Sturmey Archer — Technical Information - Five Speed Hub Gears

Part 1 GENERAL INFORMATION

1.1 Scope of this Leaflet

This leaflet refers to the Sturmey-Archer 5-STAR and 5-STAR ELITE Five Speed Hub Gears.

The hub model can be identified from the markings on the hub shell or brake arm.

The 5-STAR model supercedes the S5/2 Five Speed Hub Gear. Similarly the 5-STAR ELITE supercedes the ELITE AT5 model. For details on these obsolete products, please contact Sturmey-Archer.

1.2 Lubrication

No routine lubrication is required. However, during assembly/disassembly the hub greases should be replenished (see Section 4). Grease types meeting the following Sturmey-Archer Technical Standards should be used:

For bearings - SA103B
For all other internal parts - SA103A

Please contact Sturmey-Archer for information on the availability of these greases.

WARNING:- 5-STAR ELITE HUB ONLY
Under no circumstances should any lubricant be applied to the Brake Drum or Brake Shoes as this may prevent the brake from functioning.

1.3 Gear Changing

Continue pedalling, but ease pressure on the pedals and select the gear required. If the bicycle is stationary simply select gear required. If the **5-STAR Control** is used, simply move the lever to the gear position desired.

To change gear using the **Dual Lever Control,** refer to **Diagram 1.**

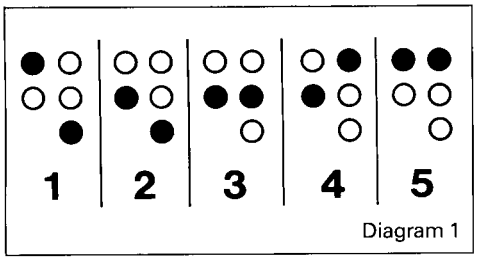


Diagram 1

1.4 Gear Ratios

Sturmey-Archer Five Speed Hub Gears have the following ratios:-

1st gear - Decrease of 33.3%
2nd gear - Decrease of 21.1%
3rd gear - Direct Drive
4th gear - Increase of 26.6%
5th gear - Increase of 50%

1.5 Sprockets

The overall drive ratio can be altered by changing the size of the rear Sprocket. A range of sprockets from 14 to 22 tooth is available, suitable for ½" pitch x ⅛" chain.

Part 2 ROUTINE MAINTENANCE

When service problems arise, they usually occur outside the hub, and the following checks must be made before removing the wheel from the bicycle.

2.1 Gear Adjustment

See Diagram 2.

1. Check that the fulcrum clips (1) if fitted, are secured tightly to the chainstays, and are at least 125mm from the hub.
2. Ensure that the indicator chains (5) are fully screwed into the axle. Unscrew by up to half a turn to ensure easy connection to the gear cable.
3. Check that the indicator chain (5) runs freely through the indicator protector (6) if fitted.
4. Select fifth gear and loosely connect the cable adjusters (2) to the indicator couplings (4).
5. Select third gear position on the gear control. Looking through the 'window' in each axle nut (9), turn the cable adjuster (2) until the shoulder at the end of each indicator rod (8) is exactly level with the end of the axle (7).
6. Tighten the locknuts (3) against the adjusters (2).
7. Check all 5 gears. Change back to 3rd gear from 5th and check adjustment.
8. If correct adjustment cannot be achieved, the fulcrum clips (1) must be moved in the appropriate direction before re-adjustment.

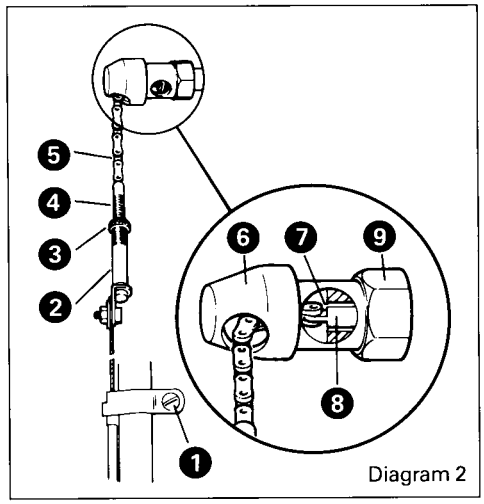


Diagram 2

WARNING: The hub must not be ridden out of adjustment as this may damage the internal parts and cause the hub to malfunction.

2.2 Hub Bearing Adjustment

If for any reason the bearing adjustment is altered, the cones must be reset correctly before using the hub. The right hand cone is pre-set at the factory and should only be disturbed at major service intervals. The left hand cone is used to adjust the bearings in the hub.

Left Hand Cone:

1. Loosen the cone locknut.
2. Adjust the left hand cone until very slight side play can be felt at the wheel rim, and none at the hub.
3. Tighten the cone locknut.

NB On the FIVE STAR Elite Drum Brake, use the cone adjuster to obtain the required adjustment.

Right Hand Cone:

1. Loosen the left hand cone locknut and cone.
2. Loosen the right hand cone locknut. Disengage the cone lockwasher.
3. Screw down the right hand cone finger tight.
4. Unscrew the right hand cone by half a turn.
5. Fit the cone lockwasher. If the washer will not engage with the cone, unscrew the cone slightly.

NB Under no circumstances must the right hand cone be unscrewed more than ⅝ of a turn.

6. Tighten the right hand cone locknut.
7. Tighten the left hand cone locknut.

Part 3 CONTROLS

3.1 Control Fitment

1. 5-STAR Control

Attach to the right-hand side of the handlebar. The control orientation can be altered to suit individual needs by removing the plastic screw cover at the control centre, and loosening the cross head screw. Rotate the control to the desired position before tightening the screw and replacing the cover. Select fifth gear. Pass the right and left-hand cables (marked R & L at the control) to their respective sides of the handlebar stem. (**NB** R is chainside).

By means of cable clips or bands, attach both cables to the down tube. Do not overtighten the clips/bands as this may prevent the inner cable from moving freely. Leave enough cable (400mm minimum) to enable the handlebars to turn freely. Pass the cables over the bottom bracket and fix to the chainstays. Adjust the gears as in Section 2.1.

