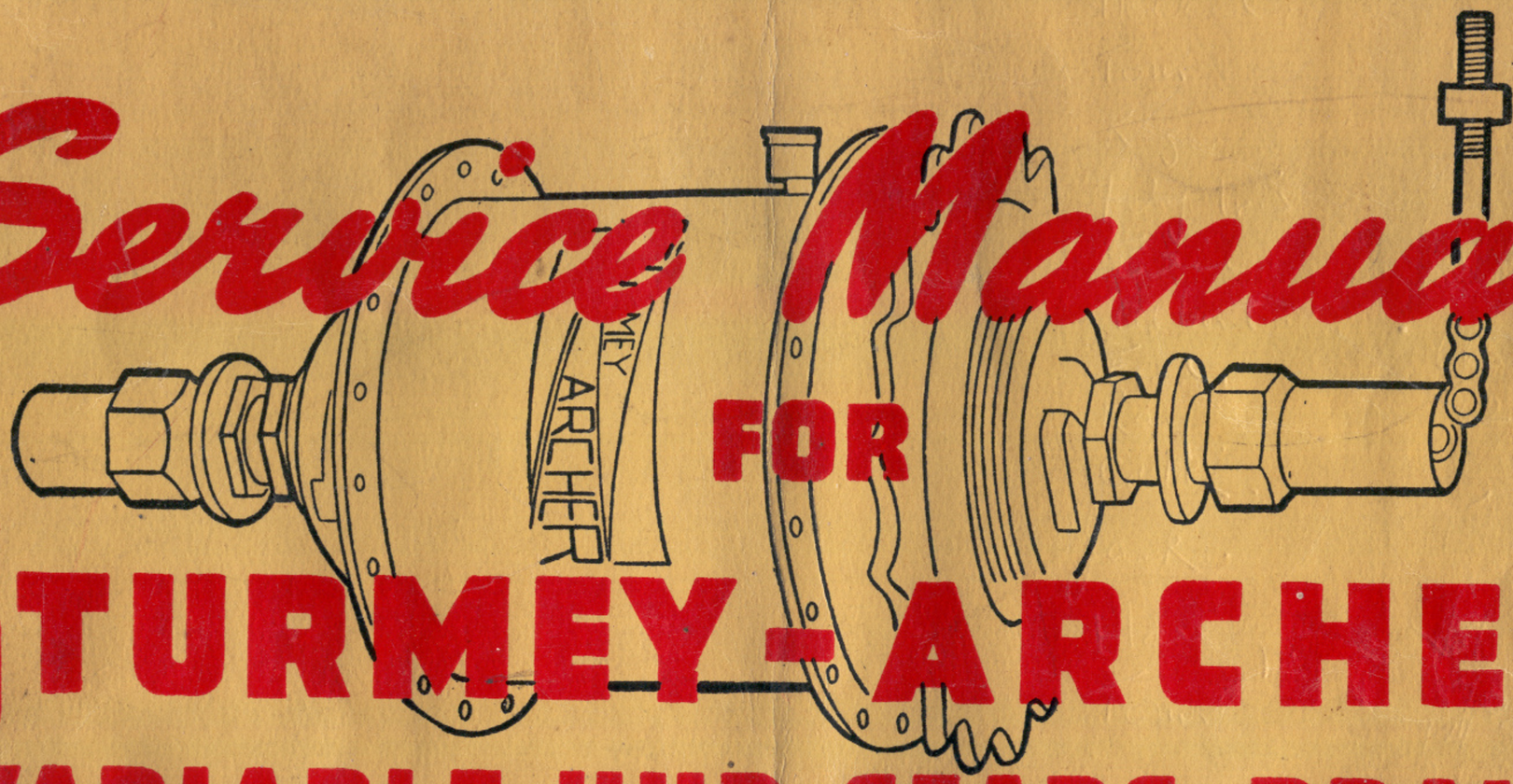
Service Manual

FOR



STURMEY-ARCHER

VARIABLE HUB GEARS, BRAKE HUBS AND DYNOHUBS

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FOR TRADE USE ONLY

FOREWORD

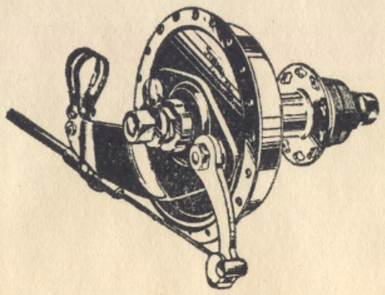
THERE is a complete range of Sturmey-Archer variable hub gears, brake hubs and Dynohubs which covers the requirements of all types of rider, but whatever the type of hub the method of dismantling and assembly is similar and is simple, providing the proper sequence is followed.

The booklet gives hints on the points to be looked for when trouble is experienced. Correct cone and gear adjustment and regular lubrication will avoid nearly all the troubles experienced in a hub, and these points cannot be too strongly emphasised.

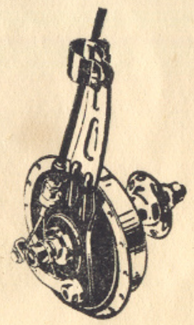
The epicyclic system has not been described because this is not necessary for the efficient servicing of the hub, but the method of operation can readily be followed from the diagrams. The information given is presented in as clear and simple a form as possible, and we trust will meet the requirements of the practical man.

A Complete Range of Hub Gears, Brakes, and Dynohubs

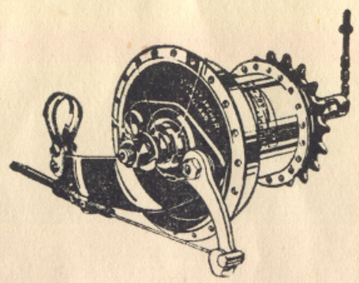
BRAKE HUBS



BRC Rear Single Speed Hub with hand operated internal expanding brake.

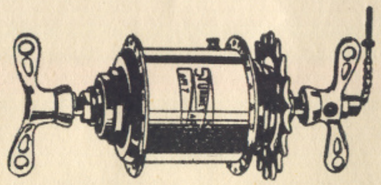


BFC Front Hub, incorporating hand-operated internal expanding brake.

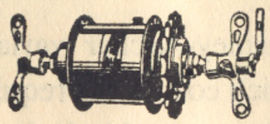


ABC Three-speed Wide Ratio incorporating hand-operated internal expanding brake.

