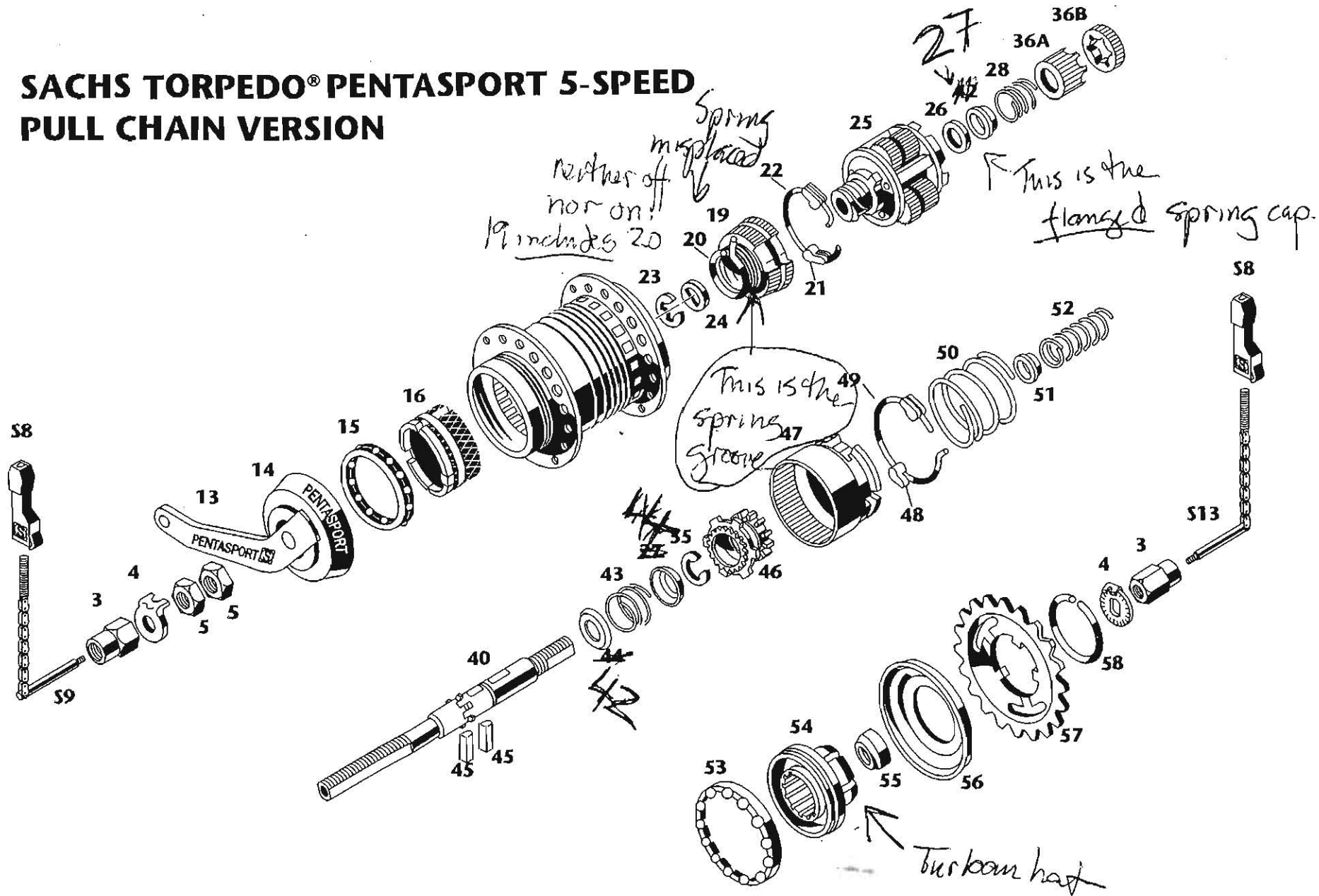


SACHS TORPEDO® PENTASPORT 5-SPEED PULL CHAIN VERSION



DISASSEMBLY AND ASSEMBLY INSTRUCTIONS FOR SACHS PENTASPORT 5-SPEED HUB

How it works

Operation of the right side of the hub is similar to that of Sachs three-speeds:

In the lower gears, the sliding clutch connects the driver with the gear ring, but pulls the gear ring to the right so its pawls are disengaged from their ratchet inside the hub shell. Drive is through the planetary gear system to the pawls on the brake cone assembly at the left side of the hub.

In 3rd (middle) gear, the sliding clutch still connects the driver to the gear ring, but the gear ring is released to the left so it drives its pawls directly, while the brake cone pawls freewheel backward slowly.

In the higher gears, the sliding clutch connects the driver to the planet carrier, and drive is through the planetary gear system to the gear ring; the brake cone pawls freewheel backward.

Drive to the coaster brake is through the gear train: there is no special set of rear-facing pawls as with the Sturmey-Archer S3C hub. Brake effectiveness therefore is the same in the three highest gears (1/1 drive to planet carrier), better in 3rd and 2nd (1.29/1) and better yet in 1st (1.5/1). Brake drive is, however, positive, as the gear ring is spring-loaded in both directions: the clutch engages the gear ring and planet cage at the same time during the only shift with a possible "neutral" position, between 3rd and 4th. If the planetary gear train fails, brake drive will, however, be lost in 1st through 3rd gears.

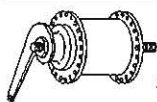
Alignment

This hub has an overlocknut spacing of 122mm which can be padded to 126mm or 130mm with spacer washers. It will therefore fit most modern frames.

