper Bushing. It is much easier to put the tool above the playfield, between the Flipper and the Bushing. That way the tool is far from the under playfield clutter. If it is your first time adjusting flippers, you can rubber-band the tool to the flipper so you don't have to worry about it falling off.

Flipper Shaft End Play Spacing Gauge

Keep that great "Williams Flipper Play" on your game!

Whenever you adjust the flipper mechanism, use the Flipper Shaft End Play Spacing Gauge (p/n 03-8194) to ensure that the flipper shaft end play is correct.

With the playfield raised, slip the prongs of the gauge around the Flipper Shaft between the nylon Flipper Bushing and the Flipper Crank Assembly (with cap screw and nut gripping the shaft). Your flipper is properly adjusted, when the End Play Gauge slides smoothly around the shaft. Excessive gauge binding (too little end play) or excessive looseness ('sloppy fit') indicates that the flipper shaft end play is incorrect.



If you want to change your old Series Coils out for new Parallel Coils, first label your wires.

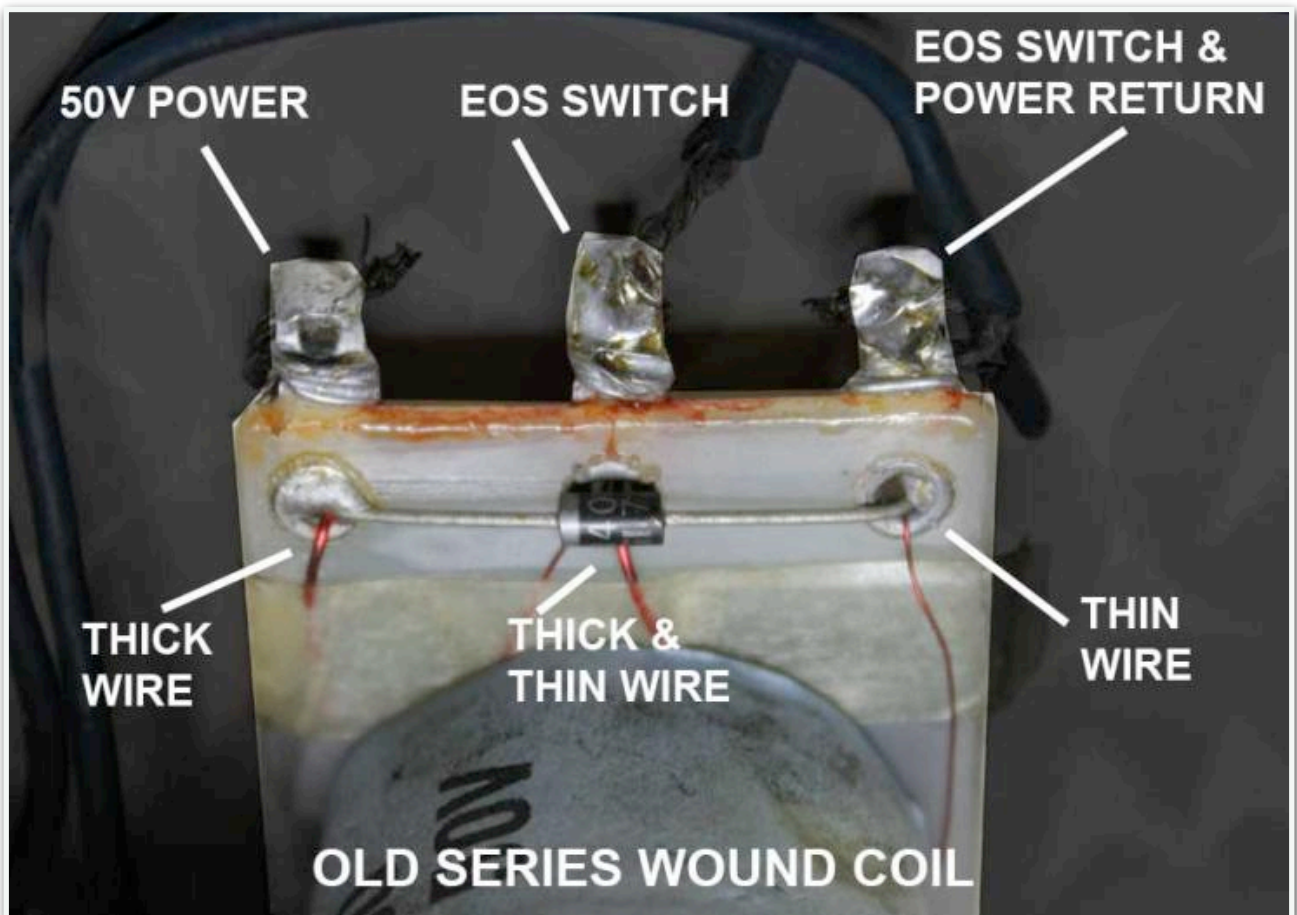
The wire(s) that come from the Banded side of the Diode lug is your 50v = make sure you note this.

