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October 2015 $12.95

MITSUBA HONDA STARTER
SM612, 710, 730 and 740 Series

2016 ERA SHOW IN MEMPHIS!

PLAIN TALK | **CAN YOU DEAL WITH the changing climate?**

A WORD FROM THE PRESIDENT
Inventory Management 4



Up until a few years ago, I had four types of inventory. Complete units ready for sale, component parts ready for use or sale, whole unit cores and unidentified component parts. When scrap prices started to go up, I decided it was time to tackle my unidentified parts inventory. At first I thought that I had a pretty good idea what I had in the way of unidentified parts. That turned out to be a wrong assumption.

First I started researching methods to go about identifying component parts. I was surprised of the number of resources that were available, not only in subscription websites, but also on vendor websites. I started with armatures, rotors and stators. To help with that task, I subscribed to the Apptrak Online website. They have an easy to use tool designed specifically for identification of unknown armatures, rotors and stators. You plug in the known information and measurements such as body diameter, number of splines, manufacturer, shaft length etc. The more information you plug in, the narrower the search results are. If you have Apptrak and have not used the tool, you should try it. It is on the main menu as ARS. As I identified each part I was able to decide whether to stock it or scrap it.

As I went through hundreds if not over a thousand of armatures, rotors and stators, my scrap barrels began to fill up, my shelf space began to open up and my inventory was becoming more manageable. Now with all my wound parts in inventory, we don't have to guess on voltage, amperage or functional fit.

Next I tackled drives, for which J&N's website was very helpful using their search options feature. Again, it was just a matter of plugging in measurements and known information into search fields. I used several resources such as websites and catalogs to identify housings, solenoids and field coils. This project took me a little over a year to complete, working on it just a few hours a week. Now I have an inventory that is manageable, more floor space and a few thousand dollars in scrap sales. Are you wondering how I determined what to scrap and what to keep?

It was based on my market and potential markets. Most of my scrap was unknown or surplus part numbers that I would never sell. As I identified what I had, I realized that a great deal of it was inventory that I had purchased from other rebuilders who were closing their businesses. Any value that was there when I purchased it had been realized or lost. As for the lost value, I am sure it was because it was not properly managed. Inventory management is a very important part of running your business. How well you do it is just as important as how well you rebuild and provide customer service. My rule of thumb is that if it goes on a shelf it has a part number and location. Otherwise it goes into a scrap barrel. Now when I read a post on the Wanted Forum, it takes just a few key strokes to determine whether I can help or not.

Mike Dietrich

NEW ERA MEMBERS

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Milfrod, Connecticut

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Plant City, Florida

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ABOUT THE COVER

Planetary gears and other parts from a Mitsuba/Honda SM710-01 starter.

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Rebuilding *is* Recycling!

PLAIN TALK— CAN YOU DEAL WITH The Changing Climate?



BY ROB BUKSAR

Summer has come and gone. Again, it wasn't a season you could count on. Most days of old, we could really count on a predictable amount of hot days with plenty of sunshine. The last 5 years or so that predictability has gone right out of the window. Around here we either burned-up, flooded out or were putting on jackets and sweatshirts. Major flexibility has been the order of the day.

It sure seems our business climate has become as fickle as recent weather patterns—unpredictable! Of course, there are some who are constantly "cutting a fat hog", there always are. Just not as many as there used to be and not as many as you think.

I have spent eons of time talking to rebuilders, small and large alike. Frankly, there are very few large ones left, for all sorts of reasons. The market won't support many large rebuilders.

The bulk of auto and truck parts are sold through major coast-to-coast part retailers. They typically deal with rebuilders and sources who can supply between 2 and 3 thousand stores. Usually, these stores are not supplied locally like they were in the old days when they were independently-owned. Am I suggesting that there are no independently-owned part stores left? Of course not. However, there's only a fraction of what there used to be and they're not as easy to service as the old days. Competitive pricing is only half the battle. The amount of part numbers and diversity of it all is nothing short of mind-boggling and bankroll-busting. Plus, the financial incentives that you have to provide to sell these guys are often times unaffordable for a small operator.

In my business career, I've seen a bunch. At our largest point, I've had 25 employees and delivered my products in my own trucks through seven states. Those were the days of Ennis, Holcombe, Reliable, Major, Amarco and a whole lot of others.

Nevertheless, the market was so large and demand so great that it wasn't possible to keep up. Everyone was behind to one degree or another. Making money was easy because the market was predictable. You really didn't have to work that hard on the business (finding new opportunities). You just had to concentrate on producing more of what you were already certain that you were going to sell.

It was far easier in those days. Business cycles were constant and predictable. Just like the weather used to be. Of course, all of that has changed. These days, like many of you, I am a small operation. As you are aware, staying ahead of the curve is no cake-walk. When you're large enough to afford a good right-hand man that can keep the day-to-day operation going that leaves the principle (you) the time and energy to work "on the business". You see, it's real difficult, maybe impossible (?) to work in the business and on the business at the same time. That, my friends, is what gets us small guys in trouble. As small owner/operators, we are so busy doing jobs for customers that we don't see the windows of opportunity open and close. We may not see our business and customer base eroding in front of us because we're too busy doin'it—doin'it—doin'it!

Everything is different these days. Death and taxes seem to be the only constant. Around here, we had to keep a t-shirt, sweatshirt and umbrella handy to deal with any unforeseen change. I suspect

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someway, somehow the same type of thinking needs to be incorporated into our small businesses.

Just some thoughts. Are you prepared?

- If you get thrown in the hospital
- Lose a vital employee
- Lose the lease on your building
- Lose bank funding
- Have a fire
- Have a major break-in
- Lose a primary customer
- Have a major customer who owes you a ton of money, file bankruptcy

So what does all of this boil down to? Simply this. Being self-employed with a small business is no cake-walk. It never has been. These days, it's a whole lot more difficult and unforgiving than it used to be. So what I think might be a good suggestion is to determine whether you have an expensive hobby or a viable business. If your wife is subsidizing you or if you're living off your Social Security, you probably have a hobby. If you can sustain yourself, your overhead and some financial safety nets then you probably have a business.

If you want to keep the business afloat over the long haul and you have the help to do so someway, somehow, you have to keep your eye on the financial climate. Circumstances change so rapidly that unless you're prepared; you may find yourself outside in a storm without an umbrella and getting soaked will be unavoidable.

Pay attention to industry trends and network with other rebuilders. Watch what the big guys are doing and adjust accordingly, if appropriate.

If it sounds like a lot of work, it's because it is. Hopefully, this makes sense and if it does, take the time and energy to keep your finger on the economic climate and pulse of our industry and adjust rapidly.

God bless our little industry!

Rob Buksar is the owner of Hoosier Electric Co., Gary, Indiana



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MITSUBA HONDA STARTER SM612, 710, 730 and 740 Series



BY BOB THOMAS

The first Mitsuba starter based on this compact design appeared on the 2000 Honda Insight, a hybrid with a 3-cylinder, 1.0L gasoline engine. That starter, Mitsuba SM612-02, was rated at 1kW. Since 2003, Honda and Acura have used one of these starters on nearly every 4-cylinder car, truck and van that they have sold in the US. Through model year 2013, there have been 24 different Mitsuba part numbers and 19 Lester numbers using this design. Applications include 14 Honda and Acura models over an 11 year span and it appears that Honda is still using it in current models, although this is not yet verified.

The SM612 starters can be differentiated by their internal through bolts, far left and right in the photo (see Figure 1). In 2006 Mitsuba introduced the SM710 series which was followed by SM730 and SM740. The 700 series starters have external through bolts, center in the photo. This 710 is rated at 1.2kW and was used on all 1.8L Civics from 2006 to 2011. Kilowatt ratings for these starters can be 1.6, 1.2 or 1.0 kW, left to right in the photo. At this time, it is believed that three armatures cover most of these starters (see Figure 2), depending upon kW rating.