2. Dual Lever Control

Attach to the handlebar stem with the cable housings pointing forwards. Attach the cables to the frame as described in Section 3.1.1.

3.2 Cable Replacement

1. 5-STAR Control

To Remove Cables:

1. Disconnect the cables at the hub by unscrewing the cable adjusters from the indicator couplings. (See diagram 2).
2. Remove cables from frame.
3. Select 1st Gear.
4. Pull outer casing away from control to expose inner wires.
5. Push inner wires to detach nipples from slots in control.
6. Pull inner wires out of control.

To Fit New Cables:

1. Select 3rd Gear.
2. Expose cable inner wires.
3. Push inner wire of left hand cable through slot in control marked 'L'.
4. Engage nipple in corresponding internal slot. (Diagram 3).
5. Push inner wire of right hand cable through slot in control marked 'R'.
6. Engage nipple in corresponding internal slot. (Diagram 3).

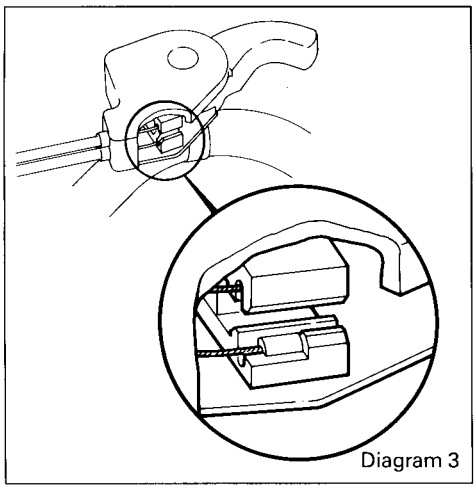


Diagram 3

7. Push outer casing of each wire so that it locks into the control recess. (Diagram 4).

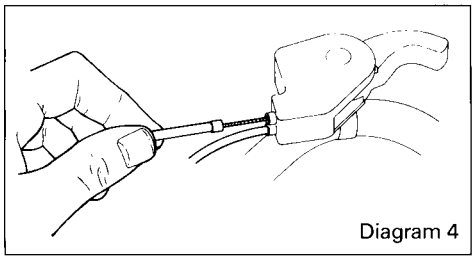


Diagram 4

8. Attach cables to frame (See Section 3.1.1).
9. Connect cables at the hub by screwing the cable adjusters on to the indicator couplings. (Diagram 2).
10. Adjust the gears. (See Section 2.1).

Note: In the event of damage to the 5-STAR Control, it is recommended that the whole unit be replaced.

2. Dual Lever Control

To Remove Cables:

1. Disconnect the cables at the hub by unscrewing the cable adjusters from the indicator couplings. (Diagram 2).
2. Select Fifth Gear.
3. Remove cables from frame.
4. Pull the inner wire sideways out of the housings then upwards until vertical.
5. Remove the nipple.

To Replace Cables:

Reverse this procedure. When the new cables have been fitted, adjust the gears as described in Section 2.1.

Part 4 ASSEMBLY/DISASSEMBLY INSTRUCTIONS - 5-STAR HUB

When service problems occur which cannot be corrected by attention to external maintenance, a close inspection of the working parts inside the hub will be necessary. Refer to the Fault Diagnosis Chart (Part 6) before commencing disassembly.

4.1 Disassembly

Fig. A

1. Remove the indicator rods, indicator protectors (if fitted), axle nuts and spacing washers from both ends of the axle.
2. Use a screwdriver to release the sprocket circlip from the driver, then remove the spacing washers, sprocket and outer dustcap (note the order of these parts).
3. Unscrew the left hand cone locknut and cone. Note the position of spacing washers (if any) between cone and locknut.

Fig. B

Loosen the right hand ball ring with a C-spanner or hammer and punch, and unscrew the ball ring to release the internal assembly from the hub shell.

NB If a complete replacement gear internal is to be fitted, no further disassembly is required.

Fig. C

Clamp the left hand end of the axle in a vice, and remove the right hand cone locknut, lockwasher, cone, spring cap and clutch spring.

Fig. D1

1. Hold the base of the gear ring and lift off together with ball ring, right hand ball cage, and driver assembly.
2. Separate the above parts. Remove driver assembly from ball ring by compressing pawls.
3. Remove clutch.

Fig. E

1. Remove axle key.
2. Remove planet cage circlip spring and pawls.
3. Remove planet pinions and pins.

Fig. F

1. Remove axle from vice. Clamp the right hand end of the axle in the vice.
2. Using circlip pliers, remove and discard the circlip.
3. Lift off the planet cage and planet cage spring.
4. Remove the washer, secondary sun pinion, and primary sun pinion, noting the order and orientation of these parts.
5. Remove axle from vice.