The center lug goes to your EOS Switch and the non banded side of the Diode lug has both the EOS Switch and the Power Return wires.

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Same strength replacements:

FL24/600-30/2600 Series wound = FL11722 Parallel

FL23/600-30/2600 Series wound = FL11630 Parallel



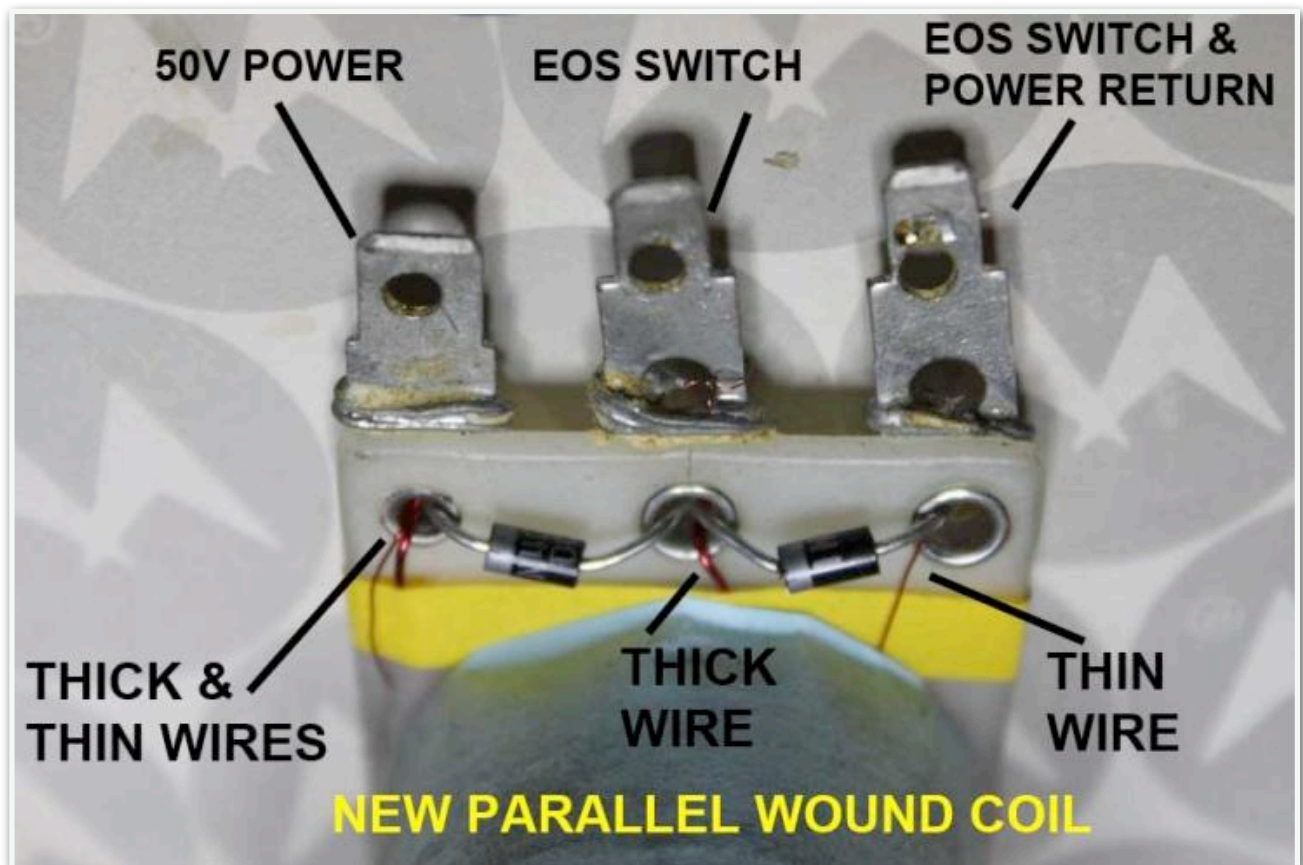
Install your new parallel coil and sleeve. Remember that the lugs DO NOT go next to the coil stop.