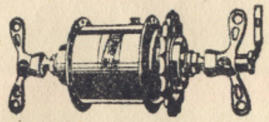
THREE-SPEED



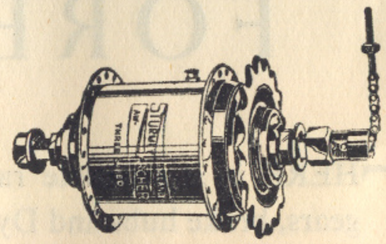
AM Three-Speed Medium Ratio, 15.55% increase, 13.46% decrease from Normal. Ideally suitable for Sports machines.



AC Three-speed Ultra Close Ratio; 6.66% increase and 7.7% decrease from Normal.

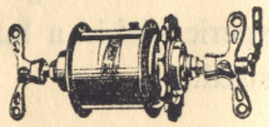


ASC The only three-speed fixed hub manufactured in the world to-day. 10% and 25% decrease from direct drive.

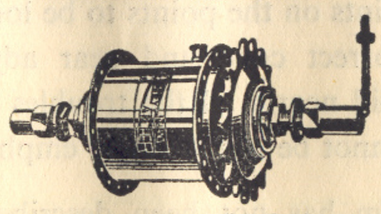


AW Three-speed Wide Ratio. 33.1/3% increase, 25% decrease from normal. Specially suitable for Roadster machines.

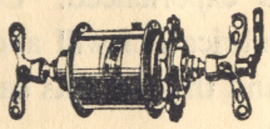
FOUR-SPEED



FM Four-speed Medium Ratio. 12.5% increase. 14.3% and 33.1/3% decrease from normal. Unquestionably the best all-round Club gear.

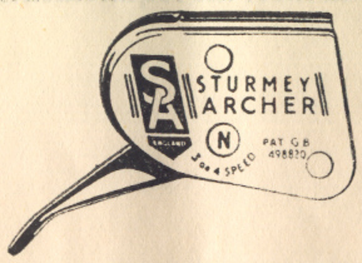


FW Four-speed Wide Ratio. The great advantage of this Hub as against the corresponding three-speed, lies in the fact that there are two normal gears. Ratios give 26.6% increase and 21% and 33% decrease from normal. There is no doubt that this is THE hub of the future, as far as Roadster machines are concerned.



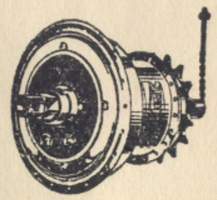
FC Four-speed Close Ratio. 9.1% increase, 10% and 25% decrease from normal. Specially designed for Massed Start Races.

Patent "Flick" Trigger Control.
The Sturmey-Archer Patent "Flick" Trigger Control provides an instantaneous change of gear by the flick of a finger.



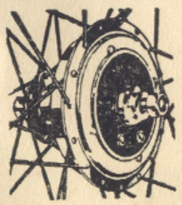
AM, ASC, AC, FM, FC. These hubs have the following exclusive refinements: ALLOY SHELL *except AM* —one-third the weight of steel. SPLINED SPROCKET—which enables you to alter gear range easily and quickly. WING NUTS. QUICK RELEASE FITTINGS.

DYNOHUBS



AG AW Wide Ratio three-speed hub, combined patent 6-volt Dynamo.

FG FW. Wide Ratio four-speed hub, combined patent 6-volt Dynamo Set. By combining the gear and Dynamo in one unit, a great saving in weight is made.



GH6 Patent 6-volt Dynohub. Like all our Dynohubs, it is completely *frictionless*,

HEADLAMP AND REAR LAMP
The headlamp is fully enclosed and of pleasing shape. It is supplied in either Black or Silver finish with Chrome rim. The Rear Light is unique in its simplicity and appearance.

DRYBATTERY UNIT
This is available with any of the Dynohubs illustrated above. It provides, with the aid of three batteries, a light when stationary.

STURMEY-ARCHER

The Original and Best

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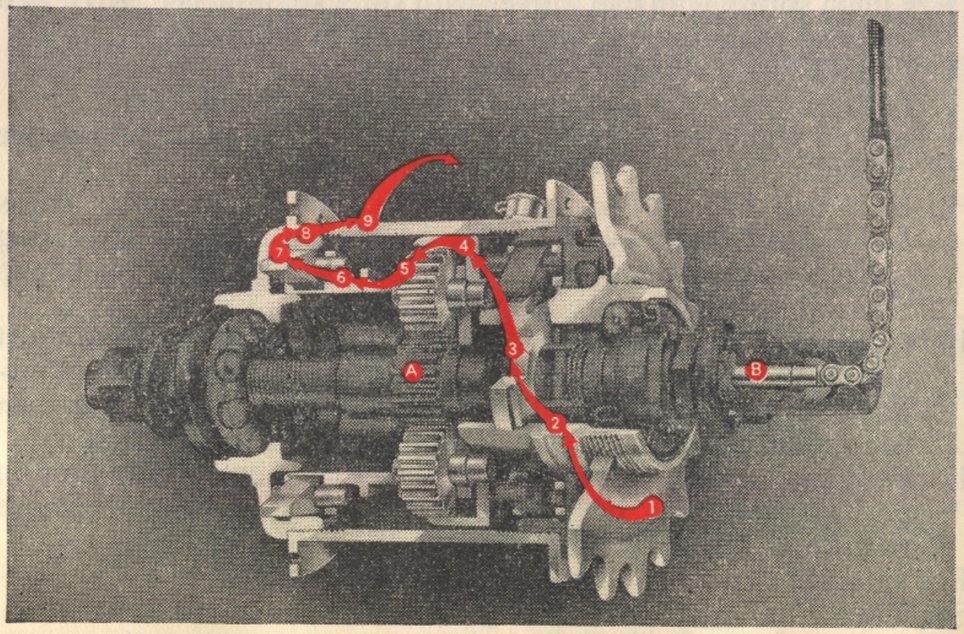
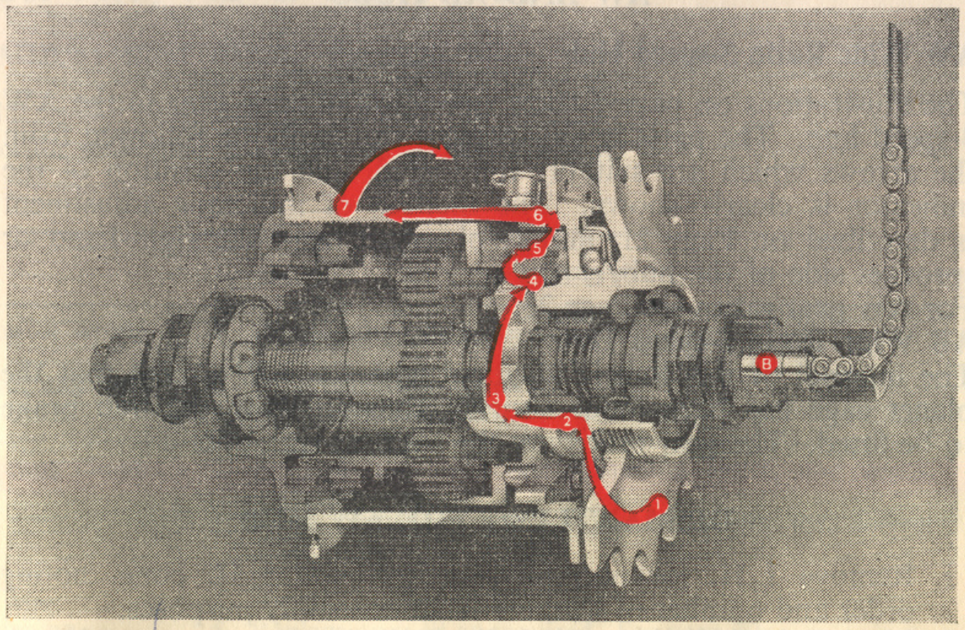
SEQUENCE OF OPERATION FOR STURMEY-ARCHER AW 3-SPEED WIDE RATIO GEAR