Two versions of the hub shell have been available. Spoking diameter is 75mm for the newer version with pressed-on spoking flanges. The earlier one-piece shell version has 68mm spoking diameter. The hub is available only with 36 spoke holes, according to Sachs literature.

As with most 5-speed hubs, using the middle gear as the "normal" gear places the low gears too high for good hill-climbing and the top gear too high to be useful at all. It is best to use the 4th gear (1.29 step-up with this hub) as the normal level-ground gear of about 72 inches. A 22 tooth sprocket and 46-tooth chainwheel, for example, will provide this gearing with a 27-inch rear wheel. This will provide a gear range of 38 to 85 inches (3.00 to 6.76 meters' development) when used with a 46 tooth chainwheel and 27-inch rear wheel. Sachs sells a 24-tooth sprocket which is useful for hilly country or retrofitting a bicycle which has a large chainwheel. Other, smaller Sachs, Sturmey, Shimano etc. sprockets will fit and are useful when installing this hub in a small wheel. Generally, the direct drive, middle gear should be about 56 inches (4.10 meters).

The provided 20-tooth sprocket, like the 24-tooth sprocket supplied with the Sachs 7-speed hub, is usable with 3/32" derailleur-type chain or with 1/8" chain, though it is stamped around the mounting hole to make it take up the same space on the driver as a thicker sprocket made only for 1/8" chain.



INTERNAL MULTI-SPEED HUBS

SACHS PENTASPORT 5 SPEED (CONT'D)

Shift Levers and Cables

Improper adjustment is the most common cause of problems with 3-, 4-, 5- and 7-speed hubs. Many people have quit riding bikes because their hub slipped out of gear when they were standing up on the pedals. Always check trigger and cable operation before deciding to overhaul a hub.

To have a cable that is in proper adjustment and will stay that way, all fittings must be tight enough not to creep along the frame, the cable must be free of kinks and knots, the pulley must operate smoothly and the bell crank or indicator chain must not be twisted. (Always back off a thread-on bell crank or an indicator chain at least 1/8 of a turn from finger tight).

Pullchain Shifting

(see parts list, page 16 -10)

Several types of shift levers are listed in the literature:

1. A single-lever handlebar shifter, available in three colors;
2. A single-lever stem shifter, available in two colors;
3. A "Pentacross" pair of stem shifters, right hand 3-position, left hand 2-position;
4. An ATB pair of handlebar shifters, right hand 3-position, left hand 2-position.

Clickbox Shifting

The Sachs parts list (180.6) for the clickbox 5-speed shows two types of shift levers, for the front and rear of the handlebar. The clickbox version uses a push-pull shifter cable, like the old Shimano Positron cables (See Sutherland's Handbook of Coaster Brakes and Internally Geared Hubs).

The clickbox assembly is integral with its cable; cable lengths in the parts list are about 51 inches and about 55 through 67 inches in increments of 50mm. The cable and its housing can not be shortened or otherwise altered, hence the multiple assemblies with different stock numbers. Measure the old cable before ordering a new one.

The cable's motion is translated into motion of two concentric pushrods by a cam assembly in the clickbox, which attaches to the right end of the hub axle.

TESTING SHIFTER OPERATION

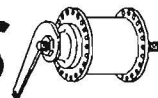
Pullchain Version

Operation and adjustment of the right-side pullchain are the same as for Sachs three-speed hubs. The pullchain is in its slackest position in 4th and 5th gears; in its middle position in 3rd gear; and in its tightest position in 1st and 2nd gears.

The left-side pullchain is tight in 1st and 5th gears and slack in the others. Adjust it so it is taut in 1st and 5th gears.

SUTHERLAND'S

INTERNAL MULTI-SPEED HUBS



SACHS PENTASPORT 5-SPEED (CONT'D)

Clickbox Version

Check shift lever/cable/clickbox assembly for straightness of cable, cracks to housings and other obvious problems.

The inner pushrod works like the left pullchain, selecting which sun gear is in use, and the outer pushrod works like the right pullchain, selecting the direction in which power passes through the gear train. Pushrod (and clickbox paddle) positions are (o = out, m = middle, i = in):

Gear	1	2	3	4	5
outer	o	o	m	i	i
inner	i	o	o	o	i

To inspect the clickbox for correct operation: with the clickbox disconnected from the hub, shift to 3rd gear and then to 2nd. Now push both paddles inside the axle hole of the clickbox as far away from you as possible. They should move smoothly and easily. Now shift up to fourth gear; the outer paddle should move toward you in two distinct steps. As you continue to fifth gear, the inner paddle lever should move toward you in one distinct step.

Now shift to 2nd gear and push both paddles down. As you shift down to 1st, the ~~control~~ ^{inner} paddle should move toward you in one distinct step. Note: you may test the clickbox and the shifter parts of the hub at the same time by installing the axle and pushrods into the clickbox after installing both axle keys and the clutch but before installing the gear ring.

WHEEL REMOVAL AND DISASSEMBLY OF SHIFTER AND SPROCKET PARTS

Pullchain Version

Disconnect shift cables and unscrew pullchains.

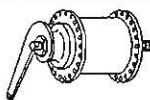
Clickbox Version

Loosen the knurled bolt on the clickbox, and pull the clickbox off the end of the axle. Remove inner and outer pushrods. **Remove these parts before removing the wheel to avoid possible damage.**

Remove wheel as usual after loosening axle nuts and removing brake arm clip bolt.

Remove axle nuts, tab washers and clickbox guard of clickbox version if hub will be rebuilt.