FIG B

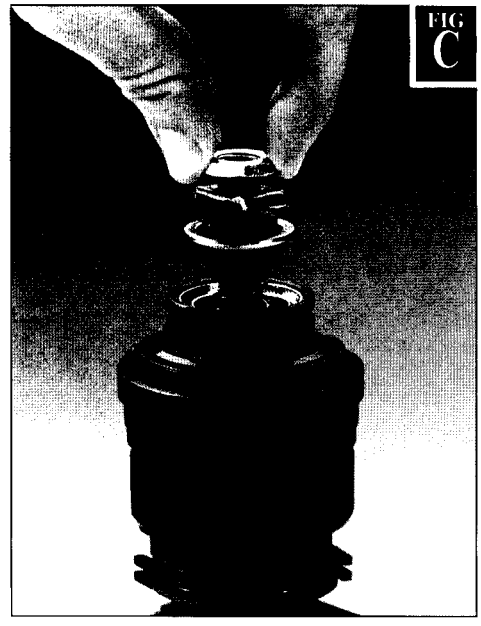


FIG C

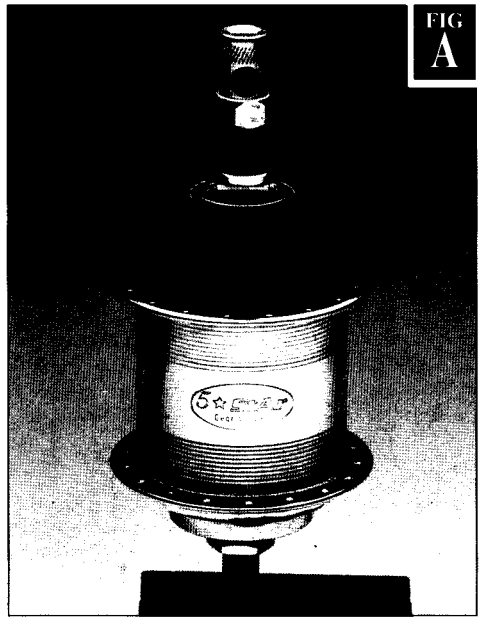


FIG A

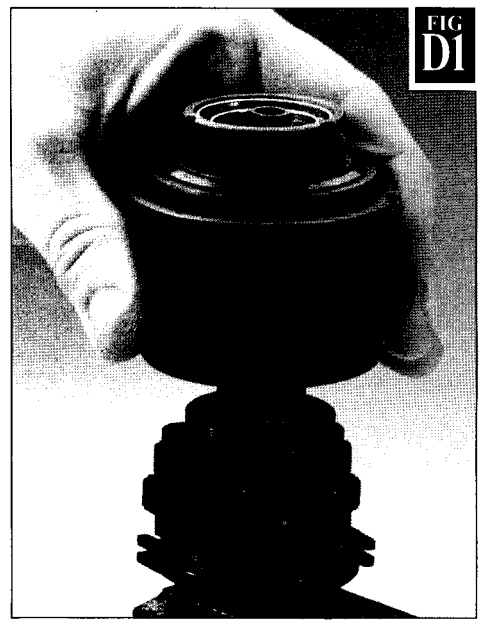


FIG D1

Fig. G

1. Clamp the axle horizontally in vice.
2. Using a small screwdriver, compress the indicator spring to release the gear selector key.
3. Remove axle washer.
4. Remove axle from vice, and release indicator spring.

4.2. Inspection and Repair of Internal Parts

Thoroughly clean all the internal parts and replace any which are damaged or worn. Specific items to be checked are:-

1. Axle: Straightness, condition of threads, condition of slots.
2. Pinions: Condition of teeth. Condition of splines (sun pinions only).
3. Planet Cage: Condition of pawls, straightness of pins, condition of circlip spring.
4. Clutch: Squareness of corners.
5. Gear Ring: Condition of gear teeth, pawls and pawl springs, worn or chipped parts.
6. Driver Assembly: Condition of splines and ball track, worn or chipped parts, free movement of pawl actuator, condition of pawl actuator, condition of pawls, condition of and correct number (7) of balls.
   NB It is recommended that this assembly is not dismantled, but if necessary replaced with a factory fitted assembly.
7. Ball Cage Assemblies: Condition and correct number of balls (7 in LH assembly, 14 in RH assembly).
8. Cones: Condition of bearing surfaces.
9. Axle Key: Threads.
10. Gear Selector Key: Threads. Check for wear.
11. Springs: Check for breakage.

4.3. Assembly

Fig. G

1. Fit axle washer against shoulder on left hand side of axle.
2. Drop the indicator spring into right hand side of axle.
3. Clamp the axle horizontally in vice.
4. Using a small screwdriver, compress the indicator spring to insert the gear selector key. Ensure that the spring is located in the selector key flat.
5. Remove axle from vice.

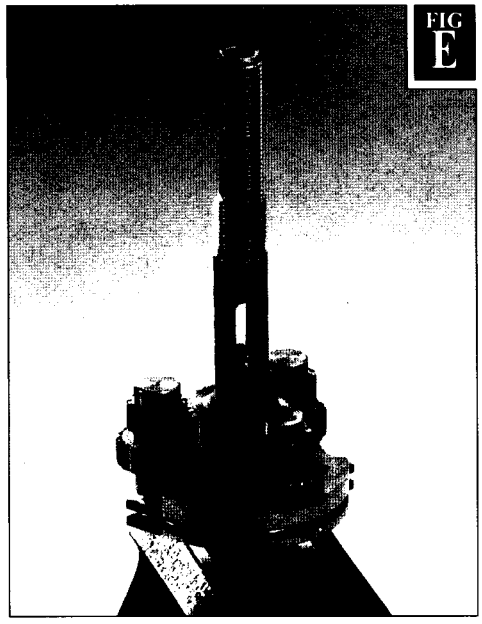
Fig. F

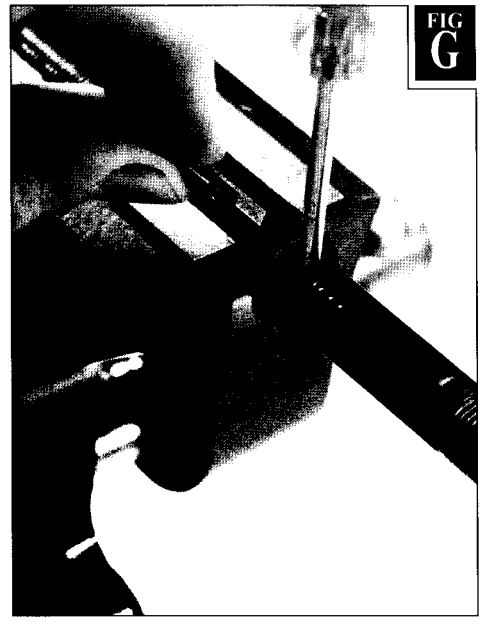
1. Clamp right hand end of axle in vice.
2. Fit primary sun pinion such that it engages with the gear selector key.
3. Fit secondary sun pinion, ensuring that the counterbore faces the primary sun pinion.See Diagram 5.
4. Fit axle washer.
5. Fit planet cage spring and planet cage.
6. Take a new circlip and locate it in the circlip groove, ensuring that circlip flat is uppermost.