FIRST (Low) GEAR—Indicator (B) pulled to position shown in illustration.

SEQUENCE OF OPERATION

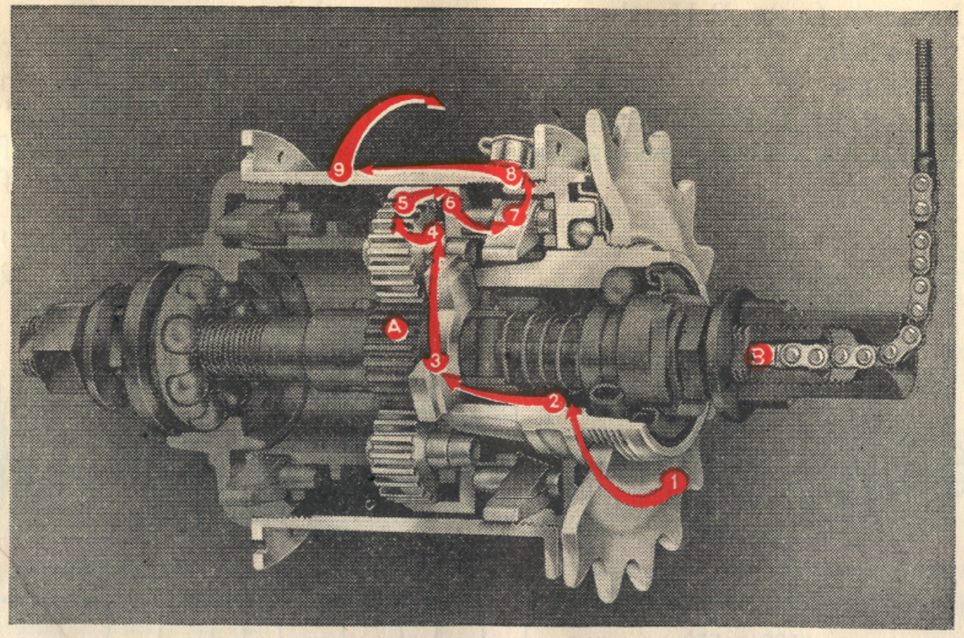
1, Sprocket. 2, Driver. 3, Sliding Clutch. 4, Gear Ring (Pawls in this part depressed by sliding clutch). 5, Planet Pinions. 6, Planet Cage. 7, L.H. Pawls. 8, L.H. Ball Cup. 9, Hub Shell.



SECOND (Normal) GEAR—Indicator (B) level with end of axle.

SEQUENCE OF OPERATION

1, Sprocket. 2, Driver. 3, Sliding Clutch. 4, Gear Ring. 5, Gear Ring Pawls. 6, R.H. Ball Ring. 7, Hub Shell. Note that the pinions, though revolving, are not in use.



THIRD (High) GEAR—Indicator (B) inside axle.

SEQUENCE OF OPERATION

1, Sprockets. 2, Driver. 3, Sliding Clutch. 4, Planet Pinion Pins. 5, Planet Pinions. 6, Gear Ring. 7, Gear Ring Pawls. 8, R.H. Ball Ring. 9, Hub Shell.

AW AND AB HUBS

AW Wide Ratio 3-speed Hub

The illustrations on page 5 show operation of each gear in the AW 3-speed hub. The parts in engagement can easily be followed from the arrows which are suitably numbered, and the position of the indicator is clearly shown. The method of indicator adjustment is described on Page 21, and is observed from the right-hand or sprocket side of the hub.

For AW gear ratios see Page 23.

AB Wide Ratio 3-speed Hub

The internal of this hub is identical with the AW except that the planet cage has been made shorter, thus allowing the hub brake to be fitted. The gear ratios are the same as the AW.