Note the direction of sprocket dish. Remove snap ring, sprocket and large dust cap from driver if necessary to replace.



INTERNAL MULTI-SPEED HUBS

SACHS PENTASPORT 5-SPEED (CONT'D) REINSTALLATION OF SPROCKET AND WHEEL

To avoid possible damage, do not install pushrods or clickbox of clickbox version before installing wheel into forkends.

Check for correct direction of sprocket dishing, then replace large dustcap, sprocket and snap ring.

Place wheel in fork-ends: for a new installation, place one tab washer on outside of each fork-end, with tabs in ~~close~~ end of fork-end slot, unless fork-end thickness is over 5.5 mm (7/32"); then place one tab washer inside and one outside left fork-end. Install but do not yet tighten the brake arm clip on the left chainstay. Install clickbox guard (clickbox version only) on the right end of the axle, and then install the axle nuts. Adjust drive chain slack, making sure that brake arm does not bind. Tighten the brake arm clip bolt.

Pullchain Version

Screw pullchains into the axle. Connect them to the shift cables. Place the shift lever into 4th gear position. Adjust for no slack, but without pulling pullchains out. Then shift to 1st gear. It should not be possible to pull pullchains further out of the hub.

Clickbox Version

Oil pushrods lightly and install them into axle.

Place shift lever in 2nd gear position. Push clickbox onto the axle. Tighten knurled knob. No cable adjustment is necessary.

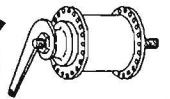
Justify?

REPAIR OF SHIFT LEVER-CABLE-CLICKBOX

Shift levers may be replaced and interchanged by removing the Phillips-head screw which holds the lever body together. The cable has a barrel head and may be slipped in and out of its mounting slot.

The clickbox end of the cable has a plastic rack gear molded onto it; adjustment of cable length is therefore not possible. However, it is possible with care to replace a cable or clickbox without replacing the other. After removing the several small screws which hold the clickbox together, the cable and rack gear may be lifted out. When reassembling, take care that the cams and cam followers are correctly installed. You must time the clickbox gears: with the shift lever in 3rd gear position, the upper cam follower is on the middle land of its cam, and the lower one is in the deepest indentation in the middle of its cam.

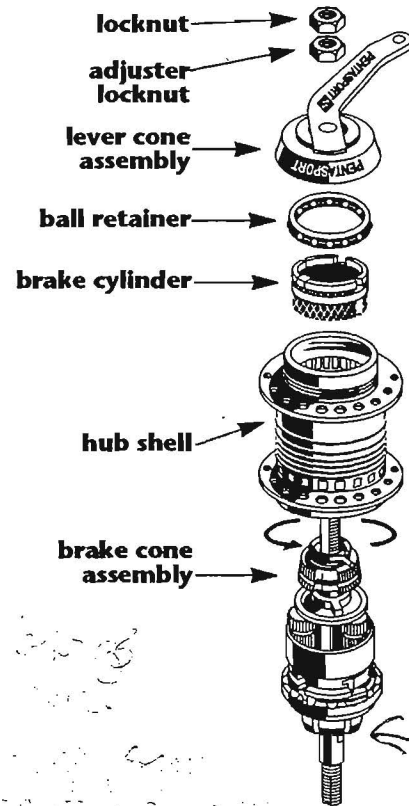
INTERNAL MULTI-SPEED HUBS



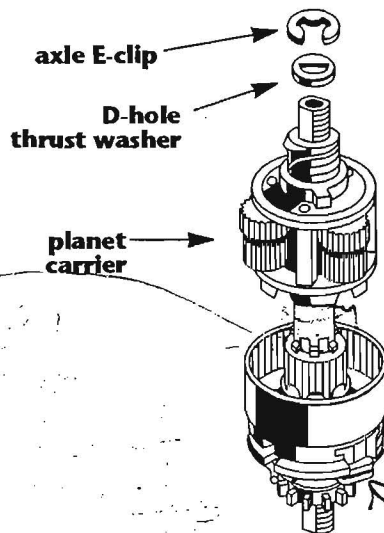
DISASSEMBLY AND ASSEMBLY INSTRUCTIONS FOR SACHS PENTASPORT 5-SPEED PULLCHAIN HUB

1 DISASSEMBLY

Clamp axle in axle vise, sprocket end down. Unscrew the two locknuts (5) from each other using a 17mm cone wrench and a 17mm open end or box-end wrench; remove the locknuts. Remove lever cone assembly (13), ball retainer (15) and brake cylinder (16). Lift off hub shell. Rotate brake cone assembly (19) counterclockwise and remove.