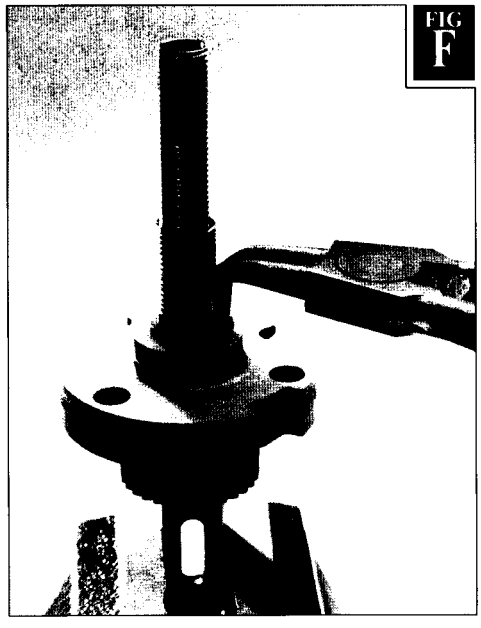
NB Take care not to overstress the circlip.

Fig. E

1. Remove axle from vice. Clamp the left hand end of the axle in vice.







2. Fit pawl spring circlip and pawls.
3. Fit planet pins and pinions with their timing marks pointing radially outwards. **IMPORTANT** See Diagram 6 for pinion timing. Each pinion has a timing mark stamped on one of its larger diameter pinion teeth.

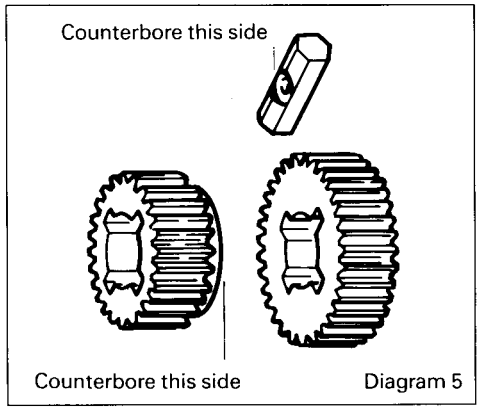


Diagram 5

4. Lubricate the pinions and pinion pins with a light application of grease to Sturmey-Archer Technical Standard SA103A.
5. Fit the axle key, such that the threaded hole runs vertically. Locate the key centrally in the axle slot with a blob of the above grease.

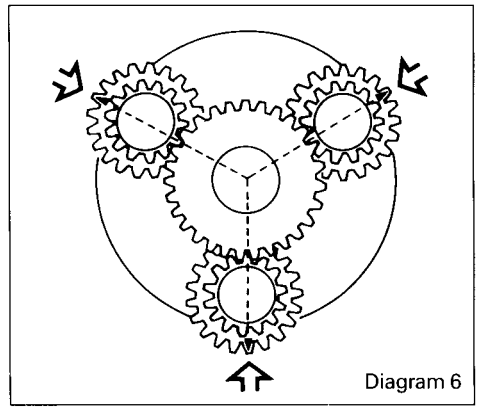


Diagram 6

Fig. D2

1. Take the gear ring and fit the pawls, pawl pins and springs as indicated in Diagram 7. Lubricate by a light application of SA103A grease.
2. Locate the gear ring assembly over the planet cage. Fit the ball ring.
3. Lubricate the right hand ball cage assembly with grease to Sturmey-Archer Technical Standard SA103B.
4. Place the ball cage assembly on the ball ring - ensuring that the balls face downwards.

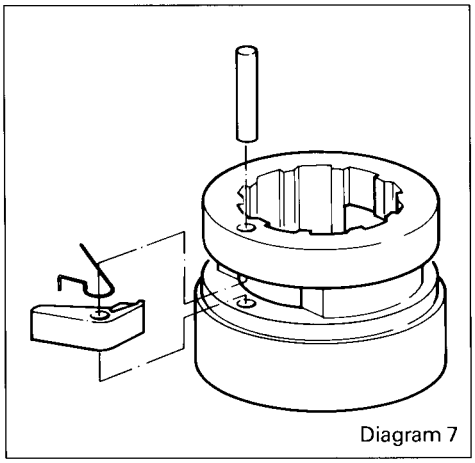


Diagram 7

5. Assemble clutch to driver assembly - Diagram 8.

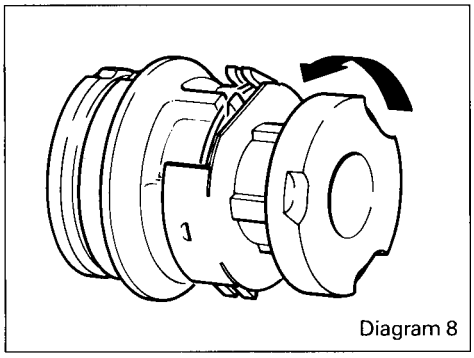


Diagram 8

6. Rotate clutch and actuator to compress driver pawls.
7. With actuator held in this position, fit clutch and driver assembly, rotating to ensure that the driver engages with the gear ring splines.

Fig. C

1. Slide the clutch spring and clutch spring cap (with its flat face uppermost) over the axle.
2. Screw down the right hand cone finger tight. Slacken the cone off by half a turn and lock it in this position with the lockwasher and locknut.

NB Under no circumstances must the cone be unscrewed by more than ⅝ of a turn as this could adversely affect gear alignment.

Fig. B

1. Remove the assembly from the vice. Apply grease to Sturmey-Archer Technical Standard SA103A to the working parts.
2. Insert the assembly in the hub shell and tighten the ball ring, turning anti-clockwise first to prevent cross-threading. Tighten with C-Spanner to a torque of 150Nm.

Fig. A

1. Fit the left hand cone, spacing washer(s) and locknut, adjust the bearings as instructed in Section 2.2.
2. Assemble the sprocket dustcap, sprocket, sprocket circlip and sprocket spacing washer to obtain the desired chainline.
3. Assemble the wheel into the bicycle.
4. Fit the lockwashers, spacing washers and axle nuts.
5. Tighten the axle nuts to a torque of 25Nm.
6. Fit indicators, indicator protectors and adjust the gears as instructed in Section 2.1.

