

Sturmey Archer Tips

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Once I retire from crank shortening, I should have time to make this a web page.

Sources of Information

Sturmey Links I get most of my information at

<https://hadland.wordpress.com/category/cycling/page/6/> Much interesting reading to be found here besides SA tech info.

This page <http://hadland.wordpress.com/2012/07/02/how-to-repair-old-sturmey-archer-hubs/> has manuals for almost every SA hub ever made. There are two sets of instructions for AWs and I suggest using the older set.

Download the ones for your models & under the heading "**From the 1956 Master catalogue**" download Fitting and Adjustment, Use and Maintenance, Fault Finding, General Dismantling, Individual Dismantling, Inspection and General Re-assembling. The info in these is handy for every model.

Detailed dimensions for every part of every(?) vintage SA hub can be found at <https://hadland.wordpress.com/2012/07/02/esoteric-info-for-sturmey-freaks/>

A couple of very useful pages from Sheldon Brown.

<http://sheldonbrown.com/english-3.html> <http://sheldonbrown.com/sturmey-archer.html>

SunRace/Sturmey Archer has their site <http://www.sturmey-archer.com/> click on the "History" button for some neat old stuff. And check out the wide variety of hubs made today. Unfortunately not many of them are available in the US.

Tools

I use a modified screwdriver and a hammer to remove the older ball cups with the square indentations. Later hubs have round indentations on the ball ring. I use the SA spanner for those. \$20 from Persons-Majestic (AKA Permaco) <http://www.permaco.com/> It's not on their website, you have to phone them.

Wooden clamps that hold a loose hub in a vice, for removing the ball cup when the hub isn't in a wheel.

Modified 16mm cone wrench, <http://bikesmithdesign.com/SA/cone-wrench-mod.jpg> 15mm box end wrench, vice, piece of 5/16" (1/4" will do) x 1.5" steel or aluminum bar, small and medium screwdrivers, needle nose pliers for holding "R" springs.

Parts Availability

Internal parts for new SRAM or Shimano hub gears are almost unobtainable in the US.

However the situation is completely different for older Sturmey Archer hubs. Virtually any part can be found for an AW, FW, S5, S5/1 or S5/2.

Between Ebay, parts for new hubs that fit old ones, collectors like myself with stashed of NOS (New Old Stock) and slightly used parts, a few suppliers who still have NOS parts, and parts salvageable from used bikes, (often found cheaply at garage sales). Though some, like 4 speed shifter rods won't be cheap.

In the USA try Aaron Goss' <http://www.rideyourbike.com/> Or [Harris Cyclery](#)

<http://www.oldbiketrader.co.uk/> have a lot of new and used parts. But with S&H from England, prices are high. For really obscure stuff, try Hilary Stone hilary.stone@blueyonder.co.uk

I have a small stock of parts. And what I don't have, I probably know someone who does.

Finding a Good Sturmey Hub

I have a drawer full of freshly overhauled AWs for sale.

Here in the US, old bikes with SA hubs are quite common. In most cases they are very low mileage, so the hubs show little wear. But they are usually gummed up with dried up lube, so an overhaul is a good idea. 4 and 5 speed hubs regularly show up on Ebay.

Check the drilling on a used hub, to make sure you can find a suitable rim. Older ones were 28h , 36h, or 40h. Raleighs and similar bikes, made before 1973 had 40h hubs in the rear and 32h in the front. Later ones were 36/36. 26" wheel Schwinn's almost always had 36/36 while small wheel bikes like Schwinn Sting Ray variants, Series 1 and 2 Moultons, 451 wheeled Raleigh "Twenties" usually had 28h.

40h are most common, at least here in the Twin Cities, where Raleigh was king. You can find good 40h rims in 700, (622 ETRTO) English bike 26" (590 ETRTO) or Mountain bike 26" (559 ETRTO), but not road bike 26" (571 ETRTO), 27", 20" or 16".

Used 28h 4 speeds and NOS 28h 5 speeds are common on Ebay.

You can swap guts between AWs, FWs and S5s made before April 1984, so keep an eye out for junked hubs with 36 hole shells. Alloy shelled hubs in 36 spokes were on some 1953 & 54 Schwinn's. Very good to find.