DISMANTLING THE AW HUB

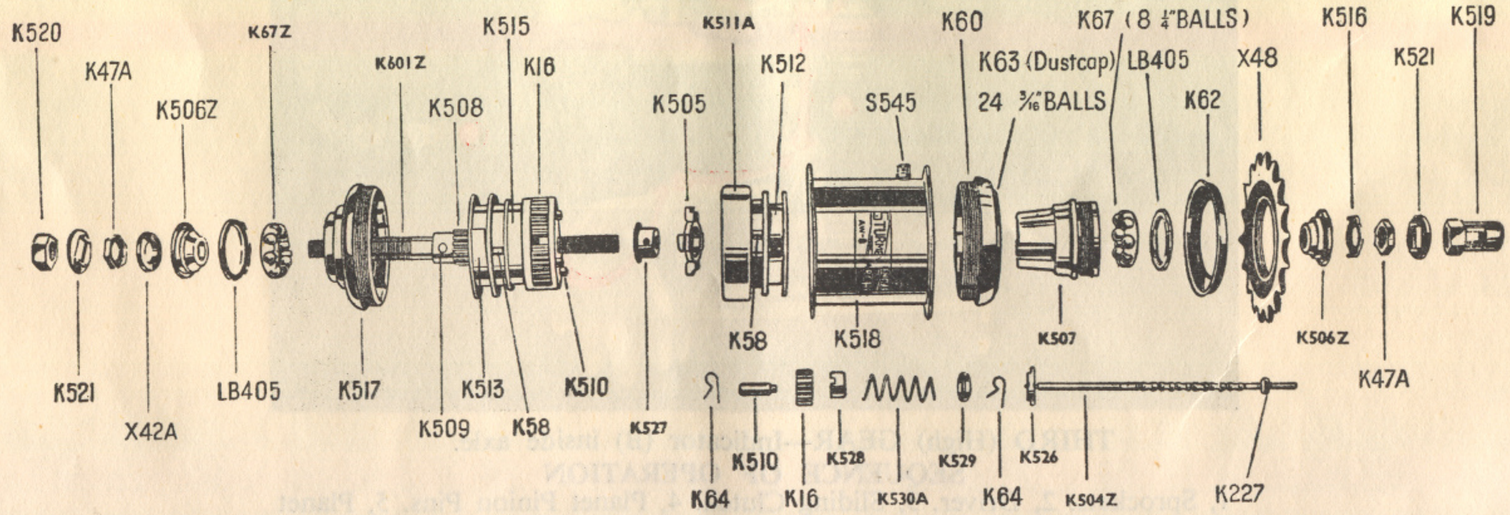
1. Remove L.H. locknut, any washers and L.H. cone, noting order and number of washers for re-assembly purposes.
2. Mark R.H. ball ring and shell. (Ball ring has two start thread, therefore, if these two marks do not register on re-assembly the ball ring has been started on the wrong thread and must be unscrewed and re-started correctly.) Loosen the R.H. ball ring by inserting a punch in one of the ball ring notches and giving it a sharp blow with a hammer (note R.H. thread); unscrew and withdraw internal from shell.
3. Remove low gear pawls, pins and springs.
4. Insert L.H. end of axle in vice and remove R.H. locknut, any other washers, cone lockwasher, and R.H. cone, noting the order for re-assembly purposes.
5. Clutch spring with cap, driver with sprocket attached, R.H. ball ring and gear ring can now be lifted off in that order.
6. Pull off thrust ring and unscrew indicator.
7. Push out axle key and remove sliding clutch and sleeve.
8. Lift off planet cage complete. Take out pinion pins and remove pinions.
9. L.H. ball cup may be removed from shell if necessary. It has *LEFT HAND* thread. There is no need to remove if bearing surface and ratchets are in satisfactory condition. Ball cup removal instructions are given on page 17.
10. Channel section dust caps in driver and L.H. ball cup are just a press-in fit and can be prised out (using a wide bladed screwdriver to prevent damage). It is usually best to fit a new dust cap should replacement of ball retainer and balls be necessary.
11. Pawl pins in the gear ring and planet cage are not secured in position and may be pushed out easily in order to remove pawls and springs for replacement.

For sprocket removal and setting chain line, see page 18.

See Fault-Finding Chart on page 7, for hints on trouble.

When examining the hub components the following points must be checked:—

i. Slide clutch up and down driver dogs to test for free movement.
ii. Note that the number of balls in the R.H. ball ring must be 24.
iii. Check gear ring for cracks and wear on internal splines and teeth.
iv. Check axle between centres for truth.
v. Check all races for pitting.
vi. Check sliding clutch for "nosing" of engagement arms.
vii. Examine all pinion teeth for wear or chipping.
viii. Examine pinion pin ends for wear.



FAULT-FINDING CHART FOR AW, AB & AG HUBS

FOR ANY FAULT CHECK INDICATOR ADJUSTMENT *FIRST*. See Pages 20/1

Faulty indicator is the prime cause of many of the faults detailed below, and should always be checked before dismantling. If the adjustment has been incorrect for some time, it is advisable to dismantle the hub and check for any damage.

SYMPTOM	FAULT	REMEDY
No low gear (1st).	1. Low gear pawls upside down or pointing in wrong direction. 2. Sliding clutch thrust collar not seating over axle key. 3. Incorrect axle spring.	1. Re-assemble pawls correctly. See pages 16/17. 2. Fit thrust collar correctly. 3. Fit correct axle spring.
Slipping in low gear (1st).	1. Low gear splines in gear ring and/or sliding clutch "nosed" off, due to bad adjustment. 2. Indicator not screwed home fully. 3. R.H. cone wrongly adjusted. 4. Bad trigger cable ends or kinks in trigger wire. 5. Twisted indicator chain through over-tightening.	1. Fit new gear ring and/or sliding clutch and adjust correctly. 2. Screw indicator home. See page 20 for correct adjustment. 3. Re-adjust R.H. cone. See page 21. 4. Fit new control cable. 5. Replace or re-fit as required. See page 20.
Fluctuating between low gear (1st) and normal gear (2nd).	1. Faulty or worn gear ring pawl.	1. Change both gear ring pawls.
Slipping in normal gear (2nd).	1. Gear ring dogs and/or sliding clutch "nosed" off due to bad adjustment. 2. Indicator not screwed home fully.	1. Fit new gear ring and/or sliding clutch. 2. Screw indicator home. See page 20.
Slipping in top gear (3rd).	1. Pinion pins or sliding clutch badly worn due to bad adjustment. 2. Very weak or distorted axle spring. 3. Incorrect R.H. cone adjustment. 4. Grit between clutch sleeve and axle.	1. Fit necessary new parts, and check adjustment. 2. Fit new spring. 3. Re-adjust. See page 22. 4. Clean away grit.
Hub runs stiffly. Drag on pedals when free-wheeling.	1. Too many balls in ball ring. 2. Cones excessively tight. 3. Chainstay ends not parallel. 4. Corrosion due to inferior oil or lack of lubrication. 5. Distorted dust caps.	1. Twenty-four balls only should be fitted. 2. Re-adjust cones. See page 21. 3. Correct chainstay ends. It is essential that the ends are parallel, otherwise the axle will be strained when the nuts are tightened and the internals may be seriously affected. 4. Clean hub thoroughly and use only R.I. "All Purpose" oil. 5. Check dust caps and replace those showing distortion or signs of binding.
Sluggish gear change.	1. Distorted axle spring. 2. Bent axle. 3. Worn toggle chain link. 4. Guide pulley out of line so that wire tends to ride up side of pulley flange. 5. Lack of lubrication of "Flick" control, or frayed control wire.	1. Replace spring. 2. Replace axle. 3. Replace indicator and chain. 4. Correct alignment of pulley on frame. 5. Lubricate control or replace wire.

ASSEMBLY

Prepare the following sub-assemblies in advance:—

(a) Fit ball cages into L.H. ball cup and driver, with ring of ball retainer facing outwards. The recess in the dust caps should also face outwards.