The wire you labeled 50v power goes to the outside lug with the Banded Diode (the thick and thin coil wires).

The center lug (with the thick coil wire) goes to your EOS Switch .

The outside lug with the Unbanded Diode (the thin coil wire) goes to the EOS Switch and the power return wire.

The capacitor goes to both sides of the EOS Switch. The capacitor has no polarity, so either leg can go to either side of the switch.



QUESTION: *Will this upgrade work for Data East machines as well? I saw it specify William and SS machines. I need to rebuild the flippers on my DE Batman and wanted to do the upgrade to it as well if it will work.*

ANSWER: *Yes, it's basically the same thing.*

Remember that Batman has early and latter versions of the flippers, so make sure you order the correct kit for your model.

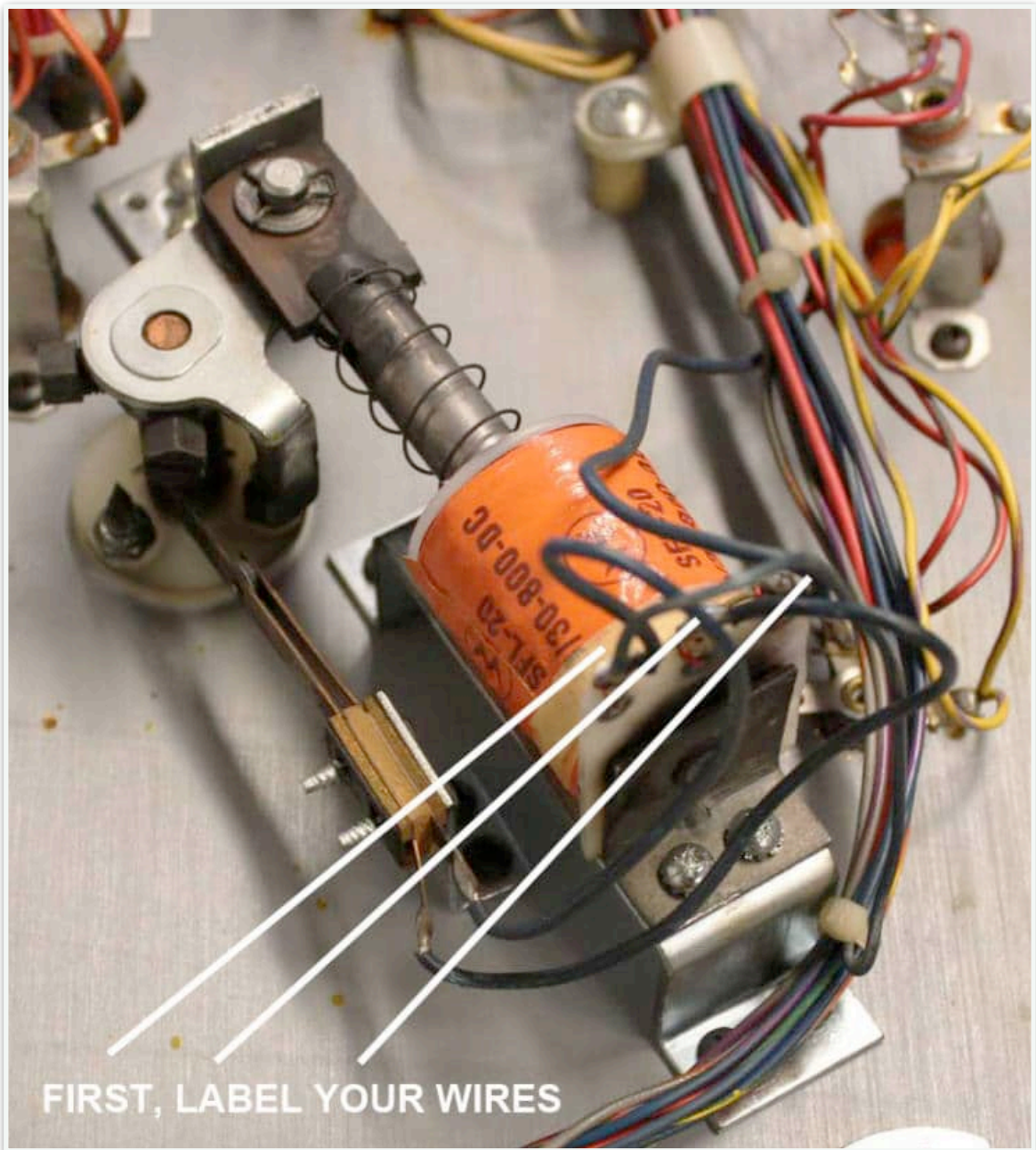
QUESTION: *Hey, Vid...should I replace the diodes during a flipper rebuild?*