Part 5 5-STAR ELITE HUB

For information on the gears in the 5-STAR ELITE Hub, refer to Sections 1 to 4 of this leaflet. The gear mechanisms of the 5-STAR and 5-STAR ELITE hubs are identical.

5.1 Hub/Frame Assembly

1. Fit the chain to the sprocket.
2. Fit the hub axle in to the fork ends.
3. Fit washers and axle nuts. Ensure that the serrations on the lockwashers face into the frame with the lugs located in the axle slots. DO NOT tighten the axle nuts at this stage, or misalignment of the brake plate may occur.
4. Select a suitable brake arm clip to clamp the brake arm loosely to the bicycle frame. With the wheel centralised and chain tensioned correctly, tighten the axle nuts to a torque of 25Nm.
5. Tighten the brake arm clip nut firmly to 7Nm max.

5.2. Cable Fitting - Closed End Cables

1. Attach the cable at the handlebar brake lever.
2. Locate the brake adjusting spigot in the slot on the brake arm.
3. Fit the cable nipple into the anchorage stud on the hub brake lever assembly, ensuring that the recess mates with the larger diameter of the nipple.

NB To maintain maximum braking efficiency avoid sharp bends and kinks in the cable.

5.3. Cable Fitting - Pinch Bolt Specification

1. Attach the cable at the handlebar brake lever.
2. Locate the brake adjusting spigot into the slot on the brake arm.
3. Push the cable inner wire through the adjuster and through the hole in the pinch bolt nut.

See Diagram 9.

4. Set the adjuster (2) so that there is approximately 5mm of thread showing above the locknut (1).
5. Holding the brake lever in the 'brake on' position, hold the pinch bolt nut on the inside of the brake arm with a spanner and tighten pinch bolt screw on the outside of the brake arm to 3Nm max.

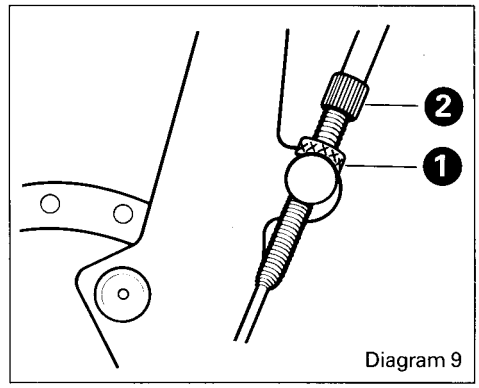


Diagram 9

NB To maintain maximum braking efficiency avoid sharp bends and kinks in the cable.

5.4. Brake Adjustment

See Diagram 9.

1. Slacken the brake adjuster locknut (1).
2. Turn the adjuster (2) until the brake is applied.
3. Slacken the adjuster until the wheel just spins freely.
4. Tighten the locknut (1).

5.5. Hub Assembly/Disassembly

See Part 4.

The internal gear mechanism of the 5-STAR ELITE is identical to that of the 5-STAR Hub.

In order to remove and replace the brake refer to Section 5.6.

5.6. Brake Shoe Service

The asbestos free linings in Sturmey-Archer ELITE hub brakes are long lasting and should only need replacement at major service intervals. A complete brake replacement unit (Item 4 on Exploded View) is available for this purpose. Before replacing this unit, check for excessive cable stretch.

5.6.1. Brake Unit Removal

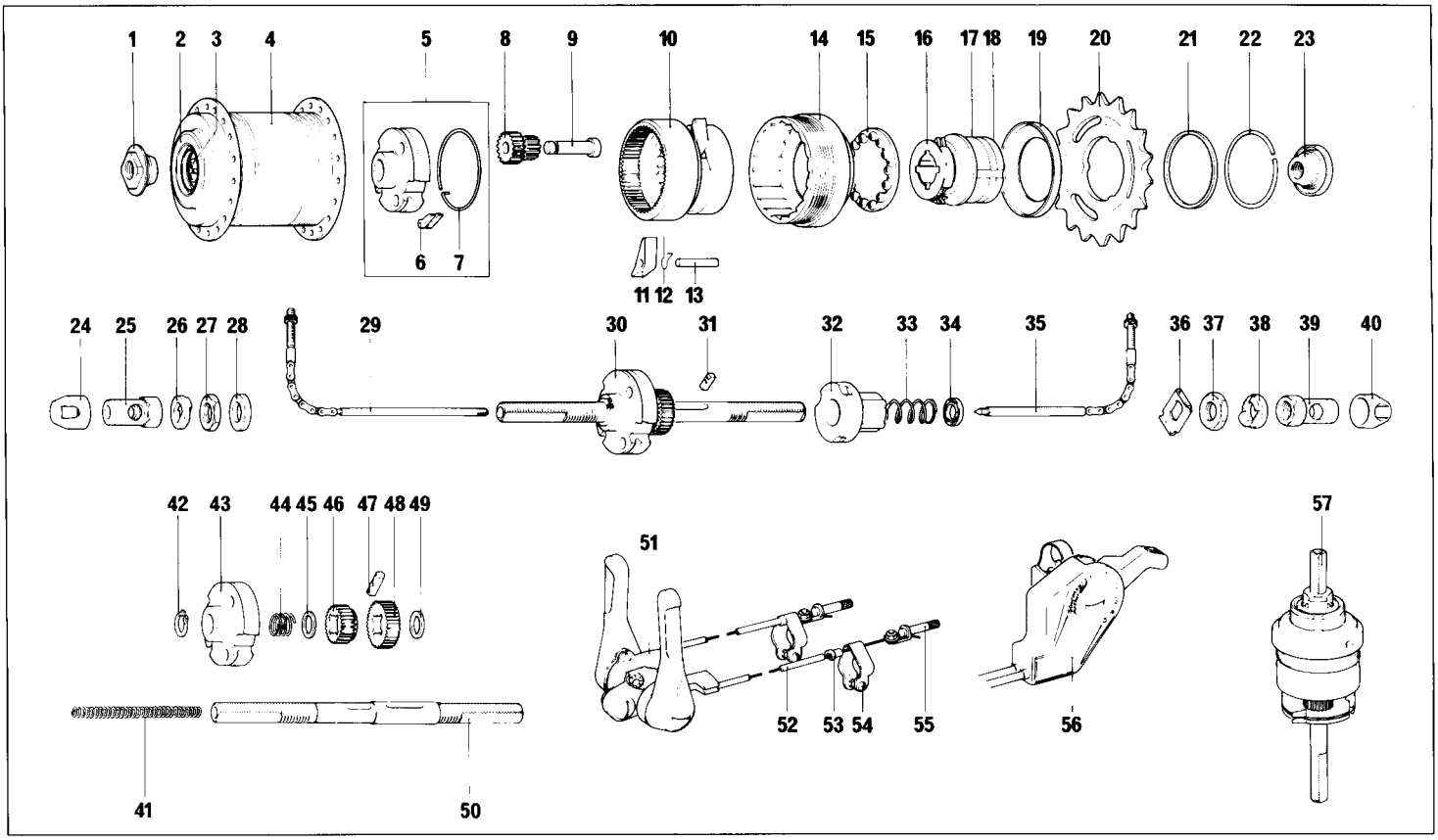
1. Remove the brake cable and brake arm clip.
2. Remove the indicator rods, indicator protectors (if fitted), axle nuts and washers from both ends of the axle.
3. Take the wheel out of the bicycle.
4. Take off the brake plate locknut, washer and cone adjuster.
5. Lift out the brake plate and shoe assembly taking care not to touch the shoes with hands.