(b) Fit balls and retainer cap in R.H. ball ring; only 24 balls must be fitted.

(c) Fit pawls, pins and springs in gear ring. See page 17 for instructions on fitting.
NOTE.—Pawls, pins and springs in planet cage should be left until internal is completely assembled.

(d) Smear grease in channels of dust caps in L.H. ball cup, driver and recess in R.H. ball ring. These are the only points where grease may be used.

Main Assembly

1. Hold L.H. end of axle in vice (the slot for axle key will then be above the sun pinion) and fit planet cage. Add planet pinions and pins. Note small end of pin protrudes.
2. Fit sleeve, sliding clutch, axle key and thrust ring, ensuring that flat of key faces upwards; screw in indicator to hold in correct position, then fit thrust ring. Be sure that the flatted ends of key are properly engaged in slots of thrust ring.
3. Fit gear ring complete, R.H. ball ring and driver.
4. Drop clutch spring over axle, then fit cap and screw up R.H. cone finger tight; slack back half a turn, lock in this position with special washer and locknut (see page 21). Note that slacking the cone back too far will affect the gear engagement.
5. Fit low gear pawls as explained on page 16.
6. Remove from vice and pour about two teaspoonfuls of oil into the planet cage, holding cage uppermost.
7. See that L.H. ball cup is fitted in shell (remember that this has L.H. thread) then hold wheel in left hand and insert complete internals from below. Screw up R.H. ball ring finger tight and examine to make sure that marks on ball ring and shell flange are in register before finally tightening up.
8. Fit L.H. cone and locknut. Adjust hub bearing as detailed on page 21. Add any special washers as noted under No. 4 of "Dismantling".
9. If sprocket has been removed from driver, fit outer dust cap over driver before fitting sprocket. See that dust cap is properly centred—there is a small shoulder on the flange of the driver over which it must fit—and screw on sprocket. See note on page 18 on obtaining correct chain line.

Indicator adjustment after re-fitting to machine is dealt with on page 20.

DISMANTLING THE AB HUB

Dismantling and re-assembly is identical to AW except that after first operation (removal of L.H. lock ring and cone adjusting washer) the hub brake anchor plate complete is removed. Then proceed as detailed for AW.

For AW and AB gear ratios, see page 23.

For details of hub brake, see page 22/3.

FW WIDE RATIO 4-SPEED HUB

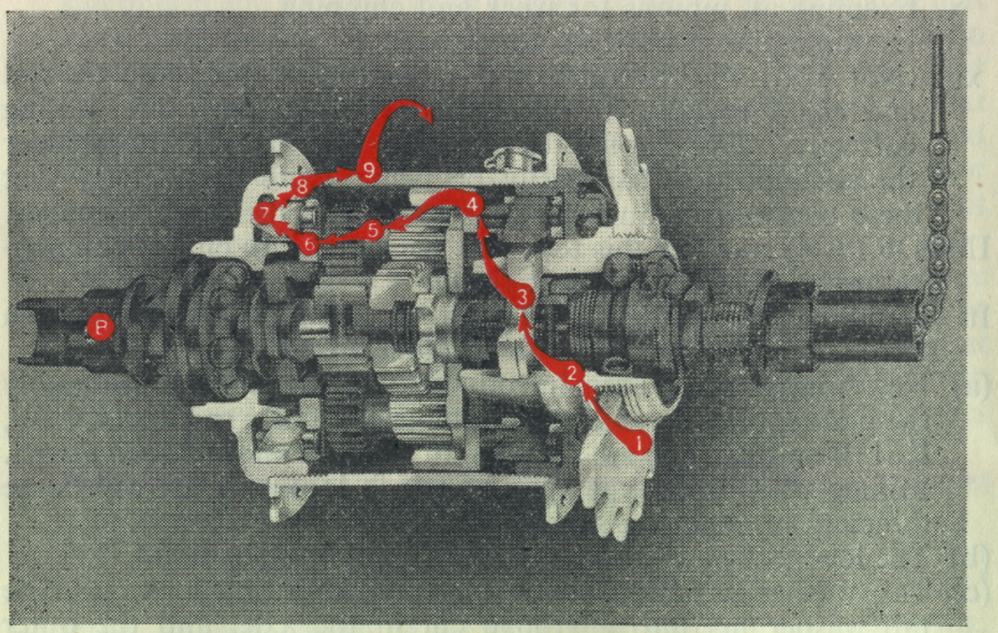
The illustrations on page 9 show operation of each gear in the FW 4-speed hub. The parts in engagement can be followed easily from the arrows which are suitably numbered, and the position of the indicator is clearly shown. The method of indicator adjustment is described on page 21 and is observed from the L.H. side of the hub (opposite side to sprocket).

For FW gear ratios, see page 26.

DISMANTLING THE FW AND AM HUB

1. Remove indicator by holding L.H. end of rod and unscrewing chain.
2. Remove L.H. locknut, any washers and L.H. cone, noting order and number of washers for re-assembly purposes.
3. Mark R.H. ball ring and shell (ball ring has two start thread, therefore, if these two marks do not register on re-assembly, the ball ring has been started on the wrong thread and must be unscrewed and started correctly). Loosen R.H. ball ring by inserting a punch into one of the ball ring notches and giving it a sharp blow with a hammer (Note, R.H. thread,) unscrew and withdraw internal from shell.
4. Insert L.H. end of axle in vice and remove R.H. locknut, any other washers, cone lock washer and cone, noting order for re-assembly purposes.
5. The clutch spring, with cap, driver, R.H. ball ring and gear ring can now be lifted off in that order.
6. The thrust ring is then removed and axle key pushed out so allowing clutch sleeve and sliding clutch to be removed.
7. Push out pinion pins and remove pinions and planet cage.
8. (Not AM.) Remove from vice. The internal compensating spring, complete with collar can now be taken out of R.H. end of axle.
9. (Not AM.) Insert R.H. end of axle in vice and remove nut and locking washer holding the internally toothed dog ring, and remove dog ring from axle.
10. (Not AM.) By pushing the two sun pinions along so that the large one engages the axle dogs, the sleeve under the small one should be moved in opposite direction to expose second axle key which can now be pushed out.