Avoid SWs, S3Bs and coaster brake models. The SW (Seldom Works) was introduced in 1954 as a cheaper, lighter replacement for the AW (Always Works). Big mistake, they re- introduced the AW in 1958. If you must have a coaster brake, your best bet is an AWC or a new, made in Taiwan, one. The older ones were pathetic though the S3Cs aren't as bad as TCWs.

Disassembly

Before starting, note the order of the spacers, nuts etc. on the axle ends. Also note the order of the cog and two spacers and whether the cog is dished inward or outward.

I just take a couple of digital photos, check the LCD when reassembling, and delete when I'm done.

Follow the general directions found in General Dismantling at <https://hadland.wordpress.com/2012/07/02/how-to-repair-old-sturmey-archer-hubs/>

Note the mention of double threads on the ball cup. Mark one of the notches and a nearby spoke or spoke hole before removing.

More detailed information for your specific hub can be found in the manuals at <https://hadland.wordpress.com/2012/07/02/how-to-repair-old-sturmey-archer-hubs/>

Be especially careful not to misplace the tiny "R" shaped pawl springs.

Cleaning

If a hub has had a few drops of oil added regularly, and has been ridden regularly, then cleanup should be easy.

Unfortunately most have been sitting since the '70s and the oil has turned to varnish. I soak the bits overnight in ZEP Citrus Cleaner and Degreaser, (Home Depot) and then use a stiff bristle brush on the parts. But it seems to take a lot longer than it should.

I just got some "Odorless Mineral Spirits". I'll try that next.

When I asked about this, on the Classic Rendezvous list, one fellow who also uses citrus cleaner said he leaves the bits in for a week. I don't recommend this, as long term immersion in citric acid can cause very hard steels to become brittle. The other suggestions were for highly volatile liquids, kerosene, gasoline, brake cleaner and carburetor cleaner. I'm sure they work quickly, but I work in my basement. I may look into some sort of agitator to speed things up with a safe solvent.

After brushing the softened gunk off, I put the parts in a screen type kitchen strainer and rinse them in very hot water, then dry them quickly with a paint stripper gun before they can start to rust.

I separate smaller parts from larger to prevent damage to the "R" springs and other small bits.

Reuse or Replace Parts?

I do carry new, NOS or slightly used replacements for just about anything for an AW, FW or S5, but I rarely have to replace anything.

Places to check for wear are;

Pawl tips - The upper surface can be polished from use, but as long as the tip isn't damaged, should be OK.

Pawl pins & Clutch keys - a little wear is no big deal if you don't have spares.

Pinion pins - The tip the clutch engages shouldn't be damaged, and a little wear on the barrel is OK.

Clutch - As long as the corners that engage the planet pinions are sharp, they are OK.

Pawl springs or "R" springs – I re-use them unless something is obviously wrong or I lose some of them. (Easy to do between my old eyes and messy shop.) Sometimes you will see some that are a little more closed up than the others. I'll open them up a bit. New ones are cheap insurance, if you have them.

Check bearing surfaces in the left & right ball cups and the driver for pitting but these are almost always OK. Same with cones

I usually have no problem re-using ball bearings if they still look shiny and even. However, I replace any that aren't. Balls are cheap and readily available but if your cups go bad it will get expensive. They are ordinary 1/4 inch balls, available at any bike shop. With a little care

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and needle nose pliers you can gently open every other tang on the ball cages to replace the balls. If this doesn't work, using loose balls is fine too but a little inconvenient. I think the cages are a holdover from the days when the bearings weren't greased.

Reassembly

The instructions in the manuals pretty much tells you what you need to know. **Sprocket & Circlip Installation.** Make sure you don't forget the dust cover.

Between the two 1/16" spacers and the dish in the cog, you have quite a bit of chainline adjustment available.

Make sure dustcap, cog and spacers are squeaky clean. Any dirt may keep the circlip from fully

seating.

Use both thumbs on the circlip and be sure to start at the split. Use a hammer, and the punch used for removing the ball cup, to seat the circlip. **Lubrication Old School** (Nothing but oil)

Grease is to be used ONLY IN THE CHANNELS OF THE DUST CAPS. In those channels "Plan A" is soap based automotive wheel bearing grease, the tan stuff or thick waterproof marine grease. "Plan B" is a poly-urea based grease such as Park PolyLube. The grease acts as a seal to keep the oil in so you don't want to use a petroleum based grease. When I used PhilWood grease in the channels, the oil dissolved it and ran out because Phil grease is petroleum based.

