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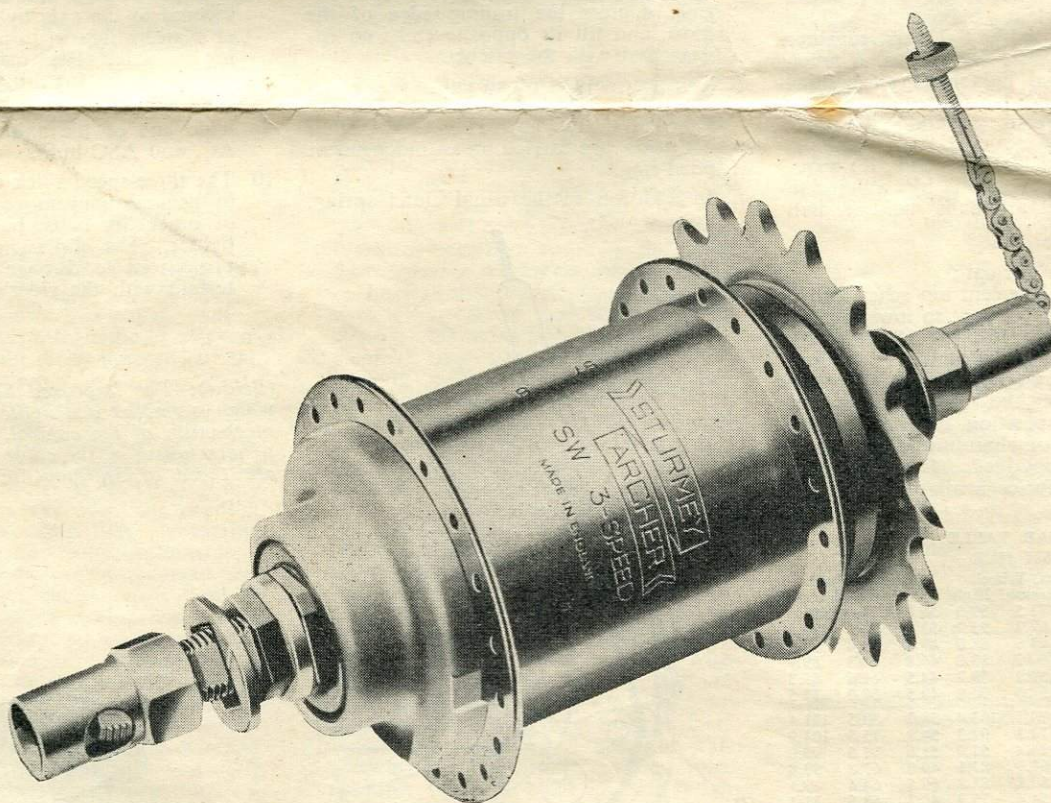
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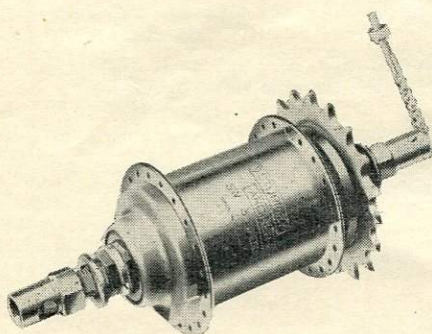
Servicing Data Sheet No. 11

STURMEY-ARCHER SW 3-SPEED WIDE RATIO HUB GEAR

Manufacturer: SturmeY-Archer Gears Ltd., Lenton Boulevard, Nottingham



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STURMEY-ARCHER SW 3-SPEED WIDE RATIO HUB GEAR

THE new Sturmeley-Archer SW 3-speed wide ratio hub is smaller than the well-known AW model. Slightly longer spokes (approximately 1/32nd in.) are required, therefore, but the over-cone dimensions are the same as the AW.

Of completely new design, this hub incorporates a number of features which will be of interest to both riders and dealers, the most important being the added strength, coupled with lightness, together with the slightly wider gear ratios. A much neater, smaller and lighter trigger control is also provided.