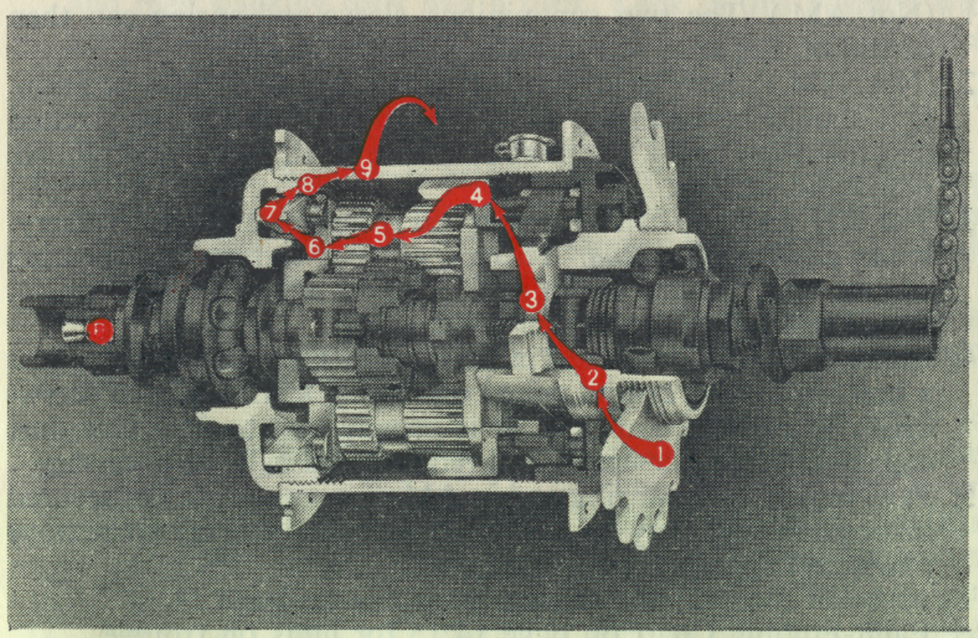
SEQUENCE OF OPERATION FOR STURMEY-ARCHER FW 4-SPEED WIDE RATIO GEAR



FIRST GEAR (Low)—Indicator (B) pulled inside the axle.

SEQUENCE OF OPERATION

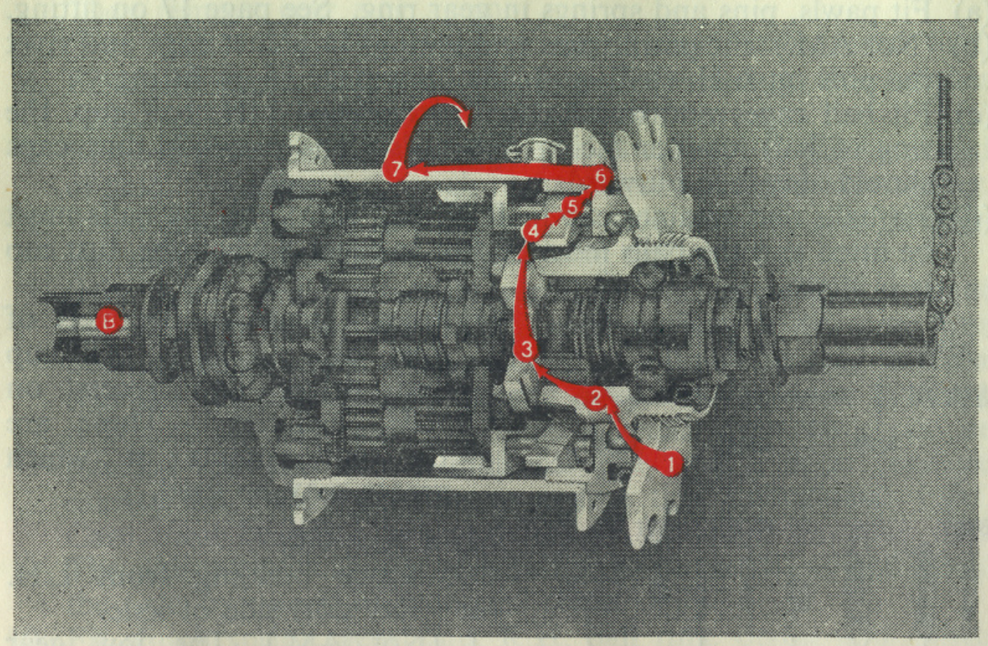
1, Sprocket. 2, Driver. 3, Sliding Clutch. 4, Gear Ring (Pawls in this part depressed by sliding clutch). 5, Planet Pinions. 6, Planet Cage. 7, L.H. Pawls. 8. L.H. Ball Cup. 9, Hub Shell. (Note that larger Sun Pinion is locked to the axle.)



SECOND GEAR—Indicator (B) level with end of axle.

SEQUENCE OF OPERATION

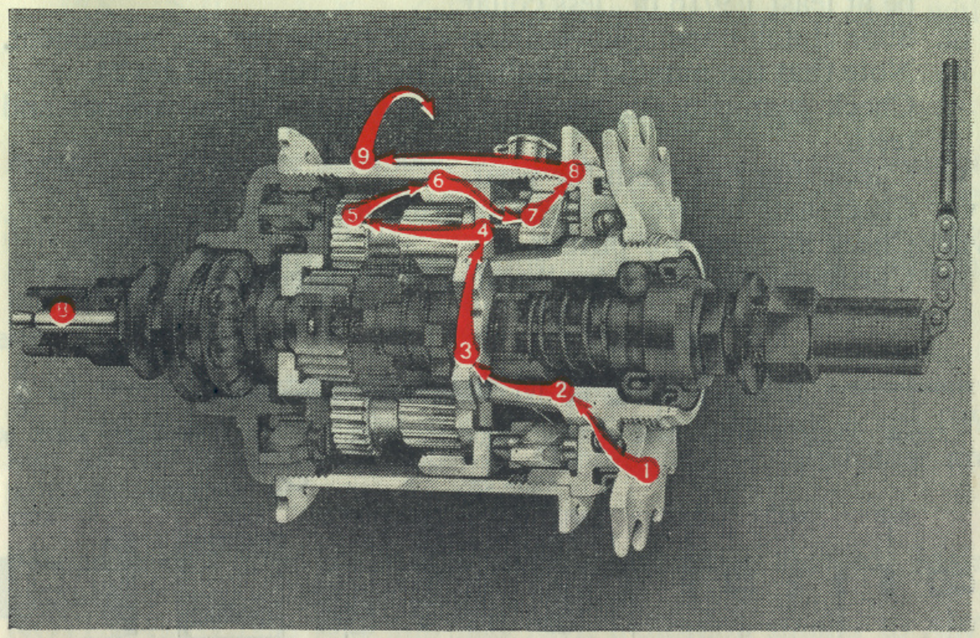
1, Sprocket. 2, Driver. 3, Sliding Clutch. 4, Gear Ring (Pawls in this part depressed by sliding clutch). 5, Planet Pinions. 6, Planet Cage. 7, L.H. Pawls. 8, L.H. Ball Cup. 9, Hub Shell. (Note that smaller Sun Pinion is locked to the axle.