This diag. goes w/ disassembly 2 → reformat with text to its left and above



Pinions misplaced

2 DISASSEMBLY

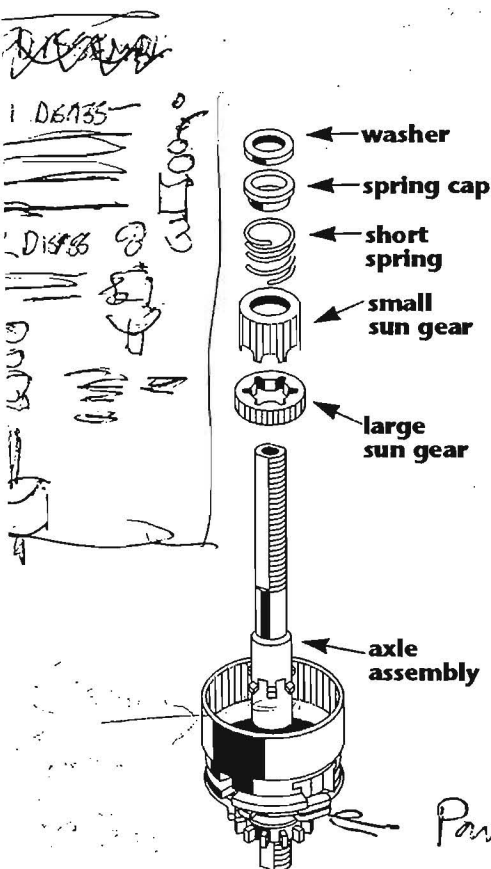
Remove axle E-clip (23) and D-hole thrust washer (24). Lift off planet carrier (25). Remove the round-hole thrust washer (26) from inside the planet carrier or from the axle. The planet carrier is a unit. Do not attempt to remove the planet pinions.

Pullchain Version

Remove short spring (28) with its spring cap and the small sun gear (36a). If the hub is equipped with a large sun gear (36b) with notches all the way through and separate spring cap (42), lift off the sun gear. A one-piece sun gear cannot be removed at this time.

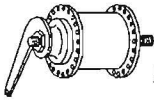
Clickbox Version

You will remove the sun gears later.



Pinions misplaced

SUTHERLAND'S



INTERNAL MULTI-SPEED HUBS

SACHS PENTASPORT 5-SPEED PULLCHAIN HUB (CONT'D)

3 DISASSEMBLY

Invert assembly — sprocket end up. Using a 17mm open-end wrench, unscrew the fixed cone (55). Remove the driver assembly (54), long spring (52) with spring cap (51) **[Note: spring cap may be wedged into long spring]**, large spring (50), ball retainer (53), gear ring (47) and splined clutch (46).

Pullchain Version

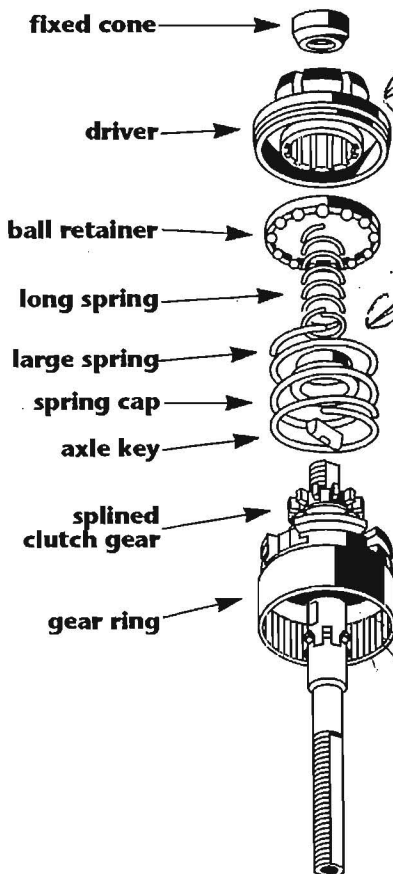
Remove axle key (45)

Clickbox Version

Compress short spring (43).

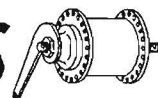
Remove axle key (45).

Remove short spring with its two spring caps.



SUTHERLAND'S

INTERNAL MULTI-SPEED HUBS



SACHS PENTASPORT 5-SPEED (CONT'D) SUBDISASSEMBLIES

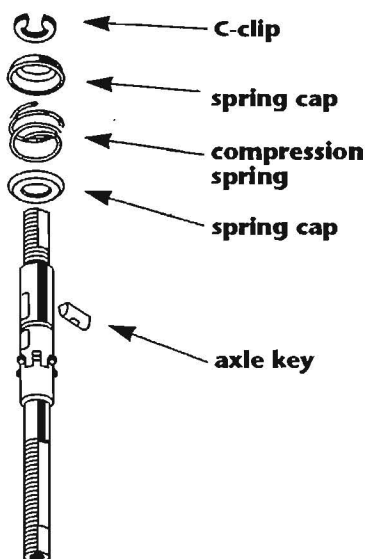
Axle

With axle still clamped sprocket end up, remove C-clip (35), spring cap (44) and compression spring (43).

Pullchain Version

Remove axle key (32b).
Remove spring cap (44), ⁴² if present. Remove the large sun gear (36b), if you have not removed it already.

Pullchain



Clickbox Version

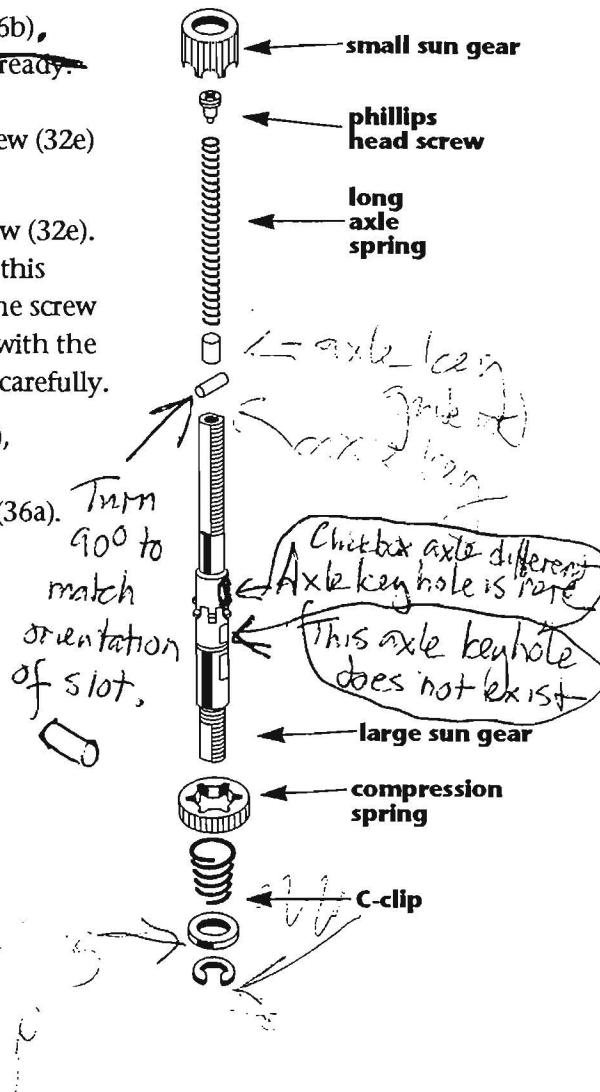
Remove the large sun gear (36b), if you have not removed it already.