Certain components common to other Sturmeley-Archer gears have been retained, such as standard cones with dustcaps, splined sprockets secured by a circlip, locked cones, and all balls held in ball retainers.

Gear ratios are :

Direct drive in normal ;

Increase of 38.4 per cent top gear ; and

Decrease of 27.7 per cent to low gear.

Sprocket sizes are 16-, 17-, 18-, 19-, 20- and 22-teeth and the sprocket is secured by a spring steel circlip, as on the AW model. By reversing the "dished" sprocket and varying the position of the packing washers, a range of chainlines from 1 1/2 in. to 1 3/4 in. can be obtained. The gear table below shows the ratios available.

GEAR TABLE
SW HUB

Chain	Wheel Sprocket	26 in. Wheel			28 in. Wheel		
		Low	Normal	High	Low	Normal	High
44	16	51.6	71.5	99.0	55.6	77.0	106.6
	17	48.6	67.3	93.2	52.4	72.5	100.3
	18	45.9	63.6	88.0	49.4	68.4	94.7
	19	43.5	60.2	83.3	46.8	64.8	89.7
	20	41.3	57.2	79.2	44.5	61.6	85.3
46	22	37.6	52.0	72.0	40.5	56.0	77.5
	16	54.0	74.7	103.4	58.2	80.5	111.4
	17	50.8	70.3	97.3	54.8	75.8	104.9
	18	48.0	66.4	91.9	51.6	71.5	99.0
	19	45.4	62.9	87.1	49.0	67.8	93.8
48	20	43.2	59.8	82.8	46.5	64.4	89.1
	22	39.3	54.4	75.3	42.3	58.6	81.1
	16	56.3	78.0	108.0	60.7	84.0	116.3
	17	53.1	73.5	101.7	57.1	79.1	109.5
	18	50.1	69.3	95.9	54.0	74.7	103.4
48	19	47.5	65.7	90.9	51.1	70.7	97.9
	20	45.1	62.4	86.4	48.5	67.2	93.0
	22	41.0	56.7	78.5	44.1	61.1	84.6

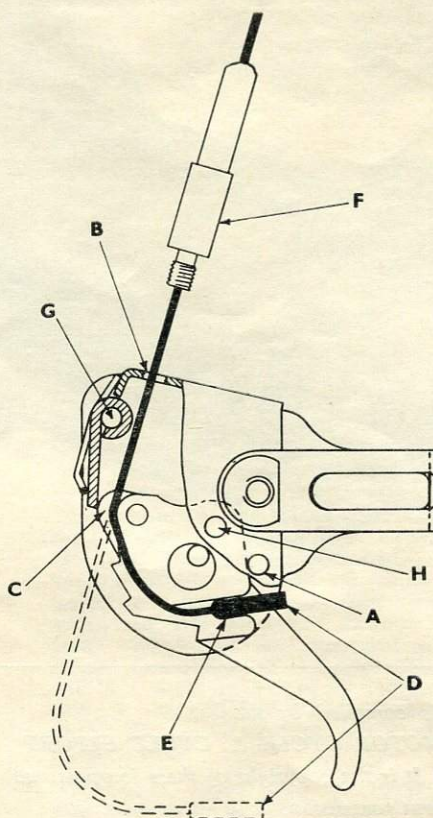
Special features of the gear are :

1. A robust three-prong driver, and sliding clutch.

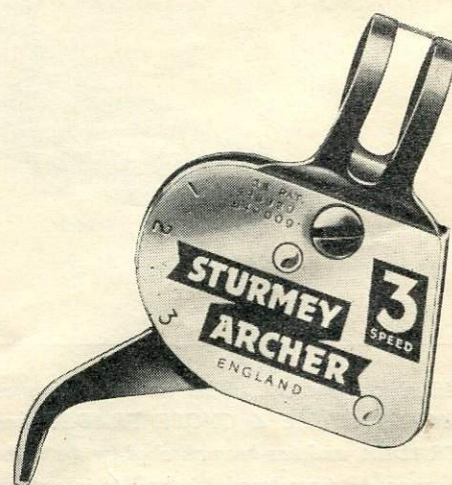
2. The planet cage and pawl-ring have three pawls each.
3. All pawls, which are silent in operation, are of the half-moon type, and are identical ; they can be reversed if one end becomes worn.
4. There are no pawl-springs, the ratchet-teeth on the ball-cup, and on the ball-ring, depress the trailing edge of the pawl, and tilt its opposite end into engagement with the ratchet.
5. The gear-ring is of an entirely new design, and the pawls, instead of being attached to the gear ring as on other SA gears, are carried on an independent pawl-ring.
6. In addition to the usual clutch-spring,

a large diameter thrust-spring fits over the driver-prongs, and one end of it contacts the thrust-washer of the pawl-ring.