THIRD GEAR—First shoulder of Indicator (B) level with end of axle.

SEQUENCE OF OPERATION

1, Sprocket. 2, Driver. 3, Sliding Clutch. 4, Gear Ring. 5, Gear Ring Pawls. 6, R.H. Ball Ring. 7, Hub Shell. (Note that the pinions, though revolving, are not in use.)



FOURTH GEAR (High)—Indicator (B) projecting 15/32 in. out of axle.

SEQUENCE OF OPERATION

1, Sprocket. 2, Driver. 3, Sliding Clutch. 4, Planet Cage Dogs. 5, Planet Pinions. 6, Gear Ring. 7, Gear Ring Pawls. 8, R.H. Ball Ring. 9, Hub Shell. (Note that smaller Sun Pinion is locked to the axle.)

11. (Not AM.) The two sun pinions, sleeve and spring can then be slid off the axle, so completing dismantling.
12. (Not AM.) Low gear pawl pins are rivetted into position. If it should be necessary to remove them, first file the rivetted part flat, then knock out pawl pins with small punch and remove pawls and springs.
13. The L.H. ball cup can be unscrewed from hub shell if necessary. It has a *left hand thread*. There is no need to remove if bearing surface and ratchets are in satisfactory condition. Ball cup removal instructions are given on page 17.
14. Channel section dust caps in driver and L.H. ball cup are just a press-in fit and can be prised out (using a wide-bladed screwdriver to prevent damage). It is usually best to fit a new dust cap should replacement of ball retainer and balls be necessary.
15. Pawl pins in the gear ring and in AM planet cage are not secured in position and may be easily pushed out in order to remove pawls and springs for replacement.

For sprocket removal and setting chain line see page 18.
See Fault-Finding Chart on page 14/15 for hints on trouble.
When examining the hub components the following points must be checked:—

i. (Not AM.) Compensator spring should drop freely through axle.
ii. (Not AM.) Check length of compensator spring which should be at least 1 9/16 in., less collar.
iii. Slide clutch up and down driver dogs to test for free movement.
iv. Note that the number of balls in the ball ring must be 24.
v. Check gear ring for cracks and wear on internal splines and teeth.
vi. Check dog ring teeth for wear.
vii. Check axle between centres for truth and dogs for wear.
viii. Check all races for pitting.
ix. Check sliding clutch for "nosing" of engagement arms.
x. Examine all pinions for wear and chipping.
xi. Examine pinion pin ends for wear.
xii. (Not AM.) Fix X8 collar on to indicator rod and screw the rod and chain together to check that the two parts are mating correctly. This should be done in the axle as the slender threaded portion can easily be bent. Note particularly that these two parts should not be screwed together without collar.

IMPORTANT.—After this test, refit X8 collar into end of compensator spring. It must be a tight fit.

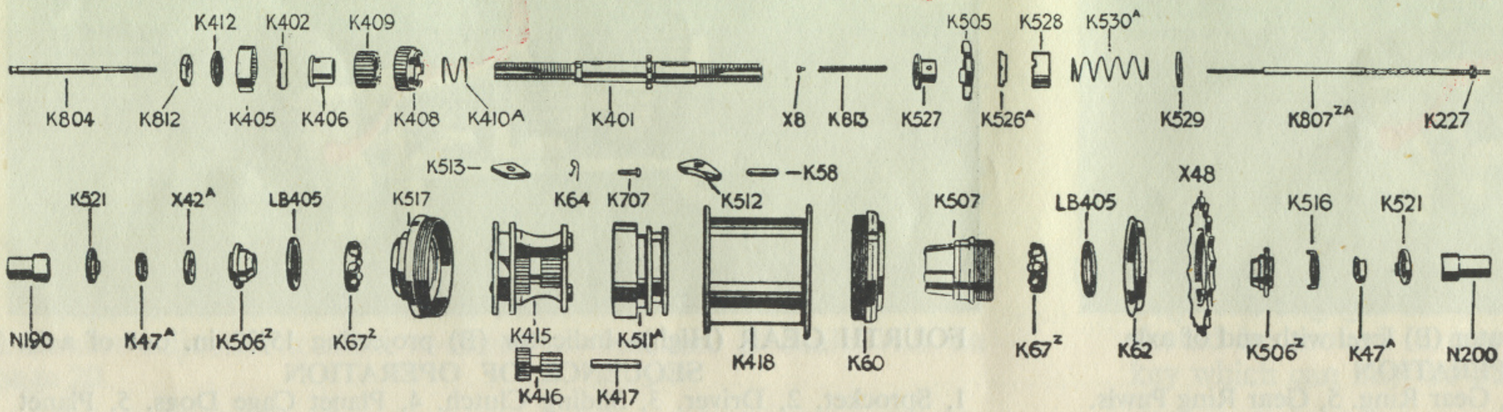
It should be noted that the following modifications have been carried out since the FW hub was first produced.

(a) New springs have been introduced which reduce considerably the pull required to engage bottom gear. These springs (K410B, K813B and K530B) are supplied in sets and *must be used in sets*. Mixing with older type springs, which look similar, will cause difficulty in engaging gears.
(b) The low gear pawl pins are now rivetted into position.
(c) Tab washer has been added to secure dog ring locknut. The tab washer fits into a groove cut in the axle, and the outer edge is turned over one of the flats on the locknut, therefore, the tab washer can only be used with grooved axle.

ASSEMBLY OF THE FW AND AM HUBS

The following sub-assemblies should be prepared first:—

(a) Fit pawls, pins and springs in gear ring. See page 17 on fitting.
(b) (Not AM.) Fit pawls, pins and springs in planet cage and rivet the pins on L.H. (ball cup) side. See page 16 on fitting.
(c) Fit ball cages and dust caps in driver and L.H. ball cup, the ring of ball retainer facing outwards. The recess in dust caps should also face outwards.
(d) Fit balls and retainer cap in R.H. ball ring; only 24 balls must be fitted and the balls must be free to revolve when the dust cap is in place.



(e) Smear grease in channels of dust caps in L.H. ball cup and driver and recess on R.H. ball ring. These are the only points at which grease may be used.