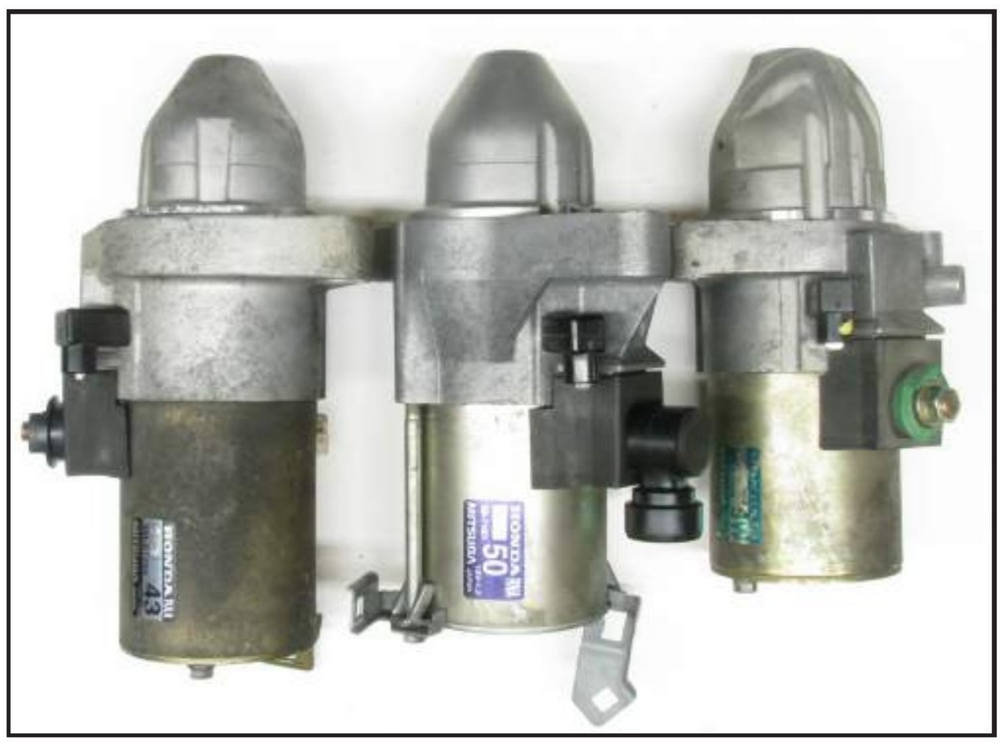

Figure 1 – Three kW ratings have been used, 1.6, 1.2 and 1.0 (left to right).

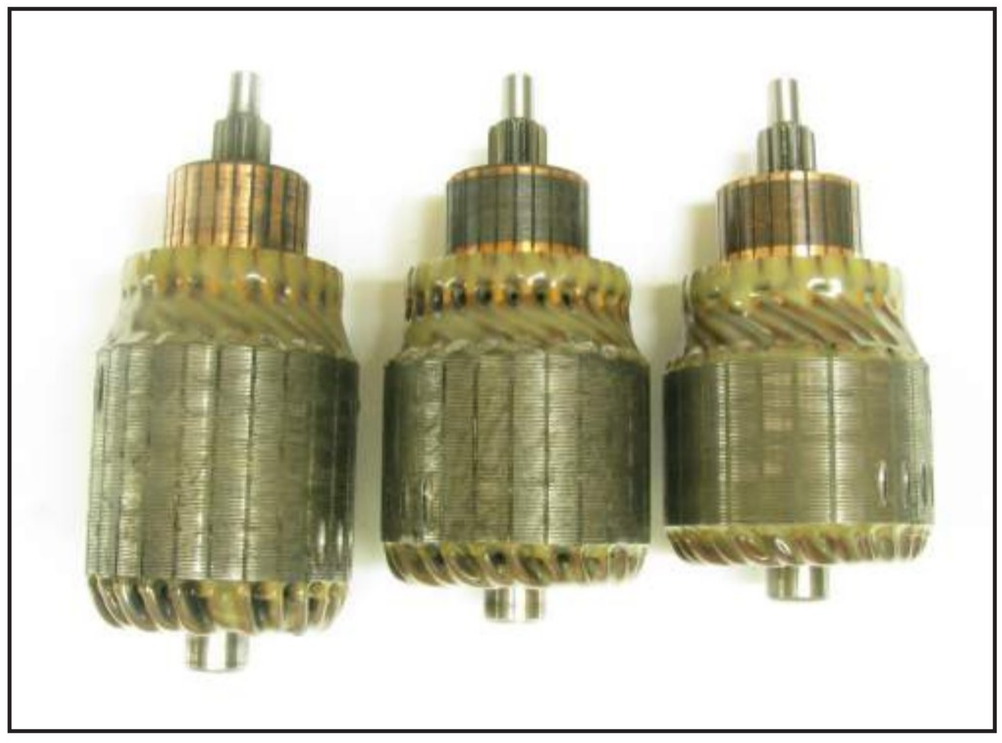

Figure 2 – Three known armatures to match kW ratings – 1.6, 1.2 and 1.0 (left to right).

Mitsuba saved weight and space by incorporating a single coil solenoid, pressed into the DE (drive end) housing between the drive assembly and the planetary gears. That eliminated the need for an externally mounted solenoid and the engine compartment space required. This starter's solenoid only controls the motor. It does not shift the drive. The roller clutch drive is engaged by helical splines on the drive shaft using inertia. Mitsuba's modified approach conceals an anti-drift spring inside the drive between the body and lock collar on the shaft – housed inside a hollow pinion. That spring also applies pressure to the drive to aid disengagement and braking.

Some rebuilders have been hesitant to rebuild these starters because they appear overly complicated. Initially, service parts were not easy to find either. But in truth they are actually simple in design and not difficult to rebuild. Many of these starters have been on the road for over a decade. Parts are now available from several different suppliers. There is no reason to believe they are not worth rebuilding.

Efficient rebuilding is dependent upon getting it apart quickly without damaging any of the components. That takes practice and patience. Removal of the through bolts will release the end plate, armature and field case in a matter of seconds. A visual inspection will tell you quickly if the armature can be salvaged. It also exposes the brush holder assembly where the starter's brushes and solenoid contacts can be easily inspected. In less than one minute, you can determine the cost of



rebuilding a core. If you find that it is not worth rebuilding, it can be re-assembled just a fast.

To proceed, you must then remove the B+ nut, insulator and the rubber cover to expose the push-on locking retainer that holds the solenoid's moving contact in place on a plastic rod. Removal of the push-on retainer can be accomplished using a 90 degree pick to bend the retainer's segments from the inside as shown (see Figure 3). Work your way around until you get the retainer past the groove it fits in. The plastic rods and steel retainer are available from several sources. You can simply cut the end off the plastic rod and replace them both to save time. If you do that, there are some precautions when using the aftermarket parts, which will be explained later.

With the retainer out of the way, the spring and moving contact disk will come off and the brush holder can be separated from the DE housing. Note that the ground brushes are welded to the the steel base plate and the positive brushes are welded to a stationary contact that is riveted to the plastic brush holder (see Figure 4). Mitsuba has used several different brush holders in these starters, some of them very similar. The most common brush holder is available from many sources as a complete assembly. But all of the brush holders can also be rebuilt by replacing the brushes and stationary contacts. The complete

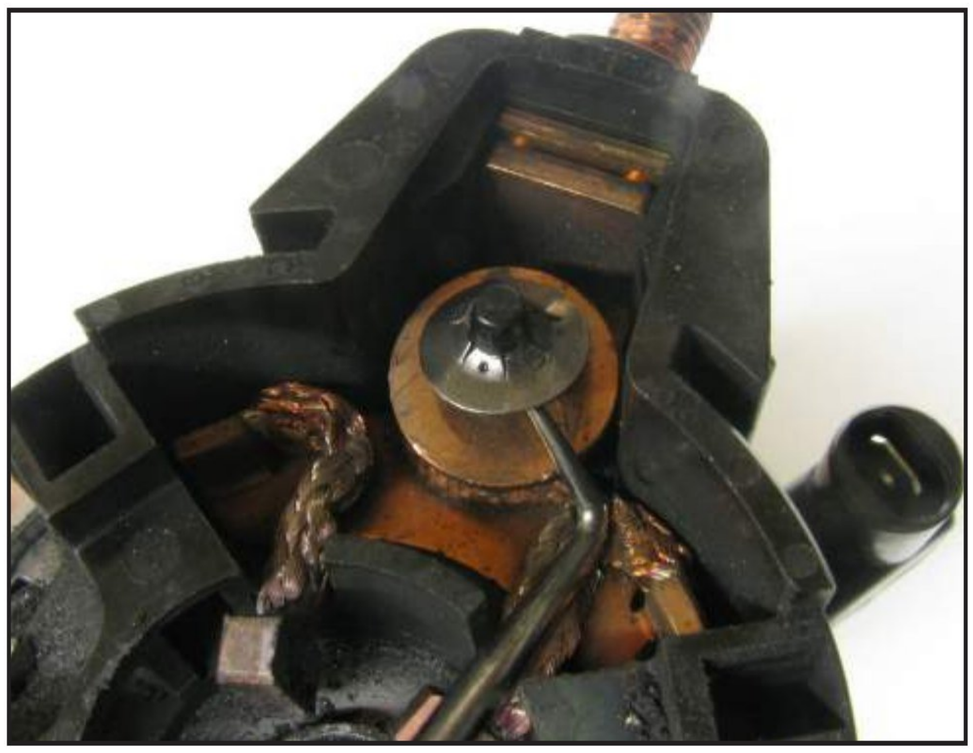

Figure 3 – Use a 90 degree pick the bend the retainer's tangs up from the inside to release it.