7. The left-hand ball-cup and the right-hand ball-ring have two start threads the former being left-hand.
8. The planet-cage and bearing plate are secured to the axle by a special washer or plate, which in turn fits in a groove in the axle. The maker provides a special punch for fitting the plate.
9. An indicator-rod is fitted in the left-hand end of the axle, as on the AM, AC, and ASC hubs.
10. The three-speed Flick control is similar in general appearance to the controls of other SA hubs, but is smaller and lighter. The clip is neater and has no projections to damage gloves or to interfere with the rider's hold.



(Below): The improved SW Flick control, which is smaller and lighter. (Below, left): mechanism of the control, showing method of attachment of the cable (reference letters are those of Sturmeley-Archer Gears, Ltd.)



MAINTENANCE INSTRUCTIONS

Gear-changing is similar to that on other SA hubs. Pedalling should be continued, but pressure on the pedals should be eased while the control-lever is moved smartly. If it is desired to change gear when the machine is stationary, the pedals should be moved slightly to allow the gears inside the hub to engage.

Lubrication should be oil not grease. It is better to oil little and often, rather than to flood with oil at infrequent intervals. The makers recommend R.I. All-Purpose oil, about half a teaspoonful a fortnight.

Bearing adjustment is similar to that on other SA hubs: That is, adjustment of the left-hand cone adjusts all bearings simultaneously. When adjusted correctly and the locknut tightened, there should be just a trace of side play or "shake" at the rim. The right-hand cone should not be disturbed, as this is set on assembly at the works. If, however, it has been disturbed, it should be reset as described in the assembly instructions given below.

Gear adjustment is as follows:

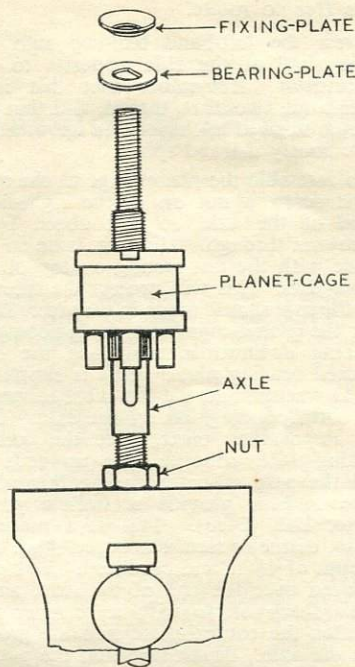
Place the control lever in the normal (i.e. 2nd gear) position. Slacken the locknut on the operating-chain connection, and rotate the knurled connection until the end of the indicator-rod at the left-hand side of the axle is flush with the axle-end; then tighten the locknut.

Make sure that the indicator-rod is screwed up firmly into the toggle-chain assembly. Be careful, however, not to strip the thread. If the gears slip, check the adjustment immediately, as continual slipping is liable to cause damage and extreme wear.

DISMANTLING INSTRUCTIONS

Before dismantling the hub, clean off the bench and spread a clean sheet of brown paper on it. As the parts are dismantled place them in order on this paper. Then:

1. Disconnect the control-cable by slackening the locknut and unscrewing the knurled connection.
2. Remove the axle-nuts and washers, and extract the wheel from the machine. Note carefully the arrangement of the washers and locknuts at both ends of the axle, as the addition or omission of any washers or nuts will affect the position of the rim and chain line. Normally, SA hubs are built "central over cones."
3. The sprocket need not be removed, unless it needs replacing. It is held in position by a spring steel circlip, which should be prised off with a screwdriver. Note the position of the two packing washers, and also whether the sprocket is fitted with offset facing towards the spokes or vice-versa. Both washers must be replaced on assembly, and the sprocket fitted the same way round, if the same chainline is to be maintained. Do not, under any circumstances, omit any washers, or the sprocket will not be held rigid by the spring steel circlip.
4. The left-hand ball-cup and the right-hand ball-ring have notches on their perimeters. The purpose of these is to enable the component to be unscrewed with a special C spanner (No. DD12418, which the makers supply) or by using a hammer and soft punch.