Invert assembly — Phillips screw (32e) end of axle up.

Remove the Phillips head screw (32e). To prevent the spring behind this screw from flying out, grasp the screw with one hand as you turn it with the other, then release the spring carefully.

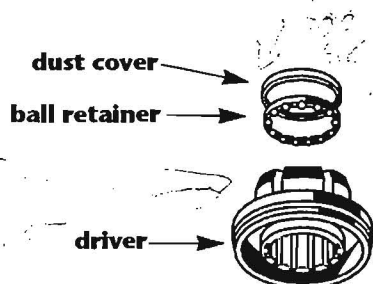
Remove long axle spring (32d), axle key guide rod (32c), axle key (32b), and small sun gear (36a).

Clickbox



INTERNAL MULTI-SPEED HUBS

SACHS PENTASPORT 5-SPEED (CONT'D) SUBDISASSEMBLIES (cont'd)



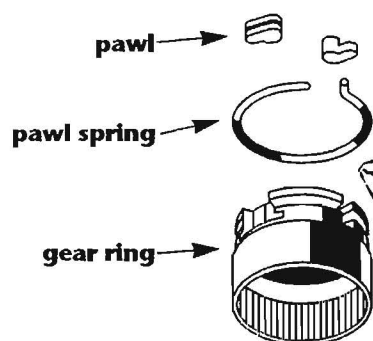
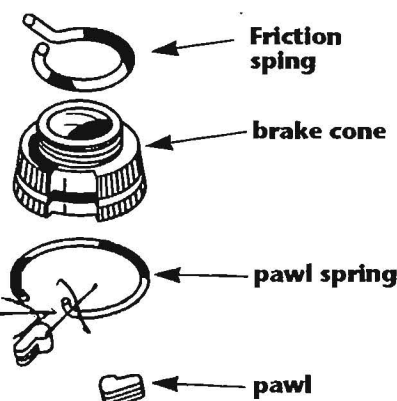
Driver

Remove dustcap with a thin-bladed screwdriver. Work slowly around dustcap to avoid deforming it. Lift out ball retainer.

Note: parts list shows driver as an assembly with the internal ball retainer and dustcap. The same ball retainer (Star 0103 251) is found also in the 7-speed hubs, different from that used in Sachs 3-speed hubs.

Brake Cone

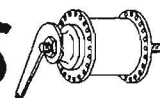
To remove pawls (21), pull outward until end of pawl spring (22) clears groove, then ease pawl spring off the end of brake cone. Remove friction spring (20) from brake cone only if it is to be replaced.



Gear Ring

To remove pawls (48), pry straight end of pawl spring (49) out of groove and ease over end of gear ring (47).

Perspective reversed



SACHS PENTASPORT 5-SPEED (CONT'D)

Cleaning

Clean all parts, including outside of hub shell, in a suitable solvent. Be very careful not to introduce dirt or grit after cleaning.

Clean the planet cage with a brush, not by immersion.

Points to Check

Numbers in parentheses refer to parts chart and exploded drawing.

1. Pawls (21,48) and ratchets of hub shell for rounding and chipping.
2. Gear ring (47), planet gears of planet carrier (25) and sun gears (36a,b) for worn and chipped gear teeth.
3. Planet carrier (25), gear ring (47), clutch (46), inside of driver (54) sun gears (36a,b), brake shell (16) and lever cone (13) for worn or rounded splines or dogs.
4. Bearing surfaces of lever cone (13), hub shell, driver (54), fixed cone (55), ball retainers (15,53), and inside driver (54) for wear or pitting.
5. Brake shell (16) and braking surface inside hub shell for wear and glazing.
6. Brake cone (19) for worn serrations.
7. Friction spring (20), compression springs (52), internal axle spring of clickbox version and pawl springs [circlips] (32d,22,49) for size and tension (manufacturer recommends replacing pawl springs at overhaul).
8. Axle (32), and pull chains (S5,S9), or pushrods of clickbox version for straightness.
9. Dust caps of lever cone and driver (13,54), sprocket dustcap (56), spring caps (27,42,44,51), circlips (23,35) and ball retainers (15,53) for straightness.
10. All threaded parts for worn or damaged threads.
11. Axle keys (32b,45) and axle slots (32) for rounding or chipping.

Lubrication

To lubricate the planet gear bearings, stand the planet carrier on its wide end and apply 2 to 3 drops of oil at the trunnion pins where visible under retaining ring, turning the gears to aid the oil in penetrating.