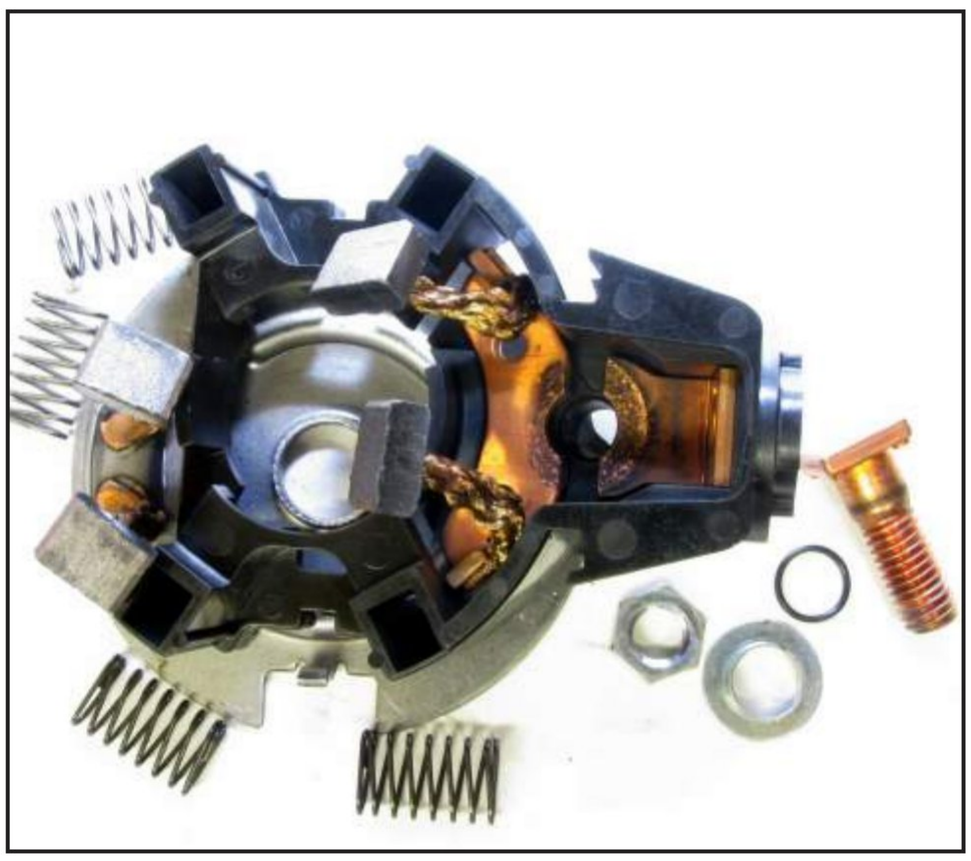

Figure 4 – The stationary contacts are riveted to the brush holder assembly.

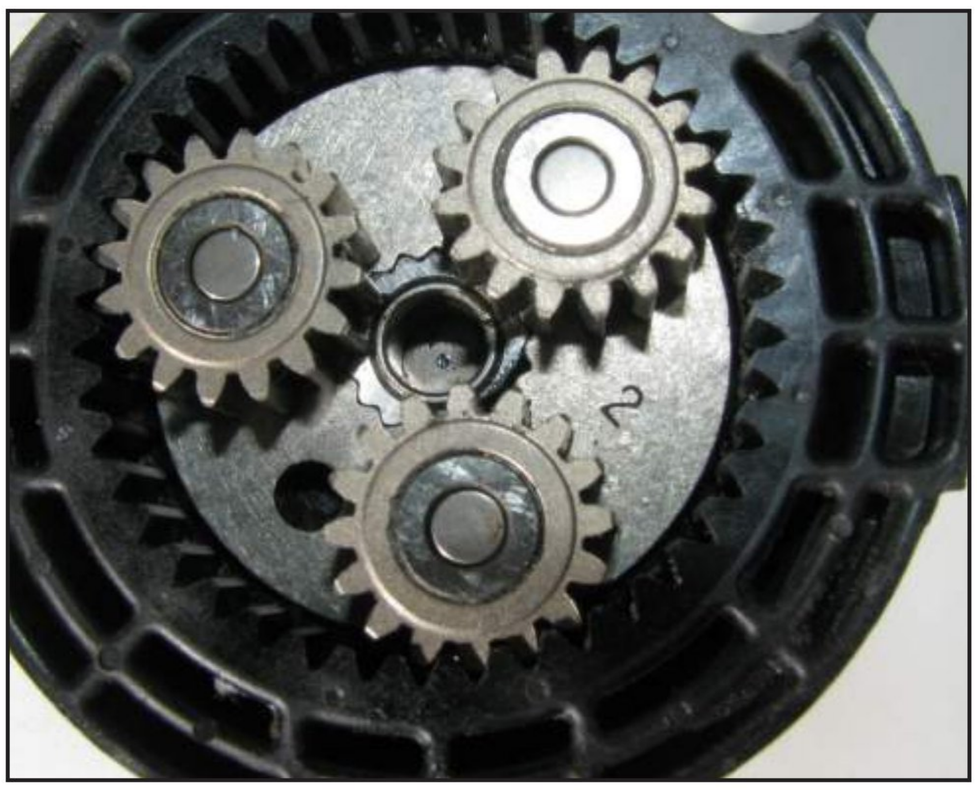

Figure 5 – Planetary gears and gear plate. The drive's shaft in the center holds CE bushing for the armature.

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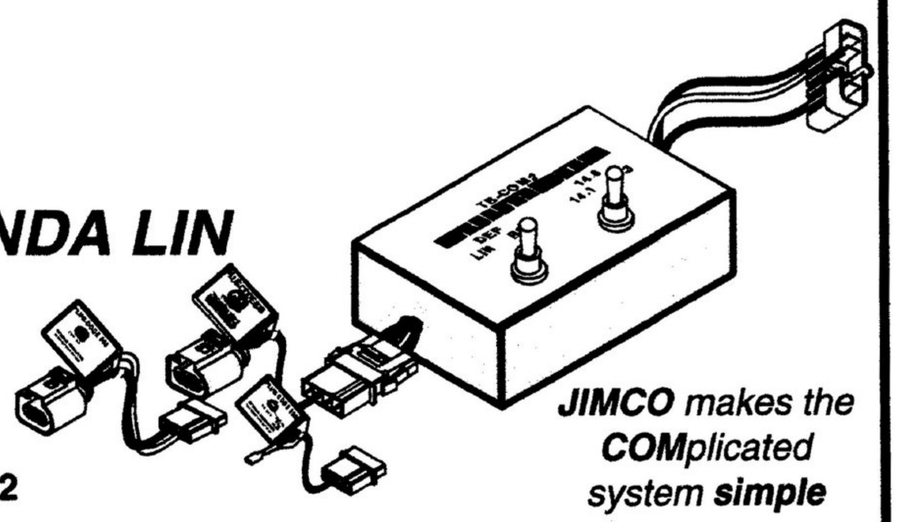

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assemblies are reasonably priced and will save you a considerable amount of time if the one that you need is available.

Once the brush holder is out of the way you can remove the planetary gears and drive plate that fit onto splines on the end of the drive shaft (see Figure 5). The stationary gear can be removed once the planetary gears and plate are out of the way (see Figure 6). Notice that the stationary gear in this starter is plastic and there is a bushing in the center to support the drive shaft. That bushing can easily fall out. I recommend locking it in with retaining compound once you clean it. A metal stationary gear with plastic backing was used in some of the earlier model starters (see Figure 7).

Beneath the stationary gear you will find the solenoid's plunger that holds the plastic contact rod. **This plunger rests on three tiny springs** that reside in small cavities inside the aluminum DE housing. Take your time removing the plunger and **watch out for these springs.** They will sometimes stick to the plunger because of residual magnetism or grease from the plunger. If they fall out and get lost, they can be very difficult to locate. Loosing one of these springs is probably the easiest mistake you can make during dis-assembly. As of this writing, no supplier offers them. And to make it worse, the springs are not the same size in all starters.

A larger spring attaches inside the plunger (see Figure 8). That spring mates to a spacer constructed from phenolic resin with a steel ring around the outside. The spacer is made to slide freely both inside the plunger and around the outside of the drive shaft. It can be lifted out once you have all of the springs accounted for. The spacer limits the travel of the plunger and controls the amount of pressure being applied to hold the



Figure 6 – Plastic stationary gears were used on later starters.