From Sturmey "A new hub must be oiled through the port on the hub shell. Thereafter lubricate once every 3 months with a few drops of Sturmey Archer (SAE 30). Do not use thick oil or grease."

Sturmey literature is quite vague and inconsistent regarding on the amount of oil to put in a rebuilt hub. One time I found something that said to use 2 teaspoons (7ml) in a fresh hub, so I tried that. Huge mess, drooled oil all over the rear wheel.

Light oil will migrate into every nook and cranny of the hub, but normal greases will not. I recently dismantled a hub that had been filled with a grease that was about 1/2 as thick as Park grease. It took forever to clean it out, yet I found that the low gear pawl pins were rusted into place.

I use 10W-30 but it's tempting to use Mobil 1 on bikes I ride in cold weather. Some people use Phil Tenacious oil which I think is too thick. I have seen it suggested that you avoid detergent motor oils in SA hubs, but I disagree. If you have cleaned it out properly, there is no reason not to.

I recently took apart a 47 year-old hub from a one-owner bike that obviously had very high mileage, and found no parts showing wear. The owner said she had just added a few drops of oil each spring.

Pros: Most efficient

Cons: Messy, you need to add oil to compensate for leakage and you depend on oil getting into the ball bearings.

Hybrid (Grease in channels and ball bearings – Only oil inside) 4

Tan Automotive grease or thick waterproof marine grease in channels. Park PolyLube for ball bearings. 10w-30 for all internal parts.

Those who feel that a piece of machinery isn't properly British if it isn't leaking oil should read no further.

Modern Times (grease, **grease** and more **GREASE**)

Later hubs, without an oiler port, use a new type of Semi-Fluid grease (And not nearly as much of it as I expected) which does get drawn into tight spaces by capillary action. **This grease can be used in older hubs too.**

One problem was finding the right stuff here in the USA as SA manuals just give an SA part #. Eventually I was able to match the part # to the NLGI grease grade "00", a Semi-Fluid grease. I did a search and found that this type of grease is also used in some commercial lawn mower gearboxes. I found a 9 ounce tube of "ALCO Super Lube "00"Grease" with enough grease to do 5-6 hubs for about \$9 at <http://www.cedarsmallengine.com/> at 38th and Cedar in So Mpls. When I asked for it, the counterperson said "You must own a Snapper."

There are synthetic Grade 00 greases but I was only able to find them by the bucket or barrel.

You just smear a thick coat on all the parts as you assemble the hub. (Thick being relative as this thin

stuff isn't sticky.) I use a 10 cent acid brush. A bit messy but once it's assembled your wheels will stay clean.

This semi-fluid grease is only used on the internal parts. For the ball bearings in the ball ring and the cones I recommend Park PolyLube. And the tan automotive wheel bearing grease or thick waterproof marine grease in the groves of the labyrinth "seals".

Pros: The greases don't leak out and don't need to be added to. I think this is ideal for bikes that aren't ridden regularly.

Cons: Messy to work on (but much less messy the rest of the time). Theoretically less efficient, especially in winter. However at 32F (0C) my greased S3X doesn't exhibit noticeable drag.

Interchangeability

Most of the parts that usually need replacing are common to, or interchangeable between, different models of hubs, built 60 years apart. You can interchange guts between AWs FWs and S5s made before April 1984.

Modification

An FW four speed depends on a hard to find and very delicate shift rod setup. And the cable tension is so high in the lowest gear that triggers with a little wear at the low gear detent can slip out of gear. The 4 speed rods and triggers bring big bucks on ebay.

If you find an FW hub without the rods, you may be able to get it cheaper than the rods typically bring. FWs can be easily converted to 5 speeds using mostly readily available parts. The one critical part that isn't easy to find, the primary sun gear, is one I can supply. (More about this on the last page, below)

Rebuilding wheels

Remember to use spoke washers, if you use modern spokes. They have larger radius bends for modern, thicker hub flanges.