Building up the planet-cage to the axle, as described on page 4 under Assembly.

to this notch should be marked, by attaching a piece of adhesive tape, or string. Both the left-hand ball-cup and the right-hand ball-ring have two start threads. Therefore, it is possible to start the thread incorrectly. The purpose of the marked spoke is to provide a means of checking on reassembly that the spoke and notch line up; otherwise, it will be necessary to re-true the wheel.

5. Next, remove the toggle-chain assembly by holding the end of the indicator-rod with a screwdriver, and unscrewing the chain—this has a right-hand thread.
6. Remove the left-hand locknut (and packing washers, if any; Note how many) and unscrew the cone.
7. Unscrew the right-hand ball-ring with the special C spanner, or by using a hammer and soft punch. If a punch is used, make sure it has a square end that will not damage the ball-ring or the ball-ring dust-cap. The ball-ring has a right hand thread. Once it is unscrewed, the complete internals can be withdrawn, the only part left in the hub-shell being the left-hand ball-cup. This need not be removed unless the ratchet and/or ball track is worn. When withdrawing the internals, hold the hub vertical, or the low-gear pawls, which are loose in the planet cage, may be lost.
8. Remove the pawls and hold the axle, sprocket-end uppermost, in the vice. Remove the right-hand locknut (washers, if any), the cone lock-washer, and unscrew the right-hand cone.
9. Lift off in the following order the parts below:
 - (a) Clutch spring.
 - (b) Driver and sprocket assembly.
 - (c) Right-hand ball-ring.
 - (d) Large thrust-spring.
 - (e) Pawl-retaining washer
 - (f) Pawl-ring with three pawls (These are loose and easily lost).

- (g) Gear-ring.
- (h) Thrust-washer.
- (j) Sliding-clutch.

10. Push the axle-key out, and the sleeve can then be slid off the axle.
11. Remove the pinion-retaining ring and the pinions, leaving the planet cage attached to the axle. This need not be removed, unless the planet-cage or axle is damaged or worn. (Check the sun-pinion on the axle). The planet-cage is secured to the axle by a special cone-shaped fixing plate or washer, which is spread with a special punch, so that it locates into a shallow groove in the axle. Between it and the planet-cage is a flat, hardened, washer which acts as a bearing-plate. If it is necessary to remove the planet-cage from the axle, fit the gear-ring on the planet cage, and stand the whole assembly gear ring down in the jaws of a partly-opened vice. Fit an axle-nut on to the end of the axle to protect the thread, and, with a hammer, drive the axle through the fixing washer. A new washer **must** be fitted on assembly. Remove any surplus metal which may be left adhering to the axle-groove.
12. As stated previously, the left-hand ball cup which is still in the hub-shell need not be removed, unless damaged or worn. This is removed in a similar manner to the right-hand ball ring, but it has a left hand thread. Mark and check on assembly, as with the right-hand ball ring.
13. The dust caps in the left-hand ball-cup and the driver can be prised out with a screwdriver to remove the ball-retainers and the bearing surfaces examined for wear. If the dust caps are damaged, fit new ones. They are pressed in, and the grooves face **outwards**. The dust caps on the cones are pressed on and their grooves face **inwards**. The back should be flush with the square on the cone.
14. The right-hand ball-ring has 24 $\frac{3}{8}$ in. diameter balls, which are held in place by the dust-cap. This can be prised off with a screwdriver; if damaged, replace. It may appear that there is a ball missing when reassembled, but not more than 24 balls should be fitted.
15. All parts should be thoroughly cleaned in paraffin, dried thoroughly and examined for wear or damage. The chief points to watch are:
 - (a) Pawls and ratchets for wear. All six pawls are identical, and may be reversed if one end is worn.
 - (b) Sliding-clutch and gear-ring splines. The corners should be square, not rounded off.
 - (c) The ends of the pinion pins on the planet cage where the clutch engages; these must not be worn or chipped.
 - (d) Pawl-ring dogs. (Corners should be sharp and square, not rounded off).
 - (e) Gear-ring dogs. (as (d)).
 - (f) Gear teeth on axle-pinion, the three planet pinions and the internal gear-teeth on the gear ring.
 - (g) All the ball races and the ball retainers (wear and pitting).