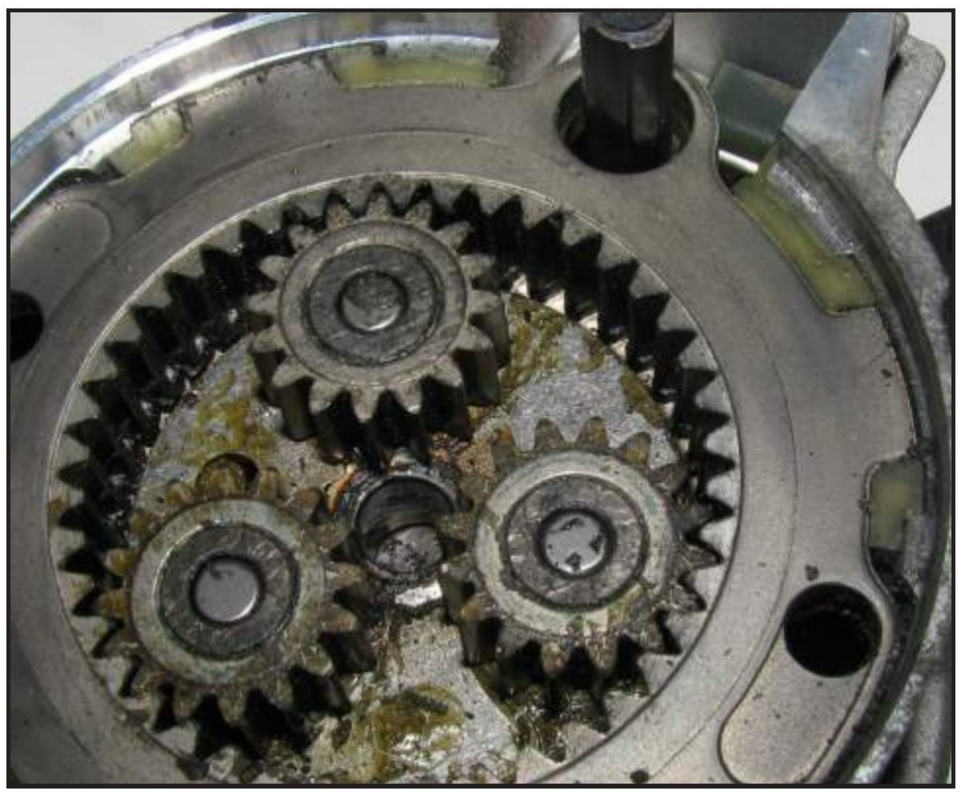

Figure 7 – Metal stationary gear were used on earlier starters.



Figure 8 – The plunger, phenolic spacer and return springs (three small and one large).

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contacts closed during cranking.

At this point you will be looking at a solenoid coil that is pressed into the DE housing. Getting it out is not as difficult as it looks. First, remove the solenoid's suppression diode (see Figure 9). The ground side is secured with a small Phillips machine screw. The positive side is soldered to the switch terminal. The same solder covers the coil's switch terminal lead but that lead is also welded to the switch terminal. Wick or blow away the solder and break the weld with a small flat blade screwdriver and a light tap from a hammer (see Figure 10). Use the same screwdriver and hammer to remove the switch terminal from the DE housing.

Next drill a 5/16" hole in the center of the end of the DE housing (see Figure 11). Then press the drive shaft, through the hole using a pin punch. The drive shaft will move freely until the anti-drift spring is collapsed. At that point you are pressing the drive assembly against the coil. If you do not have a hydraulic press, you can heat the housing and drive the coil out using the pin punch and hammer. Take care to not damage the coil leads or the splines on the drive shaft.

Behind the coil you will find a rubber seal that serves as a brake washer for the drive. You will notice that the side that goes against the drive is contoured to mate with it. Once the coil and rubber brake have been removed, the drive assembly will lift out. With a little practice, all of the tasks described up to this point can be accomplished in 15 to 20 minutes.

You may wonder how the drive comes off the shaft (see Figure 12). The answer is simple, but requires rebuilding the drive clutch, or at least taking it apart. It is worth noting that a few suppliers offer some drives assembled on the shaft.

To rebuild this drive, like any other roller drive, you have to remove the cover. New covers are available from Lewis Tool & Die and the quickest way to remove any cover is to cut it. However, if you are rebuilding these starters one at a time, you

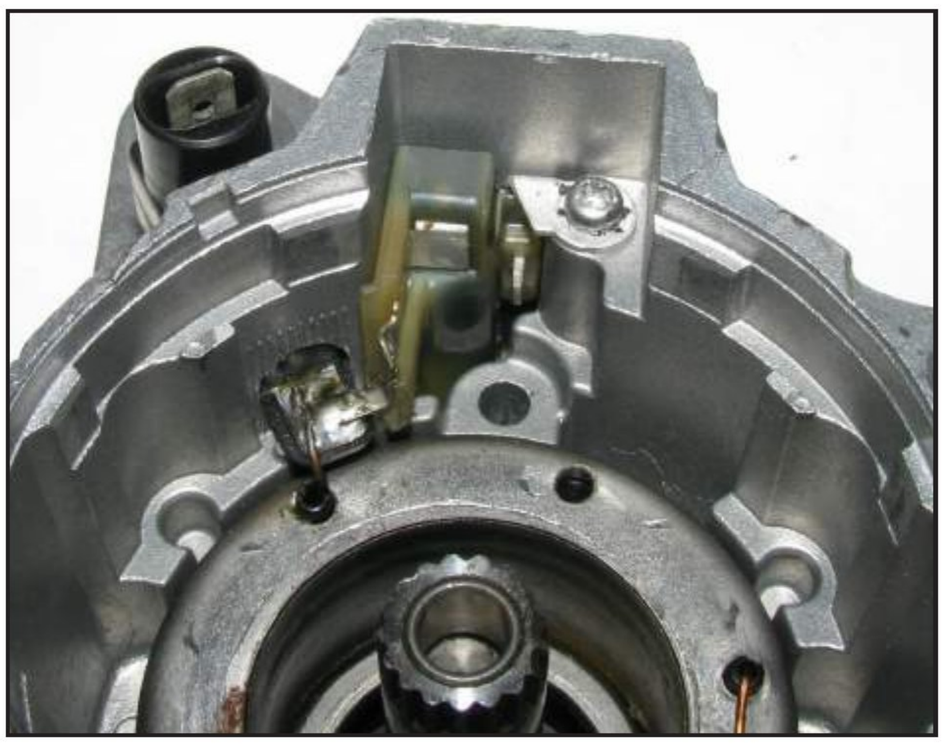

Figure 9 – Suppression diode and solenoid coil lead are both attached to the switch terminal.



Figure 10 – Use a small flat blade screwdriver to break the solenoid lead's weld to the switch terminal.



Figure 11 – Drill a 5/16th hole in the end of the DE housing to access the end of the drive's shaft.

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can remove the cover without destroying it using a Mac Tools gouge chisel GC8SS. This chisel is similar to a cape chisel but is round on one side (see Figure 13). It is made specifically for cutting out bushings but it also works well to remove drive covers. Carefully lock the pinion in a vise, and rest the straight side against the drive body with the curved back side against the cover. These Mitsuba covers are very thin and can be deformed quickly using this method. Light taps from a small hammer all around the drive (see Figure 14) will open the crimp just enough to knock the cover off using a pin punch or drift (see Figure (15).

You can see the anti-drift spring beneath the lock ring and collar in the next photo (see Figure 16). You do not have to disassemble those parts. New rollers and springs are available, if you need them. I removed the old grease and re-lubricated the body and rollers with fresh drive grease. The rollers are raised in this photo to make them more visible.

Do not use bearing grease on a drive clutch. Drive clutches require a special paste-type grease that is made specifically for roller clutches. Vensel Enterprises sells it in small containers with enough grease to rebuild hundreds of small drives. If you do not have the right grease, do not attempt to rebuild the drive.

Once the rollers and springs are in place, install the cover washer (see Figure 17). Then install the pinion by twisting it clockwise while pushing down and replace the two halves of the pinion retainer (see Figure 18). The cover should be pushed on from above and can be seated using a deep socket to push the

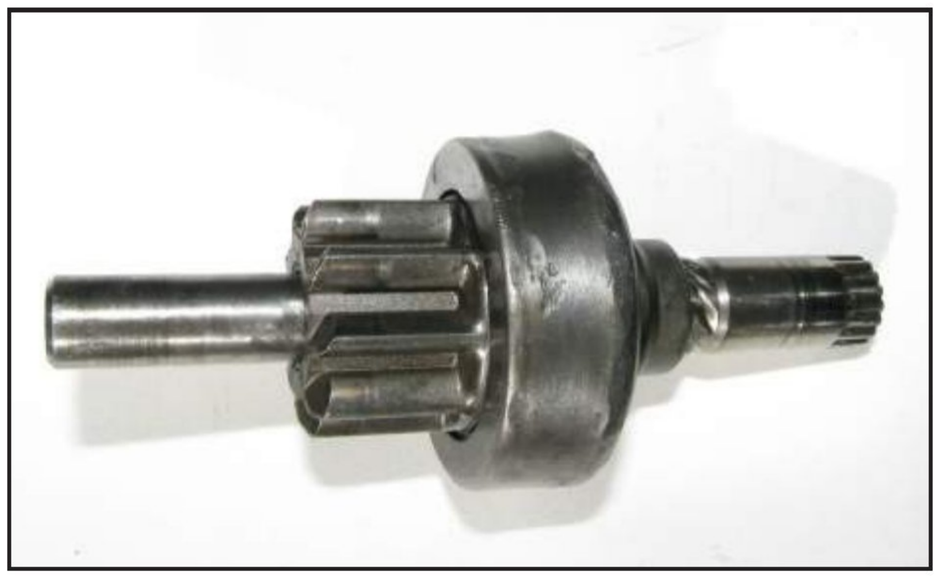


Figure 12 – The drive assembly outside the starter.