Lubricate ball cages by filling the spaces between balls with grease. Be careful not to grease pawls or clutch. Lubricate hub shell, brake shoe and friction spring liberally with a high-temperature grease for steel brake shoes. Oil, never grease, brake cone and gear ring with a good cycle oil. (WD-40 is too light for lasting lubrication, 3-in-1 oil gums up with age.)

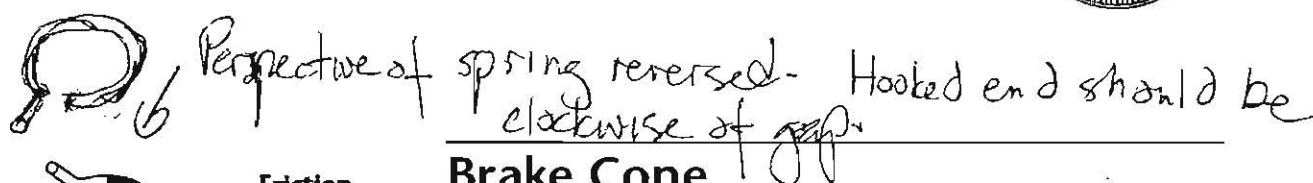
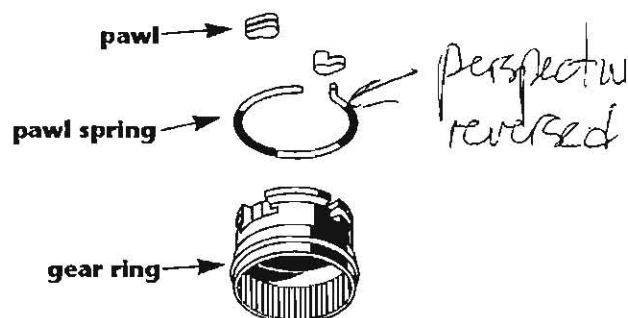
INTERNAL MULTI-SPEED HUBS

SACHS PENTASPORT 5-SPEED (CONT'D)

SUBASSEMBLIES

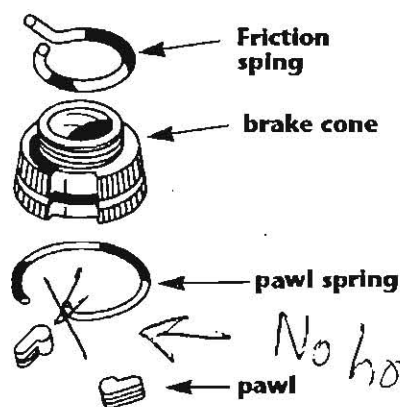
Gear Ring

Install pawls (48) under hooked; circular pawl spring (49). Pawls must point clockwise when viewed from small end of gear ring. Hooked end of pawl spring should lie in the slot that intersects pawl spring groove.



Brake Cone

Install friction spring (20) with hooked end clockwise from gap. Incorrect installation will cause excess drag, wear and possible brake failure.



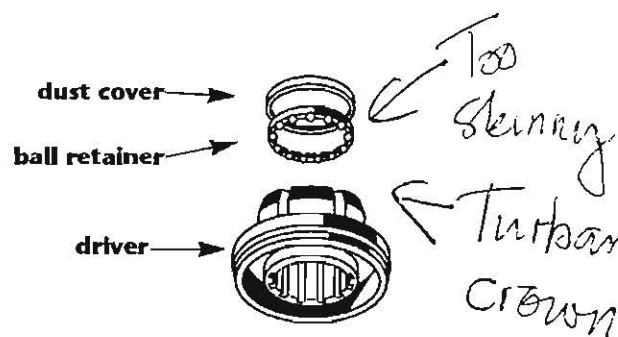
Install pawls (21) under circular pawl spring without hooked end (22). Pawls must point counterclockwise when viewed from friction spring end of brake cone. Ends of pawl spring should lie adjacent to tabs that block pawl spring groove.

← NOTE!

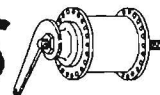
Driver

If starting with a replacement driver assembly, skip to the next section: the steps in this section have already been done for you.

Ball retainer is not available as a separate part from Sachs. If necessary, replace driver assembly. The ball retainer is a Star 0103 251, or you might replace the bearing balls in the old retainer. Install ball retainer flat side up. Start dustcap straight, flat side up, and tap home with a soft hammer.

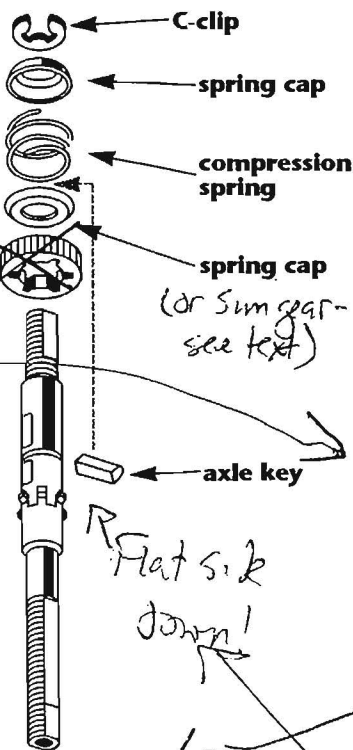


INTERNAL MULTI-SPEED HUBS



SACHS PENTASPORT 5-SPEED (CONT'D) SUBASSEMBLIES (cont'd)

Pullchain



Axle

Pullchain Version

Axle subassembly must be built up from separate parts.