ANSWER: *I never do unless they are cracked.*

UPDATING OLD SOLID STATE FLIPPERS

Ok, so you've got an old game like Disco Fever and you want to update to the modern style flipper mechs. This will REALLY tighten up the feel of the game and eliminate that 'bounce back' feel.

First label your wires so you know where your 28v and ground is.



Next pull out all the old mechs.

You might give these away to somebody who is a hard core collector – those guys want everything EXACTLY how it came from the factory.

Here for ourselves, we want the snappiest flipper action we can get.



The first problem is that the old coils are shorter than the modern standard, AND they are 28v instead of 50v.

So we need a SFL 19/400 – 30/750 coil. Often used in games like Black Knight*, the coil is full size, 28v and has plenty of power. Exactly what we need.

You also need a base plate, flipper bushing and a high voltage EOS switch (don't reuse the old one that lacks the "helper" spring leaf).

Terry at PL will actually make the entire assembly for you for only \$36:

<http://www.pinballlife.com/index.php?p=product&id=172>

Here are the options to choose:



I know right now many of you are saying “Thirty Six Dollars???” To rebuild my flipper?”, but look at it this way:

1. You are getting a completely new everything. Nothing to polish or clean.
2. You are getting that “snappy” Fliptronic feel – the best flipper design ever made.
3. Rebuild kits in the future will only be \$21 (instead of \$54 for the old style Williams one).
4. You can sell your old mechs and coil and get a few bucks back towards your new stuff.
5. You can use modern flipper bats, so you get all the cool colors, transparent, illuminated.....

* Firepower II, LaserCue and Starlight were the first games to switch to 50v flippers.