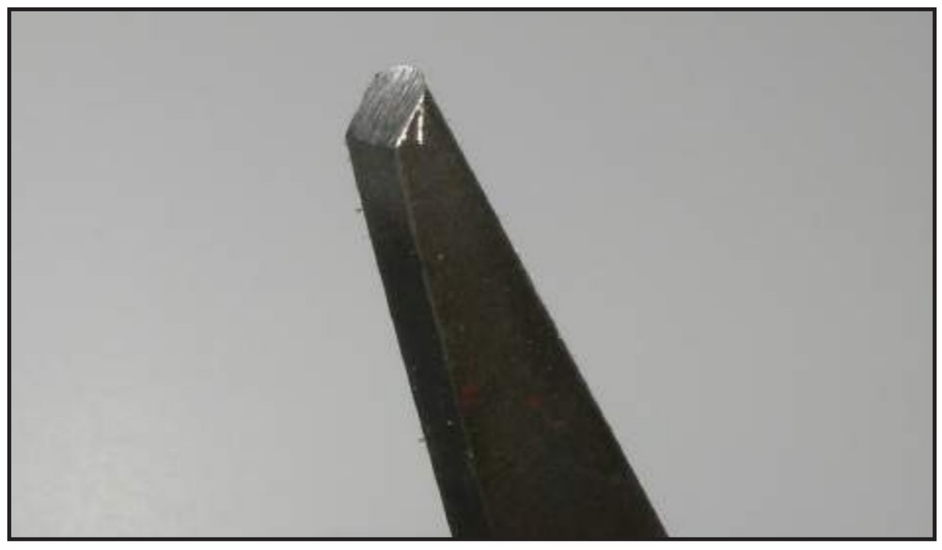


Figure 13 - A gouge chisel made to cut bushings will quickly open the crimped-on drive cover.





Figure 14 - Place the flat side of the chisel against the body and the curved side against the cover.



Figure 15 - The opened cover can be pushed off the body with a flat tipped drift.

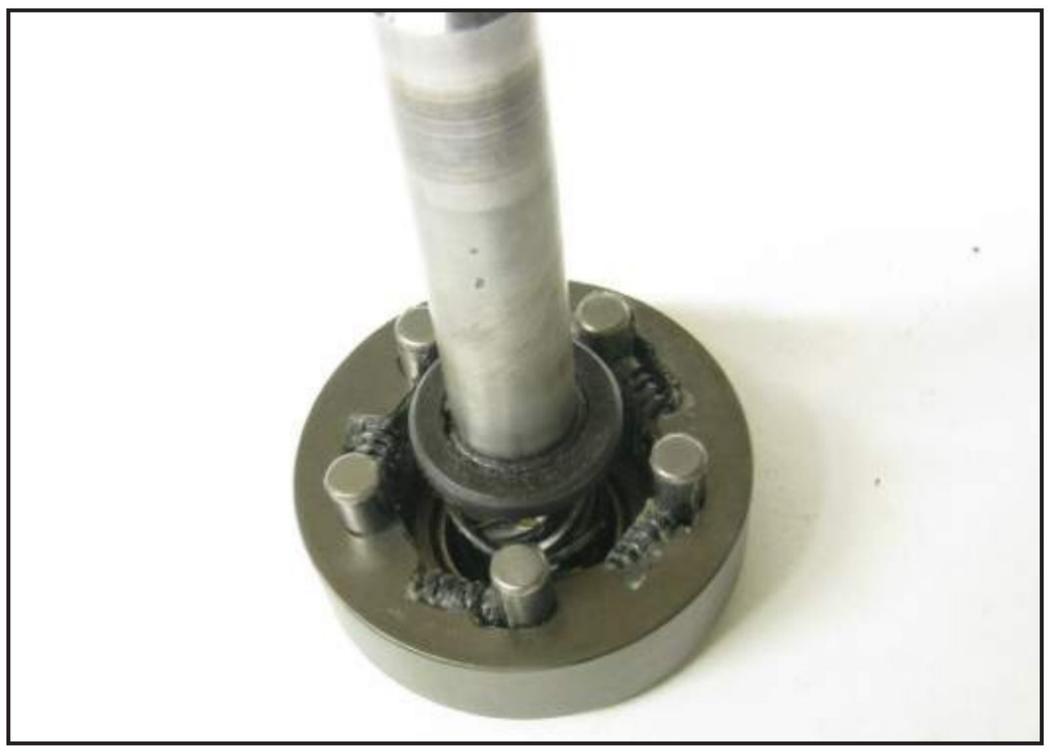


Figure 16 - This is the drive body, held onto the shaft by the anti-drift spring, snap ring and collar.

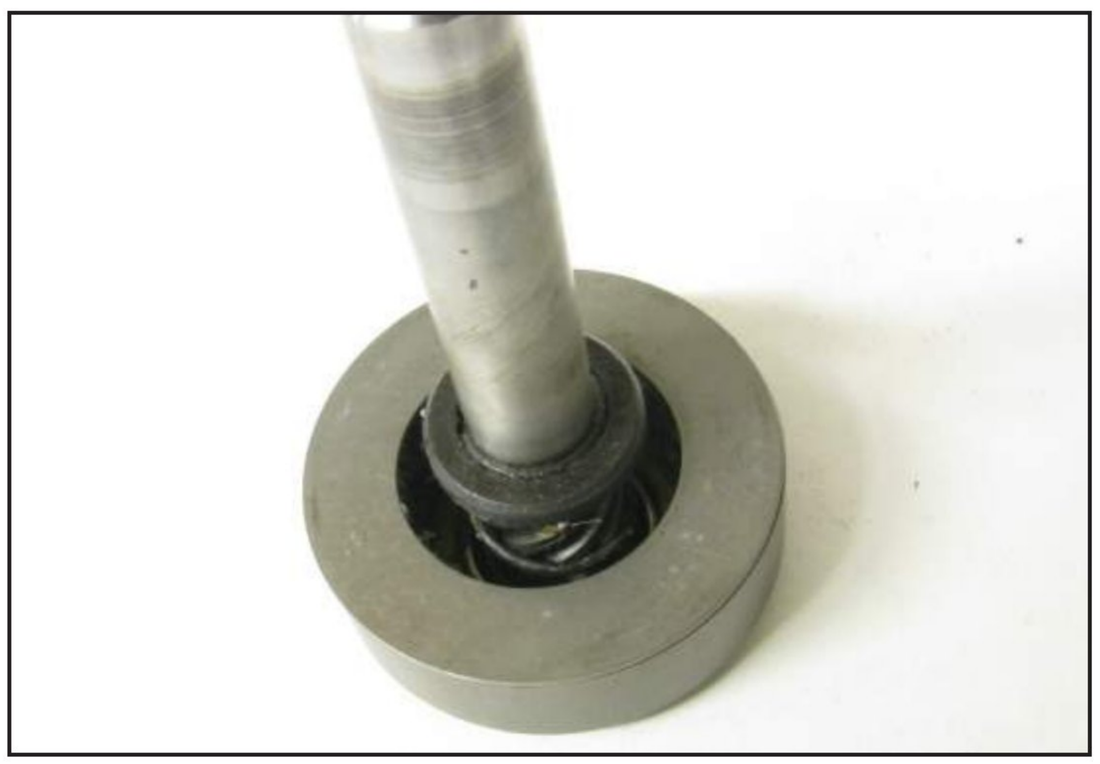


Figure 17 – Drive clutch reassembled with cover washer in place over rollers and springs.