For DT spokes I use 2 washers under the heads of inside spokes (head on the outside) and one for outside spokes. For WheelSmith I use 3 and 2.

Sun CR-18s are the only alloy rim in the 3 speed size, 26 x 1-3/8" (590 etrto) available in the US, 32, 36 and 40. Raised center "Westrick" steel rims have the same ERD, so you can reuse the spokes if they are in good shape. With flat center "Eastrick" rims you are out of luck.

Gearing

Three speeds typically came with 18t cogs and 46t chainrings. This is too high for 95% of the population. I carry cogs up to 26t to fit the typical 3 notch drivers at <http://bikesmithdesign.com/cogs/index.html>

When gearing down, you will probably have to add chain. It is often difficult to find extra links to fit your old chain, because widths and pin diameters are all over the map. It's usually best to replace the whole chain. Fortunately, SRAM and KMC make inexpensive 1/8" single speed chain. You may also have to raise your chain guard.

Cables

The Sturmey Archer trigger shifter requires a unique cable and stop. Pyramid, J&B Importers' house brand, has 3rd party cables. These are not high quality, but generally SA's aren't fussy unless the clutch spring is weak, or you have an FW.

I make my own, high grade cables by attaching 3/8" long sections of 3/23" diameter brass tubing to stainless "slick" shifter cable. Either with silver bearing solder using a soldering iron, or silver brazing filler using a propane torch. Don't forget the flux.

Unless it's for a bike I want to keep original looking, I use modern, lined, index shift cable housing. Probably overkill.

False neutrals.

There are three types of false neutrals, missed shifts and popping out of high gear under high load.

Missed shifts

If the indicator is adjusted correctly, and you are still getting a false neutral when shifting from 2nd to 3rd, it's because the spring is not pushing the clutch far enough to engage the protruding ends of the planet pins.

Most likely something is creating too much drag for the spring to overcome. Sticky cable Sticky trigger Varnish (dried out old oil) build-up

Burrs or nicks on axle key slot or driver splines – kinked chain. **Less likely**; Weak clutch spring

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Aftermarket indicators can have significant variations in length so check yours against a few others. Or, you can check the length against the dimensions shown on the last two pages of <https://hadland.files.wordpress.com/2012/07/2tables.pdf>

Don't try to stomp up hills in high gear. When in high the clutch is at the tips of the prongs of the driver, far away from the bearings that are the driver's only support.

Pedals turn when you push the bike

Your pedals should not turn when you push your bike. The most common reason is cones out of adjustment.

After removing the right hand cone locking washer, (it's the one with little tabs that fit over the cone flats) screw the cone in all the way by hand, then back it off at least 1/4 turn but no more than 1/2 turn. Then adjust the left side cone so there is an almost imperceptible amount of play.

BTW this would be a good time to freshen up the grease in the channels that act as a labyrinth seal.

If the problem still persists your hub is likely gummed up with dried up oil. Best to tear it down and clean of all the "varnish".

To remove a cog from a threaded driver;

1. Remove the right cone and lift out the driver with the cog attached.
2. Place a piece of 5/16" or 1/4" bar stock or plate in a vice
3. Slip the driver splines onto the bar.

<http://bikesmithdesign.com/SA/driver-bar.jpg>

4. Remove the cog with a chain whip.
5. After re-installing the driver, cone, RH cone locking washer and locknut, always adjust bearing play with the left cone.

Gearing down

I carry an assortment of large cogs for SA and other hubs.

<http://bikesmithdesign.com/cogs/index.html>

With the 24 or 26t cogs you may need to raise the rear end of the chainguard. If the rear mount is a little clip attached to the seatstay, you can just slide it up. However on rare occasions it is necessary to trim some length off of the end of the guard and drill a new hole for the bolt.

Input Ratios

My thinking is that if you need to gear lower than the recommended 2:1 then you aren't pushing the pedals as hard as someone who doesn't need to gear that low. Sheldon Brown even went below 1:1 on one of his bikes. My wife's SA 5 speed bikes are geared 34/24 and 40/26 and she's not small. The hub is weakest when in high gear as the clutch is at the very tips of the slots in the driver. So it's always best to downshift for hills.