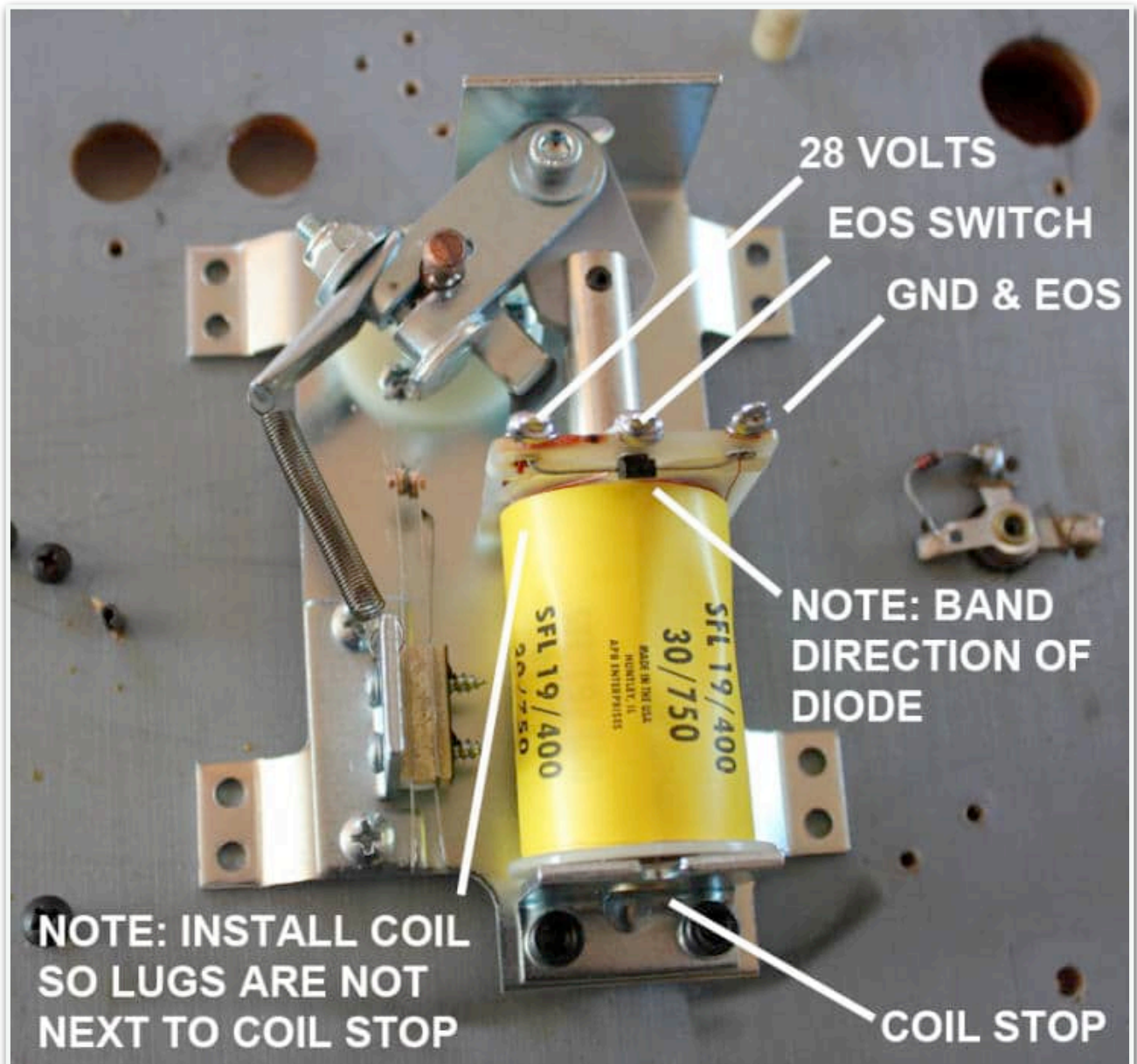
Find room on the playfield for your new mech.

You might have to spin it 180* to make it somehow fit between lights and wires.

Remember that you have a Right and Left mech, so don't make the rookie mistake of putting them on the wrong side.

Note that the solder lugs for the coil are mounted AWAY from the Coil Stop.

Note where your 28v and GND wire goes in relation to the band on the Coil Diode.