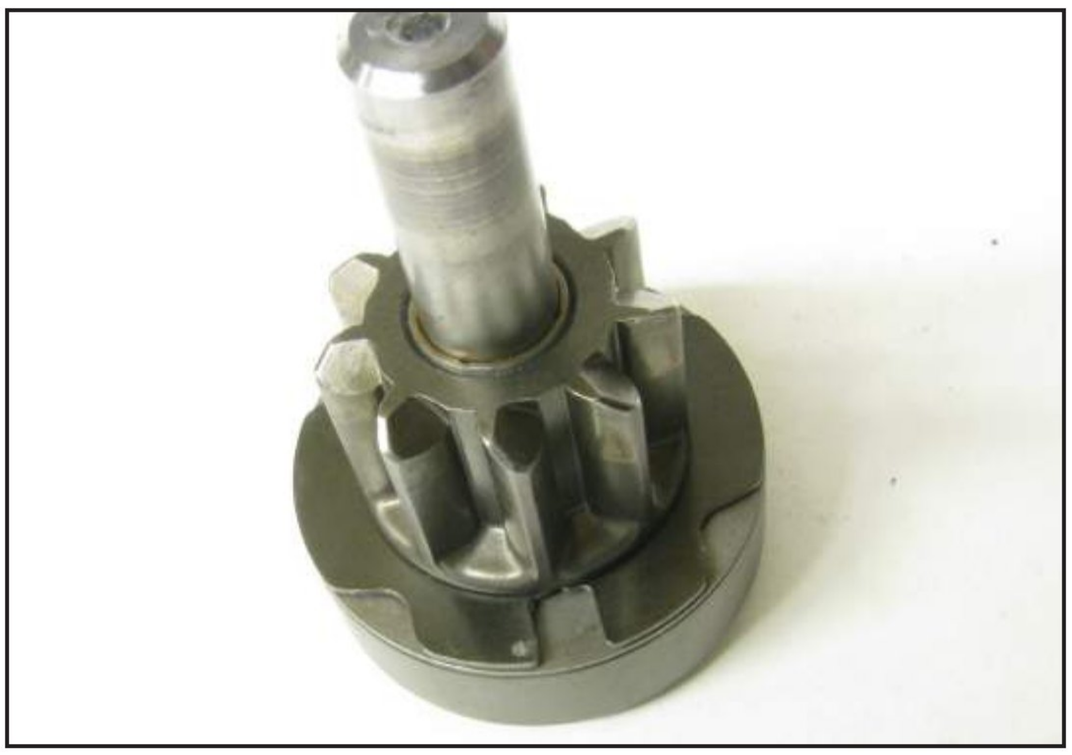


Figure 18 – The pinion and two-piece pinion retainer are in place – ready for the cover.

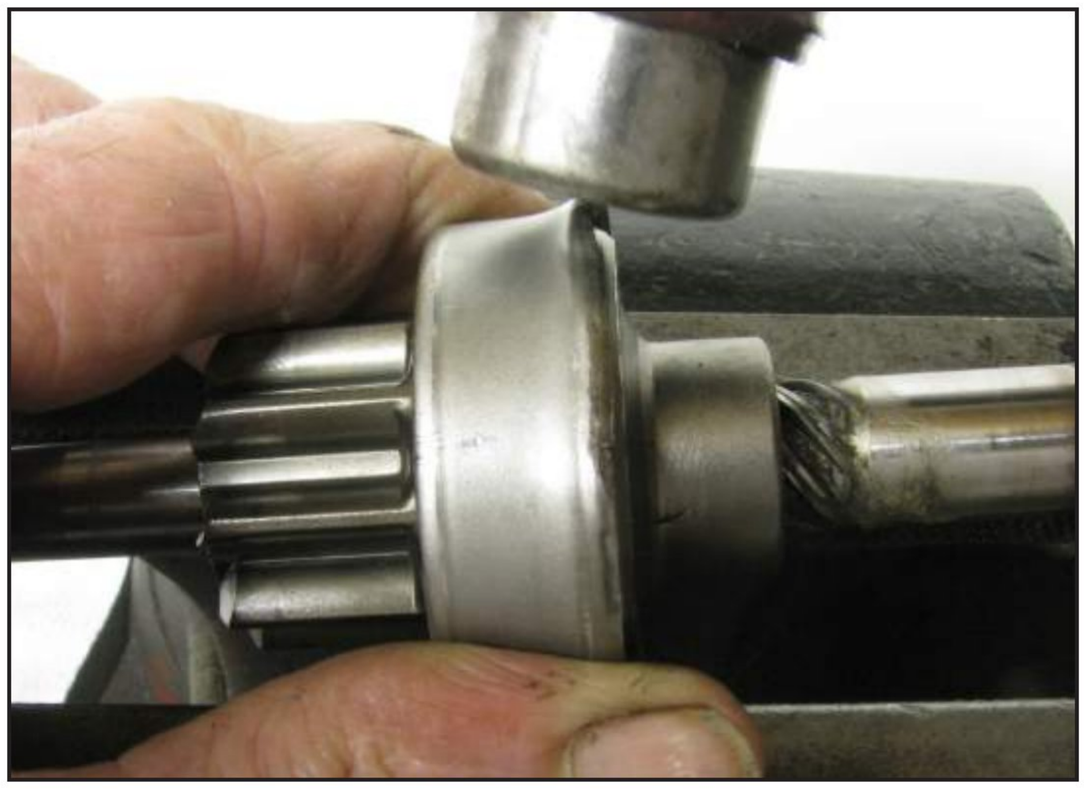


Figure 19 – Hold the cover tightly seated and use a hammer to re-crimp the cover.

assembled drive all the way into the cover. Once all of the pieces are assembled, you can re-crimp the cover with light taps from a hammer while holding it tightly against the body to insure a secure crimp (see Figure 19).

With the drive assembly now complete, you can reassemble the starter in reverse order, beginning with the DE housing and drive assembly. Then install the black rubber brake washer behind the drive (see Figure 20) and position the solenoid coil with the lead wire lined up with the hole for the switch terminal (see Figure 21). I used a 1-1/4" socket as a tool to press the coil into the DE housing (see Figure 22). With the coil in place, you can re-install the switch terminal and suppression diode (see Figure 23). It is a good idea to test the suppression diode to insure it is not open. It protects electronics on the vehicle from the high voltage generated each time the coil's magnetic field collapses as the starter is switched off.

The rest will go together quickly. Replace the phenolic spacer with the correct end up to fit into the plunger's return spring. Then place the three small return springs in their cavities in the DE housing (see Figure 24). Install the steel plunger with the plastic contact rod pointing up (see Figure 25), **making sure the plunger's three arms are perfectly aligned with the small springs. The bumps on the plunger arms must be centered on the springs.** At this point you must also pay special attention to the condition of the plastic rod, which is explained below. Then you can install the brush holder assembly, new or rebuilt. This brush holder is designed to stage the springs above the brushes for easy installation of the armature, but **do not put the armature in yet.**

You must install the moving contact disk, spring and push-on retainer next. The plastic rod and the retainer **must be inspected closely because this is a problem area for these starters.** Spend a little time to insure that the retainer you use will fit tightly into

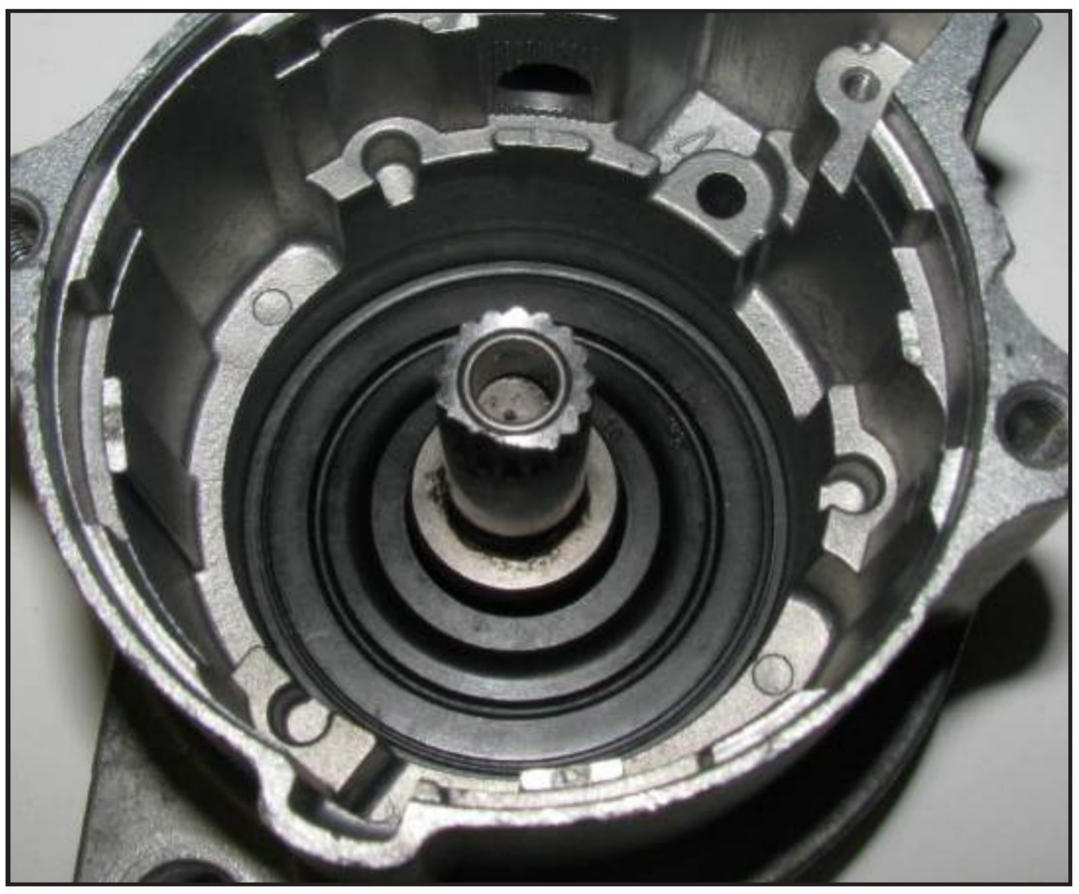


Figure 20 – Install the drive and brake washer into the DE housing.