STURMEY-ARCHER SW 3-speed wide ratio hub gear

- (h) Check the axle for truth, stripped threads, etc.
- (i) Make sure that the sliding-clutch will move freely between the prongs of the driver.
- (j) Check sprocket-teeth for wear.
- (k) Examine the toggle-chain assembly for worn links, bent or damaged adjuster, or stripped threads at indicator end.
- (l) Check control wire and control for wear or rust.

ASSEMBLY

1. Fit the ball-retainers to the driver and ball-cup with the ring of the retainer facing outwards. This is important. Then fit the dust-caps, with the grooves facing outwards.
2. Fit 24 $\frac{3}{16}$ in. diameter balls to the right-hand ball-ring. Press on the dust-cap,

Trouble-Shooting Chart

Symptom	Fault	Remedy
Slipping in low gear	Worn: <ul style="list-style-type: none"> Planet-cage pawls LH Ball-ratchet 	Replace
Clicking in low gear	Faulty indicator adjustment.	Re-adjust
Slipping in normal gear only	Worn: <ul style="list-style-type: none"> Gear-ring splines Clutch-dogs 	Replace
Slipping in high gear only	Worn: <ul style="list-style-type: none"> Planet-cage pins Clutch-dogs 	Replace
Slipping in normal and high gears	Worn: <ul style="list-style-type: none"> Gear-ring pawls RH Ball-ring ratchet Pawl-ring dogs Gear-ring dogs 	Replace
Hub runs stiffly	LH cone too tight RH cone set incorrectly Rust, lack of oil, wrong type of oil Tight chain Chain stays not parallel Dust-caps rubbing Sprocket dust-cap rubbing 25 balls fitted to RH ball ring	Adjust Reset — see instructions Clean and re-oil Adjust Repair Replace Replace Fit 24 $\frac{3}{16}$ in. dia.
Sluggish gear change	Bent axle Worn-toggle-chain Guide pulley out of line Wire off pulley Frayed or rusty wire	Replace Replace Reset Refit Replace, oil
Bearings cannot be adjusted correctly, i.e. tight and slack at rim	Worn bearings Retainer broken Retainer fitted back to front	Replace Replace Replace correctly
Pedals rotate when wheeling cycle	LH and RH cone too tight	Adjust LH cone — if pedals still rotate, loosen LH cone then reset RH cone and readjust LH cone

The SturmeY-ArchER SW is a new product, and some time may elapse before any of these hubs come into dealers' hands for servicing. Care should be taken to file this servicing data sheet for future reference.

so that the balls will not fall out, and are free to rotate.