5.6.2. Brake Unit Replacement

1. Wipe the inside of the brake drum surface with a tissue and solvent to remove grease and dirt.
2. Fit the replacement unit onto the hub over the left hand cone and re-assemble the cone adjuster, washer and locknut.
3. Adjust the bearings as instructed in Section 2.2.

N.B. To ensure concentricity of the new brake unit, tighten the cone locknut with the hub brake lever held in the 'brake-on' position

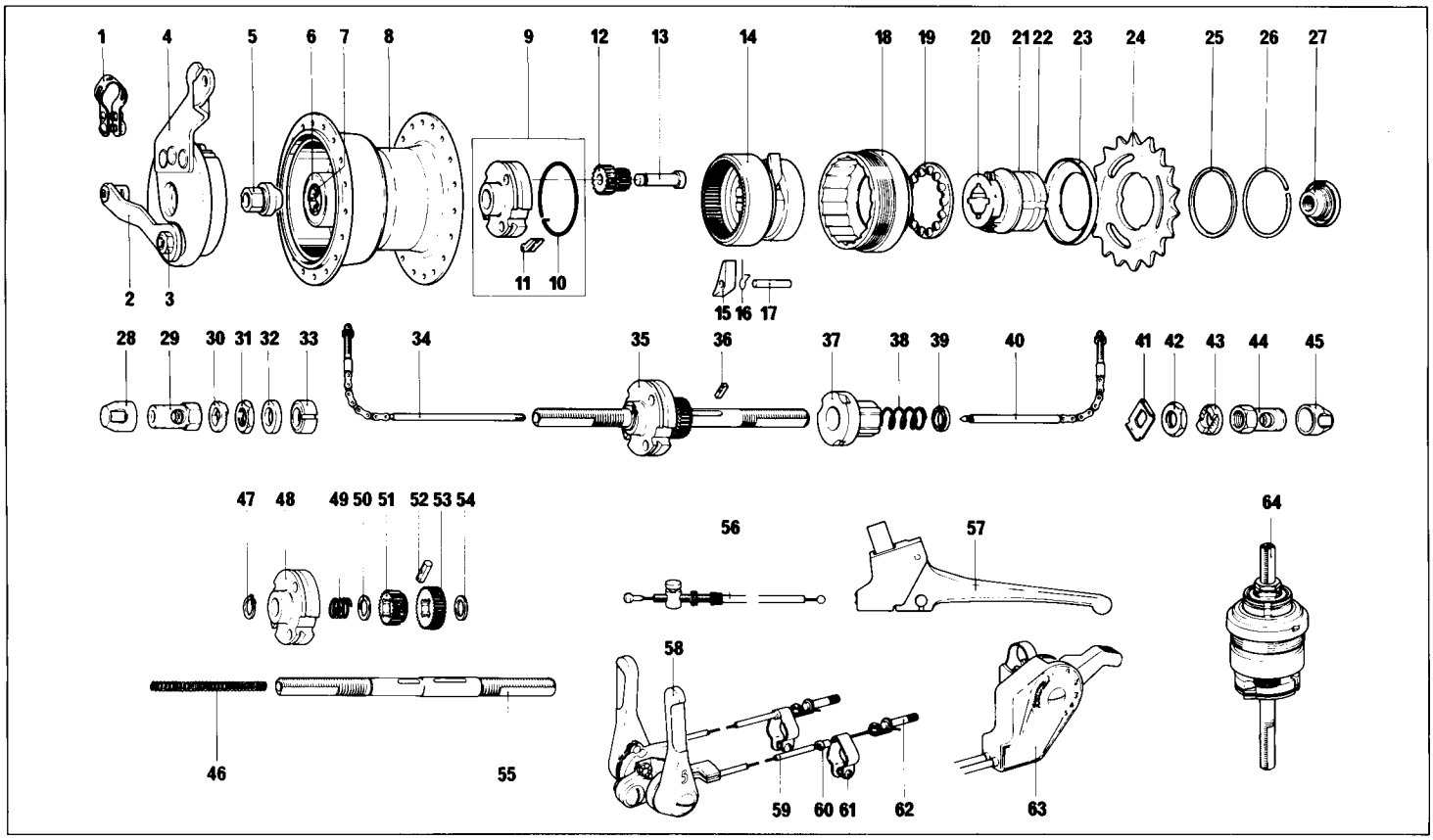
Sturmey Archer — Parts List - 5 Star Hub Gear