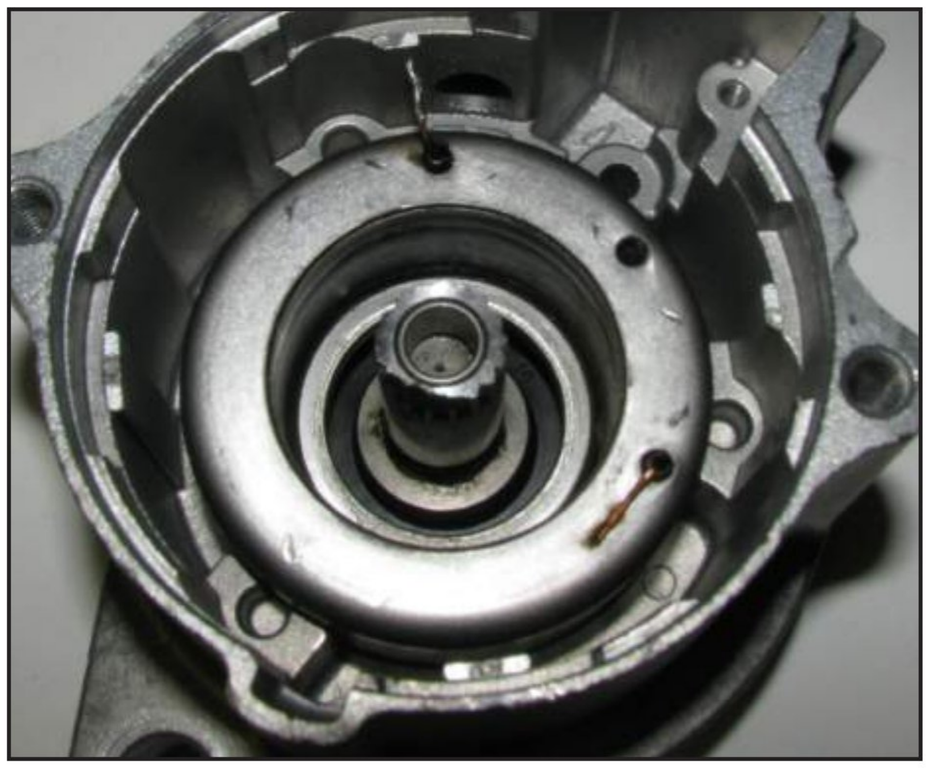


Figure 21 – Position the solenoid coil so the lead wire aligns with the hole in the housing for the switch terminal.



Figure 22 – Use a 1-1/4" socket to press the solenoid coil into the housing.



Figure 23 – Re-install the switch terminal and suppression diode. Solder the coils lead wire and diodetab to the switch terminal.

the groove on the rod. Some aftermarket rods are not formed as precisely as they should be (see Figure 26). Look closely at the plastic rods and push-on retainers in the photo. The rod and retainer in the center are original Mitsuba parts. Notice that it has a more distinct groove and the retainer has a smaller opening for a tight fit. The parts on either side are aftermarket. I strongly recommend that you enhance the groove in any aftermarket rod and tighten up the replacement retainer by smashing it lightly in an arbor press, shown on the left side in the second photo (see Figure 27). I enhanced the groove on the

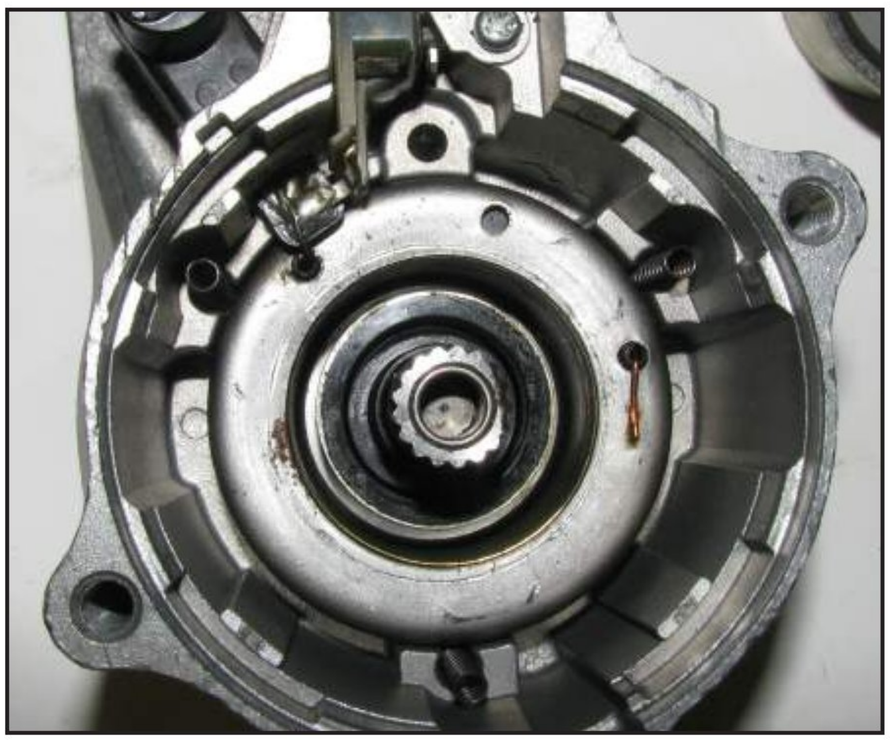


Figure 24 – Insert the phenolic spacer and position the three return springs in their cavities around the coil.



Figure 25 – Carefully rest the plunger with plastic rod on the return springs



Figure 26 – Original used plastic rod and pus-on retainer in the center. Aftermarket replacement parts on either side.



matching rod using a small flat needle file with the rod chucked in the lathe. Do not cut it too deep. It is plastic and the retainer must fit tightly in the groove.

Once you are satisfied with these parts, put the contact (rough side down), spring and retainer onto the rod in that order and push the retainer into place with a 5/16" nut driver (see Figure 28). Inspect the push-on retainer closely to insure that the tangs are in the groove (see Figure 29). At this point, I recommend testing the solenoid multiple times by grounding the DE housing and applying power to the switch terminal. Pay close attention to the push-on retainer to insure that it stays in place.

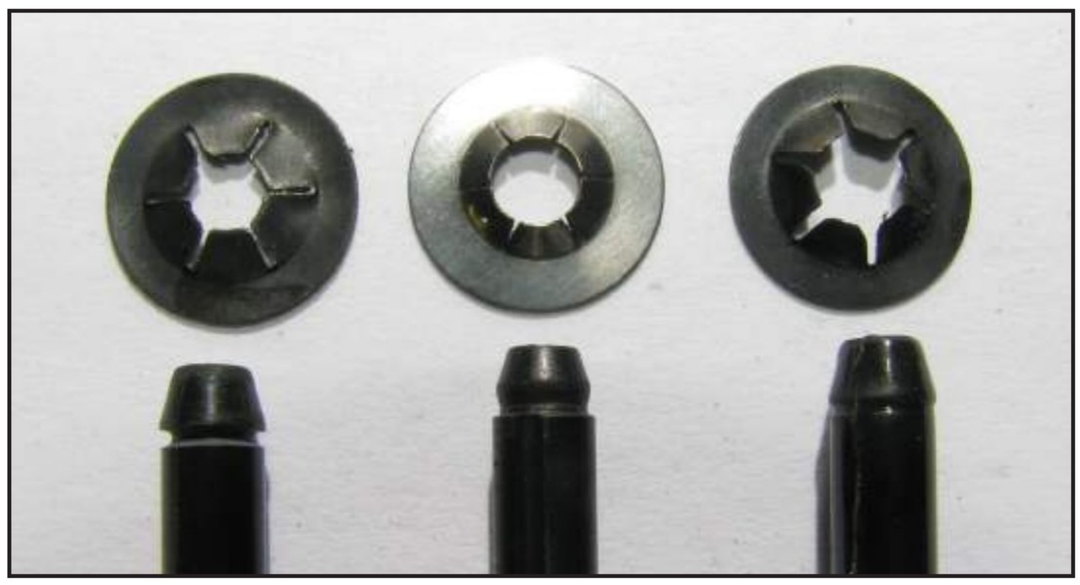


Figure 27 – The aftermarket rod and retainer on the left have been modified as described.