3. Screw the left-hand ball-cup into the hub shell at the side opposite to the lubricator. Remember that this is a left-hand, two-start, thread, and that the notch marked SA must line up with the previously marked spoke.
4. To assemble the planet cage to the axle, first screw a nut on to the right-hand end of the axle, so that about 1½ in. projects through. Hold the axle in the vice with the nut resting on top of the vice-jaws. This will protect the threads, if the axle should move in the vice. Next fit the planet-cage with the pinion-pins facing downwards, and then the hardened bearing plate. This is similar to a D washer, and the flat must locate on a corresponding flat on the axle. This is important. Next, slide the conical fixing-plate, concave side upwards on to the axle. For spreading this plate, the makers provide a hollow punch (No. DD 12403). This is a piece of $\frac{3}{4}$ in. diameter steel bar bored $\frac{1}{16}$ in. to a depth of 4½ in. and hardened. The tool is placed over the end of the axle, and a few sharp blows with a hammer will flatten the conical-plate into the groove in the axle. Make sure that the planet-cage will revolve freely. Remove the nut.
5. Fit the axle in the vice, LH end downwards; that is, with the planet-pins uppermost. Fit the three planet-pinions on the pins, and then the retaining ring.
6. Now fit in the following order the clutch-sleeve (flange facing down), axle key (flats facing upwards), sliding-clutch (recess down), and thrust-washer.
7. Fit gear-ring, and test for free rotation.
8. Smear a little grease in the pawl-pockets of the pawl ring, and fit this with the projections facing downwards. Fit the pawls into the pawl pockets, and fit the pawl-washer.
9. Fit right-hand ball-ring.
10. Fit the large thrust-spring on to the driver-prongs—the end of the spring should be central on one of the prongs.
11. Hold the spring on the driver, and fit both together. Keep the driver pressed down, so that the spring is compressed, and—at the same time—drop the clutch-spring over the axle and screw on the right-hand cone. The position of the right hand cone is very important; set it as described in the next paragraphs.
12. Screw the right-hand cone down finger tight **only** then slacken back half a turn, **not more**. Fit the cone lock-washer and any packing washers; then the locknut; and tighten up. Once set, this cone must not be disturbed. All bearing adjustments must be made by adjusting the left-hand cone only. When the RH cone and locknut are fitted and locked up, the gear unit should spin freely on the axle. There will be a slight amount of up and down play on the ball-ring. Oil all moving parts. The maker recommends RI All-Purpose oil.
13. Smear the planet-cage pawl-pockets with grease, and fit the three pawls. Re-

Supplement to Motor Cycle & Cycle Trader.
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move from the vice, and insert into hub shell. Be careful not to displace the pawls while doing this.

14. Now screw up the ball ring (right-hand thread) and tighten with the C spanner or with a punch. Make sure that the marked notch and marked spoke coincide; if they do not, refit.
15. Fit the left-hand cone, any packing washers and the locknut. Adjust the cone so that there is just a trace of play at the rim when the locknut is tight.
16. Finally, make sure that the small collar on the toggle-assembly is screwed up to the end of its thread. Then fit the indicator-rod into the left-hand end of the axle, and screw in the toggle assembly.
17. Fit to the machine and adjust the control as given previously; tighten the locknut.

TRACING FAULTS

Before dismantling hubs, always check the adjustment, as this is the likeliest cause of faulty operation. See that the indicator-rod is flush with the end of the axle when the lever is in normal (2nd gear). Check the control-wire for fraying and rusting inside the outer casing. Check the control for stiffness caused by damage or lack of oil. Check the cable-fulcrum stop and the pulley for tightness, as these may slide along the tube if not tight. The pulley must also be checked for alignment.

The next servicing data sheet in this series will deal with

VELOCETTE LE MOTOR CYCLE

and will be included in the issue dated
4 August, 1956.

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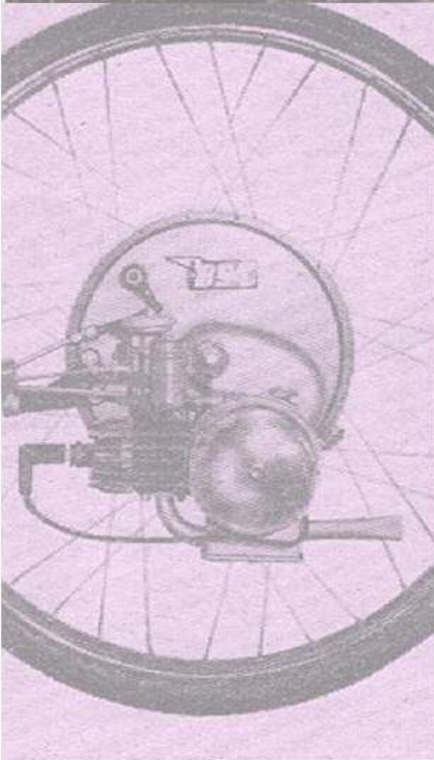
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