Item No.	Sales No.	Description
1	HSA101	L.H Cone
2	HSA102	Outer Dust Cap
3	HSA284	L.H. Ball Cage Assembly 6.4mm Ball
4	HSA447	Hub Shell Assembly - 28 hole (Chrome)
	HSA448	Hub Shell Assembly - 36 hole (Chrome)
		NB: Hub Shell Assemblies include Items 2 and 3.
5	HSA449	Planet Cage Assembly (includes 2 off Item 6, 1 off Item 7)
6	HSA410	Planet Cage Pawl
7	HSA450	Pawl Spring Circlip
8	HSA451	Planet Pinion
9	HSA464	Pinion Pin
10	HSA452	Gear Ring Assembly (includes 2 off Items 11,12,13)
11	HSA119	Gear Ring Pawl
12	HSA120	Pawl Spring
13	HSA415	Pawl Pin
14	HSA437	Ball Ring
15	HSA438	Ball Cage Assembly
16	HSA439	Driver Assembly (includes 1 off Items 17, 18)
17	HSA284	R.H. Ball Cage Assembly 6.4mm Ball
18	HSA102	Outer Dustcap
19	HSL701	Sprocket Dustcap
20	*HSL714	Sprocket 14 Teeth
	*HSL715	Sprocket 15 Teeth
	*HSL716	Sprocket 16 Teeth
	*HSL717	Sprocket 17 Teeth
	*HSL718	Sprocket 18 Teeth
	*HSL719	Sprocket 19 Teeth
	*HSL720	Sprocket 20 Teeth
	*HSL747	Sprocket 21 Teeth
	*HSL722	Sprocket 22 Teeth
21	HMW127	Sprocket Spacing Washer 1.6mm
22	HSL721	Sprocket Circlip
23	HSA101	R.H. Cone
24	*HSL711	Indicator Protector
25	HMN129	Axle Nut
26	*HMW155	Serrated Lockwasher 7.9mm Slot
	*HMW494	Serrated Lockwasher 9.5mm Slot
27	HMN132	Cone Locknut
28	*HMW146	Spacing Washer 1.6mm
	*HMW129	Spacing Washer 3.2mm
	*HMW483	Spacing Washer 4.8mm
	*HMW484	Spacing Washer 6.4mm
29	HSA453	L.H. Indicator
30	HSA454	Axle Assembly (includes Items 41-50)
31	HSA295	Axle Key
32	HSA455	Clutch
33	HSA128	Clutch Spring
34	HSA129	Clutch Spring Cap
35	HSA316	R.H. Gear Indicator (4 Mark)
36	HMW147	Cone Lockwasher
37	HMN132	Cone Locknut
38	*HMW155	Serrated Lockwasher 7.9mm Slot
	*HMW494	Serrated Lockwasher 9.5mm Slot
39	HMN129	Axle Nut
40	*HSL711	Indicator Protector
41	HSA456	Indicator Spring
42	HSL729	Circlip
43	(See Item 5)	Planet Cage
44	HSA457	Planet Cage Spring
45	HMW327	Axle Washer
46	HSA458	Secondary Sun Pinion
47	HSA459	Gear Selector Key
48	HSA460	Primary Sun Pinion
49	HMW327	Axle Washer
50	HSA462	Axle 161.9mm
51	*HSJ776	Dual Lever - Alloy - Stem fitting with cables
52	HSJ777	Cable Complete with Anchorage - 1346 x 1194mm - for Dual Levers
53	HSJ515	Fulcrum Sleeve
54	HSJ775	Universal Fulcrum Clip 15.9mm Ø Chainstay
55	HSL759	Cable Anchorage
56	*HSJ829	5-STAR Control with Cables 22.2mm Clip
57	HSX123	Gear Internal Assembly Complete (includes Items 5-18, 30-34. 36-37, 41-50)

*Optional Fitment

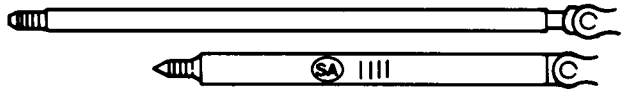
Sturmey Archer — Parts List - 5 Star Elite Drum Brake