One of the Honda dealer cores that I disassembled had failed because the original push-on retainer came off. It happened to Mitsuba on an original core. It happened to me with a rebuilt unit. It can happen to you if do not pay attention to detail on this step.

Once you are satisfied that the contacts are operating correctly you can replace the rubber boot and B+ insulator. New rubber boots are available but once again, the original will always fit better. Then drop the armature in and push the brush springs into position behind the brushes. You will have to hold the armature in place while you install the field case. It takes firm pressure to overcome the pull of the magnets. Once the field case



Figure 28 – Use a 5/16" nut driver to install the push on retainer.



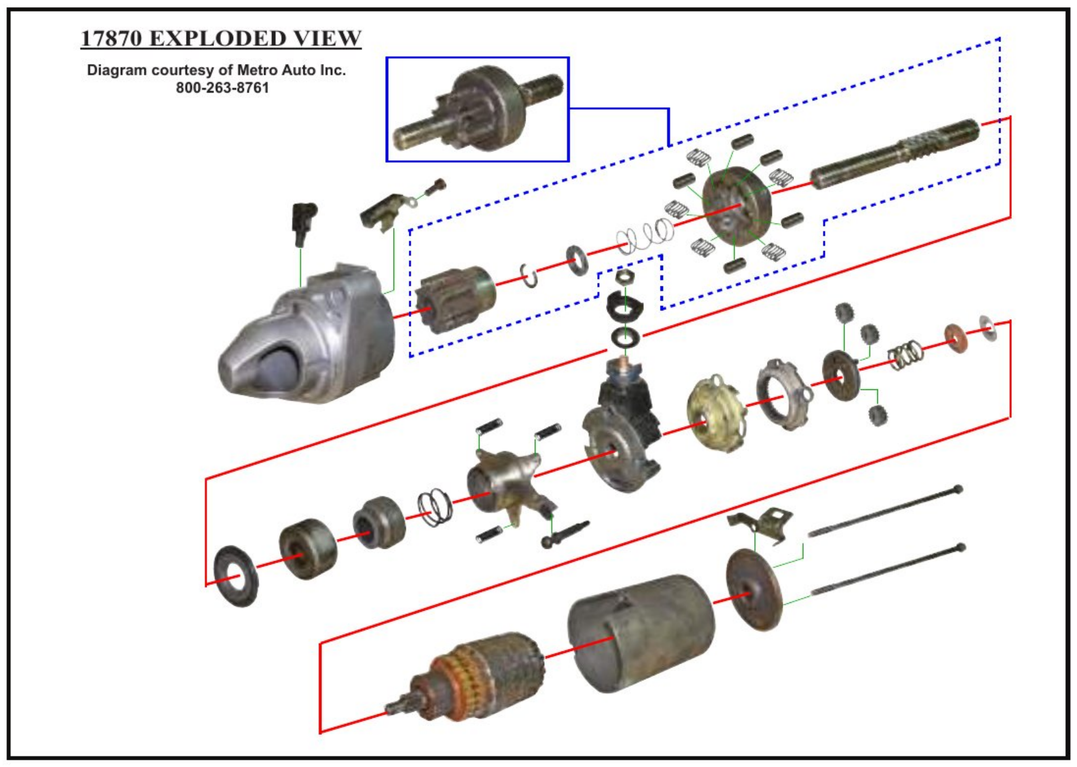
is in place you can install the rear cover and through bolts.

Notes: This starter has eight bushings. While they should not be packed full of lubrication, a thin coat of light bearing grease on all of them is recommended. The hole that was drilled in the DE housing can be left open or sealed with gray epoxy.

While some parts interchange on these starters do not assume it based on a quick comparison look. Many replacement parts look almost identical yet may not be interchangeable.



Figure 29 – Check the retainer closely to insure it is secured within the groove around the plastic rod.



The exploded view of the SM612 was provided by Metro Automotive. A full page version can be found in the Technical Library on the ERA website where it can be downloaded in PDF format for printing.



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Saturday Night in Memphis



A famous American President once said that you can't please all of the people all of the time. But that won't stop the ERA from trying at 2016 Expo in Memphis, March 18-20.

Downtown venues offer a variety of choice in terms of food and entertainment but come with at the cost of high room rates and limited pay parking. Outskirt venues offer better room rates with free parking but are often isolated with few alternatives for meals and nothing to do after sundown. A poll proved that opinion was evenly divided between the options.

The Memphis show will offer both by providing a shuttle service between the hotel and downtown on Saturday evening at the very affordable price of $10 – a fraction of the cost of a one-way taxi ride. Transit buses will leave the hotel at 15 minute intervals to transport participants downtown with stops at Pro Bass World on the Mississippi River and the Historic Beale Street District.



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- Vendor sponsored reception that afternoon
- Technical Seminars
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- Technical Seminars
- Exhibition hall opens that afternoon

SUNDAY, MARCH 20:
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Scott's first job was repairing equipment at a John Deere dealership. He later moved to a larger dealer where he eventually became the general manager. But the long hours it demanded were hard on his family, so Scott moved to JIMCO in 2001, where he's had the opportunity to learn charging systems inside out.

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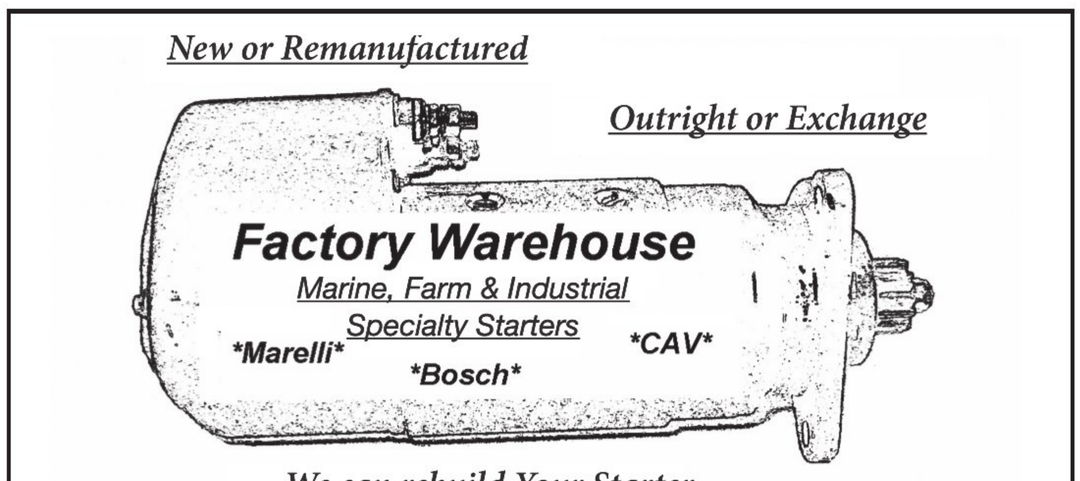

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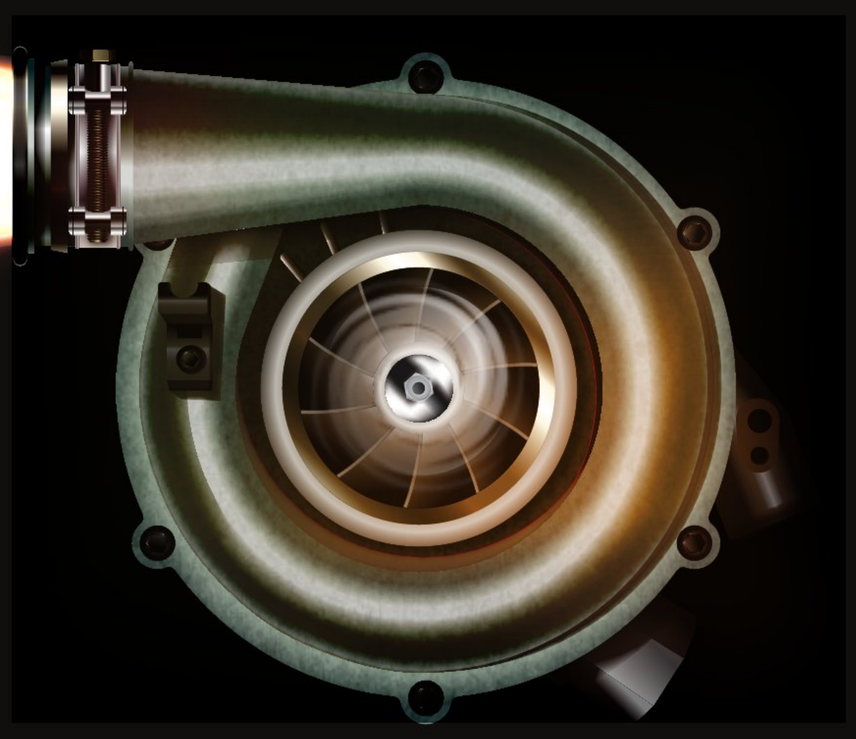

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