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Converting an FW 4 speed to an S5 Five Speed

Why? It's fairly easy to find an FW without it's delicate 2 piece indicator rods. Indicator rods, when they are on Ebay, bring steep prices. The high cable tensions in bottom gear are tough on 4 speed triggers and the triggers themselves are not cheap or all that common. S5 is IMHO a simpler, more robust unit, And the added high gear allows you to run a larger rear cog and still have a gear suitable for those rare tailwinds.

What Do You Need?

AW or FW trigger, AW axle key and indicator. Left side shifter, cable, and cable stops or guides as needed. To be authentic, you would use a 2nd pulley and a fulcrum clip. It's best to use a friction shifter for the left, whether thumb, stem, downtube or bar-end.

Bellcrank;

If you are using a friction shifter for the left side, you can use a common Shimano bellcrank that has been bored out and retapped to 13/32" x 26 TPI. I am equipped to do this. If you will be using Sturmey Archer shifters on both sides, you will need a Genuine Sturmey Bellcrank to get the correct leverage ratios.



I have the modified Shimanos for \$18. And a few NOS Sturmeys for \$59.



There are two versions of the machined Sturmev Archer bellcrank. The upper one looks more elegant, and has a sight hole that appears to serve no purpose except to let dirt in.

The S5s had a shifting problem. If the ends of the dogs on the axle and the sliding sun gear were lined up when you shifted, the cable stopped moving, the shift didn't happen and you ended up in a false "Neutral". With a spring between the cable and the bellcrank, the shifter and cable keep moving and the spring stretches. When the ends of the dogs are no longer lined up, the spring completes the shift. It happens so quickly you don't notice. The spring is still stretched a bit after the shift is completed, keeping the sun gear fully engaged. I doubt this would work with a Sturmev shifter, but might with a stiffer spring.



I can supply the Shimano bellcranks with the spring and a new SA adjuster rod, stolen from a new indicator, for \$29. Or \$64 for the Sturmev bellcrank w/spring.

Pushrod:

Sturmev made many versions of the S5 pushrod. The 1st version, which only works with the early sheet metal bellcranks, screwed into the low gear axle key. The idea was that when you removed the bellcrank to change tires, you wouldn't lose the pushrod. Problem was if the wheel fell over on the left

side, the pushrod would break the low gear axle key. The next version works with the machined bellcranks and has a larger head with a slot for the bellcrank actuating arm. The only purpose for the slot appears to have been to make installation more difficult. I recently scored a complete NOS S5 kit, from the last year of production, on Ebay. The pushrod is just a very nicely machined nail. Turns out the best design was the cheapest to make.

But I always prefer a modified nail because you can fine tune the length.



Now the rare bits; (Of which I have a few) HSA 269 - S5 Primary Sun Pinion \$12.00

<http://bikesmithdesign.com/SA/S5andFWsuns.jpg> The FW sun is on the axle. As one side of the dogs are ramped, it will only transmit power in one direction.

I have the 4/5 speed low gear pawl pins, which are rivets \$2 each. If you are careful you can remove and reinstall them once. But if the pawl & spring look OK & move freely, leave them alone.

HMW 149 - Lockwasher for Dog-Ring \$2. **I was out, but just tracked down some more.** This washer is keyed to the axle and you fold it over the dog ring locknut HSN 133. You can usually reuse the original lockwasher once. However, I'm not sure they are needed, and might even make things more likely to get loose. So I don't use them anymore. Blue Locktite couldn't hurt.

Don't mix up the dog ring locknut HSN 133 and the similar looking cone locknut HSN 132

Longer axles. If you intend to use your newly converted FW>S5 in a bike with forged dropouts, make sure you have the 6-1/4" axle. Sturmey axles only have threads on about 60% of their circumference. Thick forged dropouts allow 4-5 less threads of axle/nut engagement than the typical thin plate British dropouts of that era. So the last 5 threads on the axle are often stripped when 5-3/4" axles are used. I have NOS 5-3/4" axles for \$19 each and NOS 6-1/4" axles for \$35 each.

I also have 13/32" I. D. hardened Grade 8 washers for \$1 each. Because they are so hard, they can be

only $7/128$ " (0.059") thick. When used between the nuts and dropouts they may gain you another thread or so of engagement compared to thicker ones.