Clickbox Version

If starting with a replacement axle assembly, skip this entire axle subassembly section; the steps in this section have already been done for you.

Both Versions

Clamp the axle in an axle vise with the long slot on top.

If using one-piece ^{large} sun gear with round opening (36a), install it with the internal notches down and the round opening up. If using sun gear with notches all the way through (36b), do not install it now.

Pullchain Version

If you did not install the sun gear, (36b) install the spring cap (44), concave side upward. Fit the axle key (45) into the lower axle slot, flat side down.

Clickbox Version

Install tapered compression spring, small end up, and the spring cap (44), concave side down. Replace C-clip (35).

Install the compression spring of thinnest wire (43) and the cupped spring cap (44), concave sidedown. Replace C-clip (35).

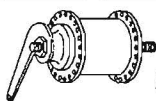
Clamp the axle in a vise with the long slot down. Install large sun gear (36b) if not already installed; small sun gear, (36a) notches down; the cylindrical axle key; the axle key guide rod; and the long, thin compression spring. Compress the spring and install the Phillips-head screw into the end of the axle.

Note that spring cap #42 is in parts list only for pullchain version.

There is a drawing of this in disassembly. It belongs here too.

SUTHERLAND'S

The numbers 42 and 44 were interchanged



INTERNAL MULTI-SPEED HUBS

SACHS PENTASPORT 5-SPEED (CONT'D)

1 ASSEMBLY

Pullchain Version

Install axle key (45) into the longer axle slot, flat side up.

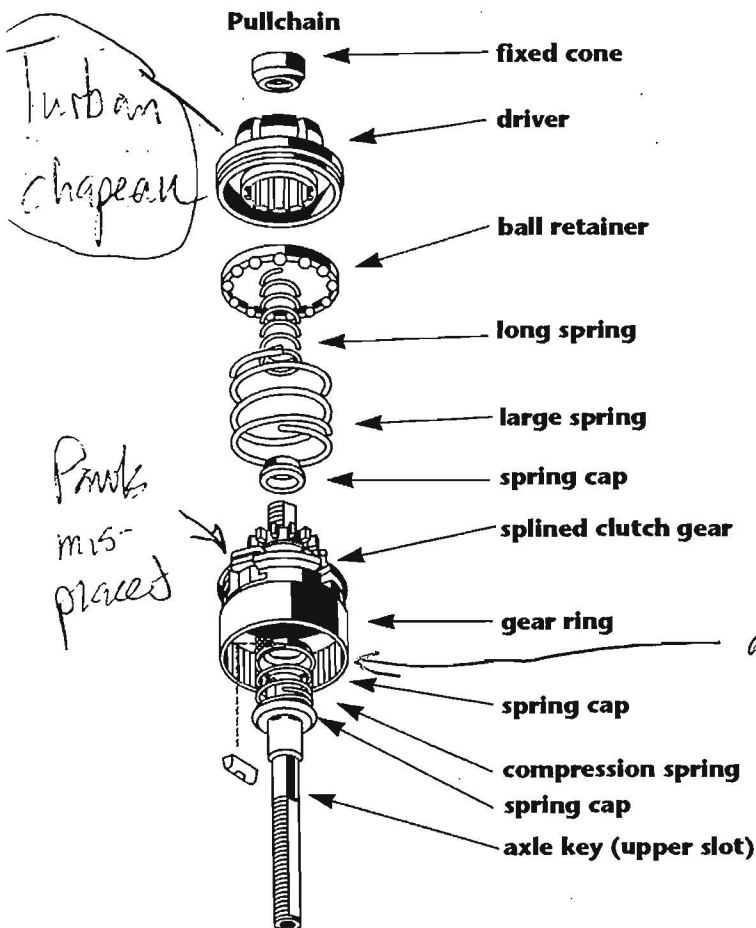
Clickbox Version

Install shorter compression spring between two spring caps, or sun gear and cap, (concave sides toward spring) then compress spring and install axle key with shoulders resting on face of upper spring cap.

Install splined clutch (46), larger end down. Install gear ring (47), with pawls and pawl spring. Install largest ball retainer (53), flat side up.

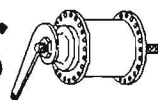
Install spring cap (51), flat side down. Install the large spring (50). Install long spring (52).

Install driver assembly (54). Press driver down against spring force and screw down fixed cone (55), flat side up; tighten to 14.5 ft. lbs.

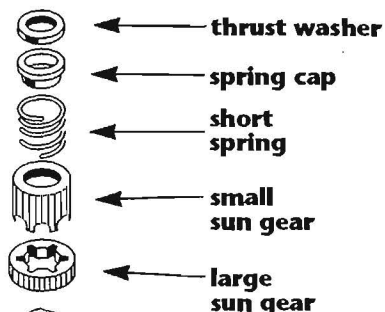


SUTHERLAND'S

INTERNAL MULTI-SPEED HUBS



SACHS PENTASPORT 5-SPEED (CONT'D)



← thrust washer
← spring cap
← short spring
← small sun gear
← large sun gear

2 ASSEMBLY

Invert assembly – Place axle in a vise by its flats, long-slot end up.