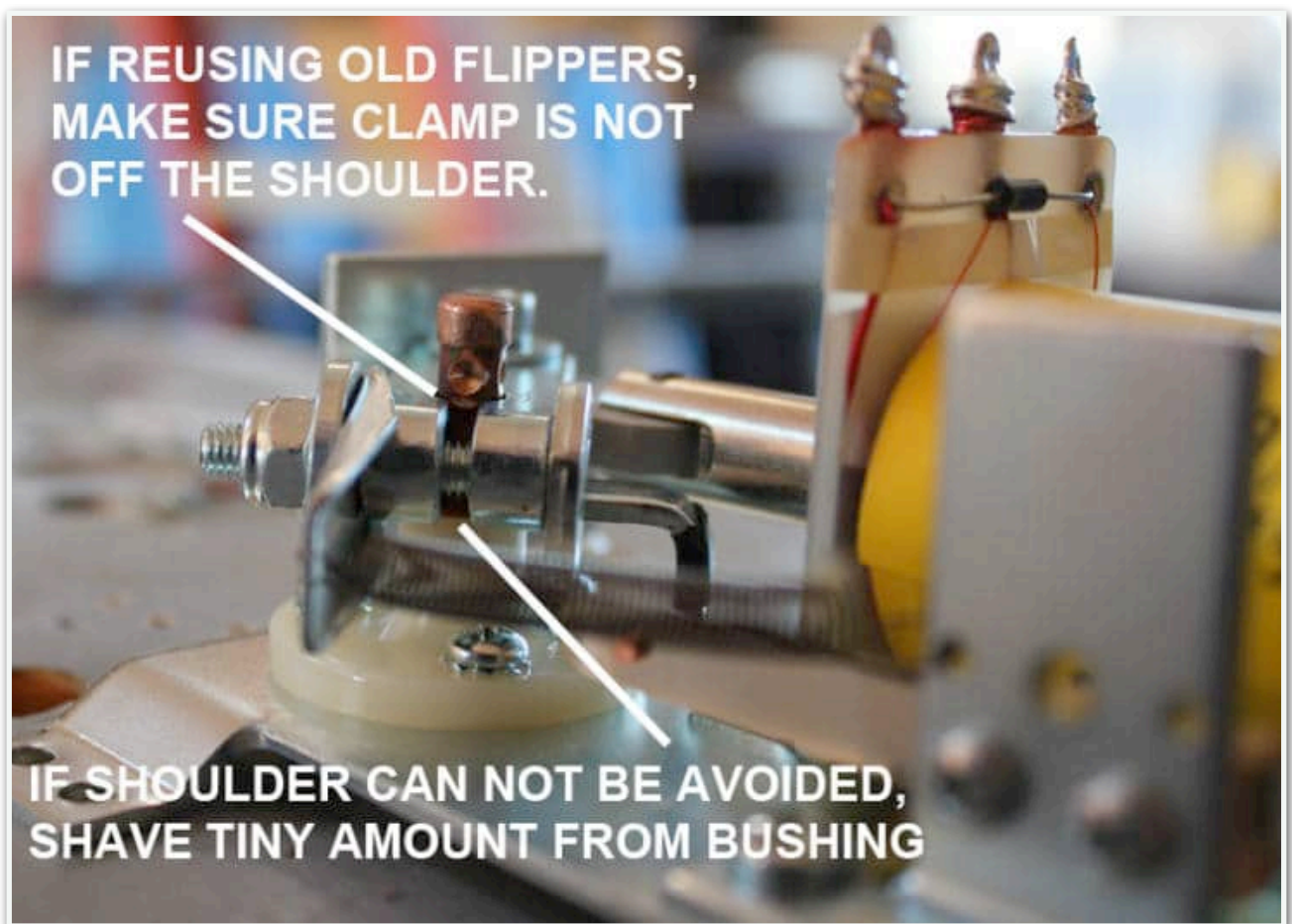
Unless your flipper bats are something special like Time Warp or Disco Fever, just buy new, smooth shaft ones like modern games use:

<http://www.pinballlife.com/index.php?p=product&id=915>

But if you do have special flippers and need to reuse them, just make sure that the clamp is squarely on the shoulder. If it's not, you won't be able to get a good enough grip on the shaft.

Shave a small amount of Nylon off of the Flipper Bushing to give you the necessary clearance. Normally less than 1mm.

Gently tighten the shaft clamp, but do not crank down on it yet.



I normally set the EOS Gap while the flipper is still on the bench, as it is easier.

Note that when the flipper is at rest, the helper leaf spring is putting strong pressure on the short contact leaf.

You want to be sure that, as the gap is opened, you see that the helper spring is making the short contact leaf follow into the gap.