Item No.	Sales No.	Description
1	*HCB101	Brake Arm Clip Assembly 15.9mm
	*HCB103	Brake Arm Clip Assembly 18.3mm
2	*HSB293	Brake Lever Assembly - Closed End Cables
	*HSB313	Brake Lever Assembly - Pinch Bolt
3	HMN139	Brake Lever Nut
4	HSB398	Brake Replacement Unit - Closed End Cables
	HSB399	Brake Replacement Unit - Pinch Bolt
		NB: Brake Replacement Units include 1 off Items 2 and 3.
5	HSA379	L.H. Cone
6	HSA241	Cone Dust Cover
7	HSA284	L.H. Ball Cage Assembly 6.4mm Ball
8	HSA463	Hub Shell Assembly 36 Hole NB: Hub Shell Assembly includes 1 off Items 6 and 7
9	HSA449	Planet Cage Assembly (includes 1 off Item 10, 2 off Item 11)
10	HSA450	Pawl Spring Circlip
11	HSA410	Planet Cage Pawl
12	HSA451	Planet Pinion
13	HSA464	Pinion Pin
14	HSA452	Gear Ring Assembly (includes 2 off Items 15,16,17)
15	HSA119	Gear Ring Pawl
16	HSA120	Pawl Spring
17	HSA415	Pawl Pin
18	HSA437	Ball Ring
19	HSA438	Ball Cage Assembly
20	HSA439	Driver Assembly (includes 1 off Items 21, 22)
21	HSA284	R.H. Ball Cage Assembly 6.4mm Ball
22	HSA102	Outer Dustcap
23	HSL701	Sprocket Dustcap
24	*HSL714	Sprocket 14 Teeth
	*HSL715	Sprocket 15 Teeth
	*HSL716	Sprocket 16 Teeth
	*HSL717	Sprocket 17 Teeth
	*HSL718	Sprocket 18 Teeth
	*HSL719	Sprocket 19 Teeth
	*HSL720	Sprocket 20 Teeth
	*HSL747	Sprocket 21 Teeth
	*HSL722	Sprocket 22 Teeth
25	HMW127	Sprocket Spacing Washer 1.6mm
26	HSL721	Sprocket Circlip
27	HSA101	R.H. Cone
28	*HSL711	Indicator Protector
29	HMN129	Axle Nut
30	*HMW155	Serrated Lockwasher 7.9mm Slot
	*HMW494	Serrated Lockwasher 9.5mm Slot
31	HMN132	Cone Locknut
32	*HMW146	Spacing Washer 1.6mm
	*HMW129	Spacing Washer 3.2mm
	*HMW483	Spacing Washer 4.8mm
	*HMW484	Spacing Washer 6.4mm
33	HSA371	Cone Adjuster
34	HSA453	L.H. Indicator
35	HSA454	Axle Assembly (includes Items 46-55)
36	HSA295	Axle Key
37	HSA455	Clutch
38	HSA128	Clutch Spring
39	HSA129	Clutch Spring Cap
40	HSA316	R.H. Gear Indicator (4 Mark)
41	HMW147	Cone Lockwasher
42	HMN132	Cone Locknut
43	*HMW155	Serrated Lockwasher 7.9mm Slot
	*HMW494	Serrated Lockwasher 9.5mm Slot
44	HMN129	Axle Nut
45	*HSL711	Indicator Protector
46	HSA456	Indicator Spring
47	HSL729	Circlip
48	(See Item 9)	Planet Cage
49	HSA457	Planet Cage Spring
50	HMW327	Axle Washer
51	HSA458	Secondary Sun Pinion
52	HSA459	Gear Selector Key
53	HSA460	Primary Sun Pinion
54	HMW327	Axle Washer
55	HSA462	Axle 161.9mm
56	HSK698	Cable Complete Black
57	*PKL205	DELRIN Brake Lever Assembly RH/LH 22.2mm Clip
	*PKL206	DELRIN Brake Lever Assembly RH/LH 23.8mm Clip
58	*HSJ776	Dual Lever - Alloy - Stem fitting with cables
59	HSJ777	Cable Complete with Anchorage - 1346 x 1194mm - for Dual Levers
60	HSJ515	Fulcrum Sleeve
61	HSJ775	Universal Fulcrum Clip 15.9mm Ø Chainstay
62	HSL759	Cable Anchorage
63	*HSJ829	5-STAR Control with Cables 22.2mm Clip
64	HSX123	Gear Internal Assembly Complete (includes Items 9-22, 35-39, 41-42, 46-55)

*Optional Fitment

Sturmey Archer Technical Information - Five Speed Hub Gears

Marking	Sales No.
	(Left side) HSA453 (Right side) HSA316

Part 6 FAULT DIAGNOSIS CHART

Use this chart only if a fault persists after attention to gear adjustment and bearing adjustment. (See Part 2)

A. SLIPPING AND SELF-CHANGING GEARS

Table 1 - Symptoms
Refer to the relevant faults and remedies in Table 2 for each of the following symptoms.

Symptom	Possible Faults and Remedies (See Table 2)
Slipping in first gear	a,b,c,d,e,f,i,k,l.
Slipping in second gear	a,b,c,d,e,f,j,k,l.
Slipping in third gear	f,g,h,l,m.
Slipping in fourth gear	a,b,c,f,g,h,j,k,l,m,n,o.
Slipping in fifth gear	a,b,c,f,g,h,i,k,l,m,n,o.
Self changing between 1st and 2nd gear	a,b,c.
Self changing between 1st and 3rd gear	g.
Self changing between 4th and 5th gear	a,b,c.

Table 2 - Faults and Remedies
Refer to Table 1 for the symptoms that will be caused by each of the following faults.

Ref.	Fault	Remedy
a.	Kinked or stiff gear cables.	Replace or lubricate cables
b.	Twisted indicator chains/ catching protector caps.	Replace indicators/Re-align protector caps
c.	Indicators not screwed in fully.	Screw in fully.
d.	Deformed or weak planet cage circlip.	Fit new circlip.
e.	Worn planet cage pawls.	Replace pawls.
f.	Worn gear ring splines.	Replace gear ring.
g.	Worn gear ring pawls.	Replace pawls and springs.
h.	Weak or sticking gear ring pawl springs.	Clean the hub, lubricate and/or replace pawl springs.
i.	Worn primary sun pinion.	Replace primary sun pinion.
j.	Worn secondary sun pinion.	Replace secondary sun pinion.
k.	Worn gear selector key.	Replace gear selector key.
l.	Worn driver pawls.	Replace pawls.
m.	Worn right hand ball ring ratchet teeth.	Replace ball ring.
n.	Tight or weak clutch spring.	Clean the hub and fit new spring.
o.	Incorrect right hand cone adjustment.	Re-adjust the hub (see PART 2).

B. OTHER FAULTS

SYMPTOM	FAULT	REMEDY
Hub runs stiffly, drags on pedals when free-wheeling	1. Chainstay ends not parallel.	1. Re-align chainstay ends (un-parallel chainstay ends can cause axle bending.
	2. Incorrect cone adjustment.	2. Re-adjust both cones (see Section 2.2).
	3. Distorted dust caps.	3. Replace dust caps.
	4. Corrosion due to lack of lubrication.	4. Disassemble hub, clean and re-grease (see Part 4).
	5. Planet pinions are not timed correctly.	5. Check and re-time the pinions (see Diagram 6).
	6. Brake rubbing (5-STAR ELITE hub only).	6. Re-adjust brakes (see Section 5.4).
No gears at all	1. Pawls stuck.	1. Clean and re-grease.
	2. Broken gear selector key.	2. Replace gear selector key.
	3. Broken axle key.	3. Replace axle key.
Sluggish gear change.	1. Rusty or frayed gear cables.	1. Replace cables.
	2. Worn gear indicator couplings.	2. Replace indicator couplings.
	3. Bent axle.	3. Fit new axle.
	4. Damaged axle slots.	4. Fit new axle.
	5. Distorted axle spring.	5. Replace spring.
	6. Damaged gear selector key.	6. Replace gear selector key.

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