Pullchain Version

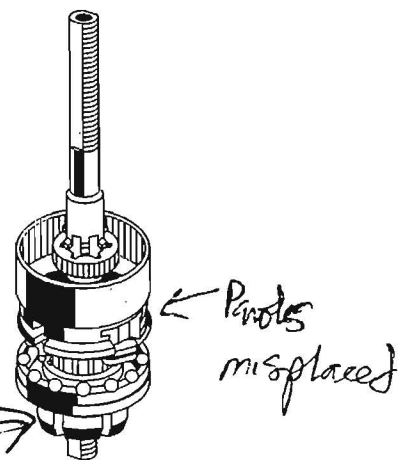
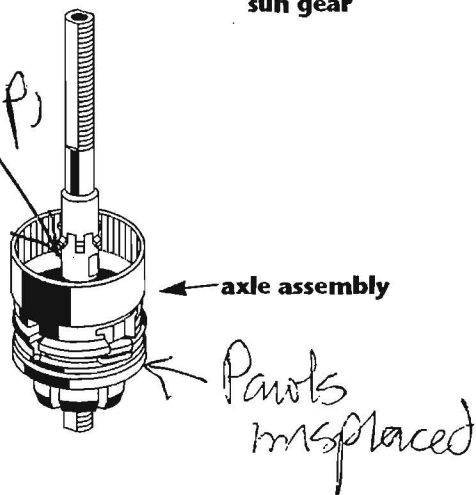
If using a large sun gear with notches all the way through (36b), you have not installed it yet. Install it now, push it past the axle dogs and twist it to lock it into place.

Install small sun gear (36a), tabs downward. Install shortest spring (28) and spring cap (42).

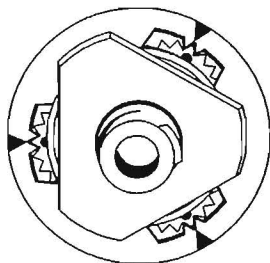
Install thrust washer (26).

Clickbox Version

Sun gears have already been installed. Skip these steps.



Red Timing Aid

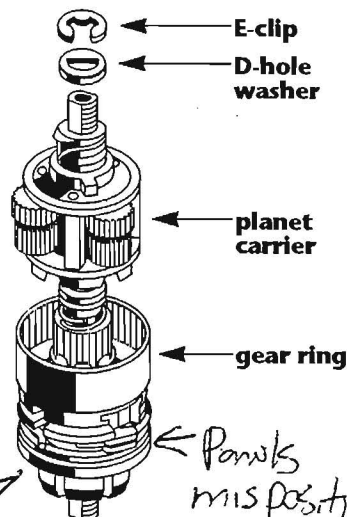


Align planet gears with timing marks facing precisely outwards and install planet carrier (25). Sachs parts list mentions a red timing aid (62) which aligns the gears during installation; correct assembly is, however, possible without using this. Carrier must engage fully over sun gears and turn smoothly. Recheck timing marks after installation.

Caution: if planet gears are incorrectly timed, hub will sustain damage in use.

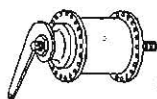
Work planet carrier down until E-clip notch on axle is exposed.

Install D-hole washer (24) and then install E-clip washer (23). Planet carrier should turn freely, with very slight lengthwise play on axle.



SUTHERLAND'S

Brand new
leopardskin pillbox
turban hat



INTERNAL MULTI-SPEED HUBS

SACHS PENTASPORT 5-SPEED (CONT'D)

3 ASSEMBLY

Screw brake cone assembly (19), conical side up, onto the threads of the planet cage.

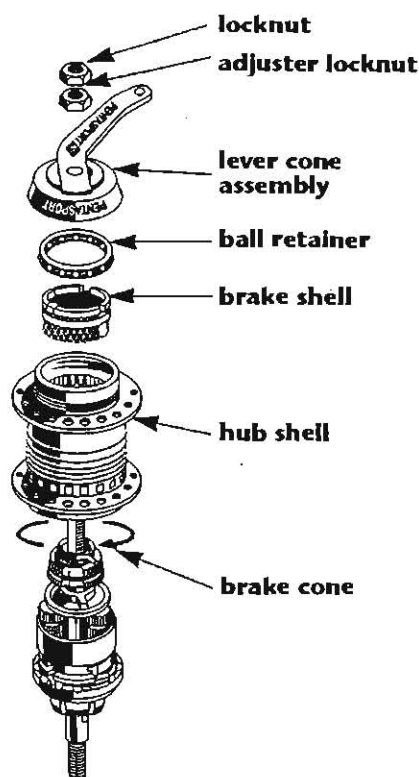
Install hub shell, turning it slightly counterclockwise to clear pawls.

Install brake shell (16), with internal tabs upwards. End of friction spring on brake cone must engage in one of the two slots in lower side of the brake shoe.

Install remaining bearing retainer (15), flat side up.

Install lever cone assembly (13), turning it clockwise to engage brake shoe tabs.

Screw on the two locknuts, (5) adjust for minimal bearing play without binding, and lock the nuts against each other (not against lever cone assembly!) using a 17 mm cone wrench and 17 mm open-end or box-end wrench.



GEAR TABLE FOR INTERNALLY GEARED HUBS

Multiply by gear value obtained from chainwheel and rear sprocket gear charts.

Gear	1	2	3	4	5	6	7
Sachs							
2-speed	1.00	1.36					
3-speed	0.73	1.00	1.36				
5-speed	0.50	0.78	1.00	1.29	1.50		
7-speed	0.59	0.67	0.81	1.0	1.24	1.48	1.69
Shimano							
3-speed	0.75	1.00	1.33				
7-speed	0.63	0.74	0.84	0.99	1.14	1.33	1.55
Sturmey Archer							
3-speed	0.75	1.00	1.33				
4-speed	0.67	0.79	1.00	1.27			
5-speed	0.67	0.79	1.00	1.27	1.50		

SUTHERLAND'S