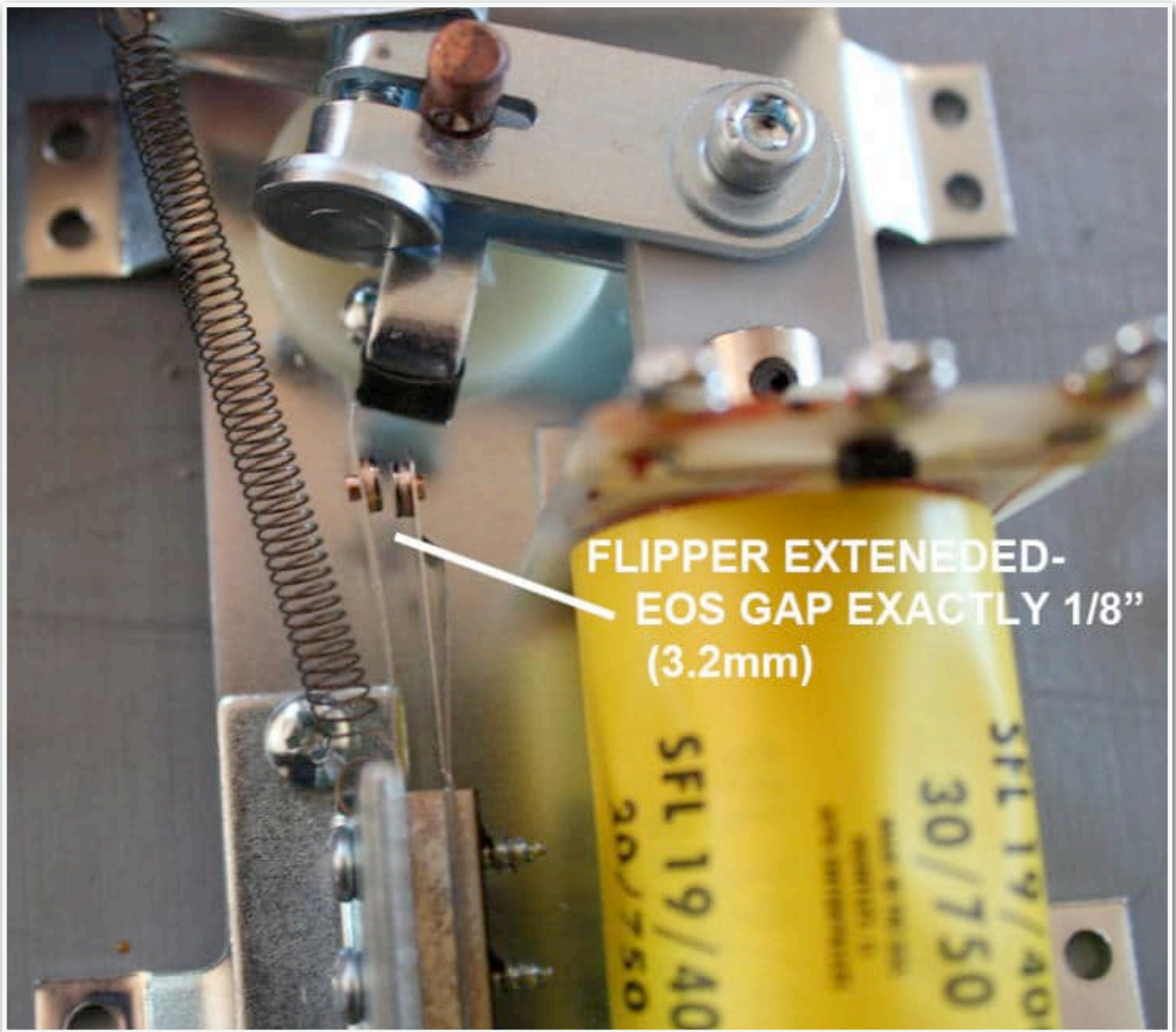
If you don't do this, one flipper will be weaker than the other – often 10 minutes into the game.



Here you see the EOS Switch gap with the flipper fully extended.

Note that the gap is exactly 1/8" (3.2mm). Not more, not less.

This makes for STRONG flipper action, by insuring that the flipper does not switch to low power until the very last millisecond.



Finally, align the flipper with the ball guide, so the ball has a perfectly straight path, or in the case of Curved flippers (Williams never called them “Bananas” 😊) use the flipper Alignment Pin.

The Alignment Pin is the steel hole behind the flippers, often overlooked. Put a drill bit or fat toothpick in the hole and tighten the flippers clamps down while holding the flipper against it.

That’s it.

Your old SS game will play super tight with new mechs, and if you’ve never played Time Warp with tight, snappy Curved flippers – you are in for a treat!