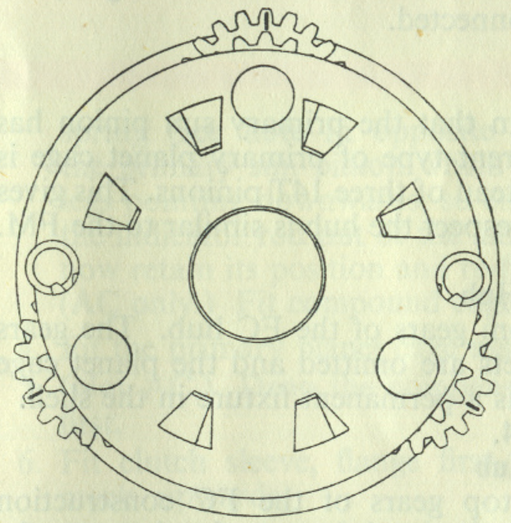
Main Assembly

Commence building from L.H. (or short slot) side of axle.

1. (Not AM.) The low gear spring (see note on page 13 regarding springs), primary

sun pinion and secondary sun pinion are slid on to the axle in that order and pushed along until the dogs engage. Holding them thus, withdraw secondary sun pinion sleeve until low gear keyhole is exposed and insert low gear key, making sure that both keyhole and axle bore are in line. Release the pinions and they will spring back, so securing the key. Using the indicator rod, check that the hole in low gear key is still in alignment with axle bore.

2. Fit dog ring so that it engages on to the axle square, and secure with washer and nut, spanner tight, finally turning down one edge of lockwasher over flat of locknut to secure it. (Note that earlier hubs may not be fitted with the tab lockwasher.) Drop indicator rod down axle to check that end of indicator comes level with end of axle.
3. Hold axle vertically in vice by flats on L.H. end and put planet cage in place.
4. The double planet pinions and pins are next fitted so that they engage with the two sun pinions. The marked teeth should point radially outwards in each case as shown on drawing, or hub will not be "timed" correctly. Note also that only three teeth of small end of each planet pinion are visible over end of planet cage. (See illustration in next column.) To check that timing has been done correctly, engage gear ring with pinions and rotate several times. It should rotate quite freely. Then remove gear ring again.
5. (Not AM.) Drop compensator spring down axle, collar first.
6. Fit clutch sleeve, sliding clutch, key and thrust ring. The notches on thrust collar must engage with flats on key.
7. Remove from vice. Insert chain and coupling in right hand end of axle, threading it through main key and compensator spring.
8. Insert indicator rod in L.H. end of axle, threading it through low gear key and compensator spring collar.
9. (Not AM.) Hold assembly vertically and press L.H. end of axle and indicator rod against a solid surface, at the same time pressing down on the sliding clutch. It will now be easy to screw together the indicator, chain and coupling. As soon as chain is felt to be fully screwed home a *small* screwdriver can be inserted into the slot in indicator rod, and a slight pressure exerted on indicator chain to ensure that indicator is tight. Care must be taken not to twist off the small threaded end. The sliding clutch should now be free to be moved up and down the axle by means of indicator chain.
10. Fit clutch spring, gear ring, R.H. ball ring, driver and clutch spring cap, in that order.
11. The R.H. Cone is now fitted by screwing it down finger tight and then slacking back half a turn. Lock in this position with special washer and locknut (see page 21). Note that slacking back cone too far will affect gear engagement.
12. *AM only*. Fit low gear pawls as explained on page 16.
13. Pour about two teaspoonfuls of oil into the working parts.
14. See that L.H. ball cup is fitted in shell (remember that this cup has L.H. thread). The complete gear internal is then inserted into hub shell and R.H. ball ring screwed up tightly. Ascertain that the two marks on ball ring and shell coincide.
15. Fit L.H. cone, washer and locknut. Adjust hub bearings as detailed on page 21. Add any special washers as noted under No. 4 of "Dismantling".



16. If sprocket has been removed from driver, fit outer dust cap over driver before fitting sprocket. See that dust cap is properly centred —there is a small shoulder on the flange of the driver over which it must fit— and screw on sprocket. See note on page 18 on obtaining correct chain line.

Indicator adjustment after refitting to machine is dealt with on page 21.

AM MEDIUM RATIO 3-SPEED HUB

Apart from the axle assembly, this hub is identical in construction to the FW, but there is only one sun pinion cut solid with the axle. The gears are obtained in exactly the same way as the top three gears in the FW, although the ratios differ because of the different number of teeth on the pinions and gear ring.
For AM gear ratios see page 24.

DISMANTLING AM HUB

The AM hub is dismantled in exactly the same manner as the FW hub as far as operation No. 7. Operations not applicable are suitably marked.

ASSEMBLING AM HUB

Sub-assemblies given under FW apply except where marked. Main assembly is also suitably marked.
NOTE.—Early type AM hub had R.H. indication similar to AW. In this case, items 5, 6 and 7 are omitted and item 2 from AW assembly on page 8 is inserted in their place.

FM, FC, ASC, AND AC HUBS

FM Medium Ratio 4-speed Hub

High, normal and low gears are obtained in exactly the same way as described for the AW hub, except that the primary sun pinion is rotated by a secondary gear train to reduce the variation between the gears. The secondary gear train consists of a fixed secondary sun pinion, gear teeth cut into the L.H. ball cup and planet pinions attached to a planet cage which rotates the primary sun pinion through medium of the low gear dog.

In bottom gear the primary sun pinion is disengaged by low gear dog from secondary gear train, and fixed to the axle by dogs, and the gear train is then exactly the same as the FW bottom gear, the secondary gear train being disconnected.

For FM gear ratios see page 26.

FC Close Ratio 4-speed Hub

This hub differs from the FM in that the primary sun pinion has 20T instead of 30T, and a different type of primary planet cage is fitted, using four 20T pinions instead of three 14T pinions. This gives closer ratios, but in every other respect the hub is similar to the FM.

For FC gear ratios see page 25.

ASC Close Ratio 3-speed Fixed Hub

This hub utilises the three bottom gears of the FC hub. The gears being fixed, all pawls and ratchets are omitted and the planet cage is splined to the ball cup which is a permanent fixture in the shell.

For ASC gear ratios see page 24.

AC Ultra-close Ratio 3-speed Hub

This hub uses only the three top gears of the FC construction and as there is no need here to disengage the connection between the secondary planet cage and the main sun pinion, these two parts are made all in one piece which we call the compound cage. The FC axle is used, but the smaller slot is not utilised and the AM type of indicator is fitted. The secondary planet pinions are the usual 20T size as fitted in our AW hubs, and the special secondary sun pinion also has only 20T

For AC ratios see page 25.

DISMANTLING FM, FC, ASC AND AC HUBS

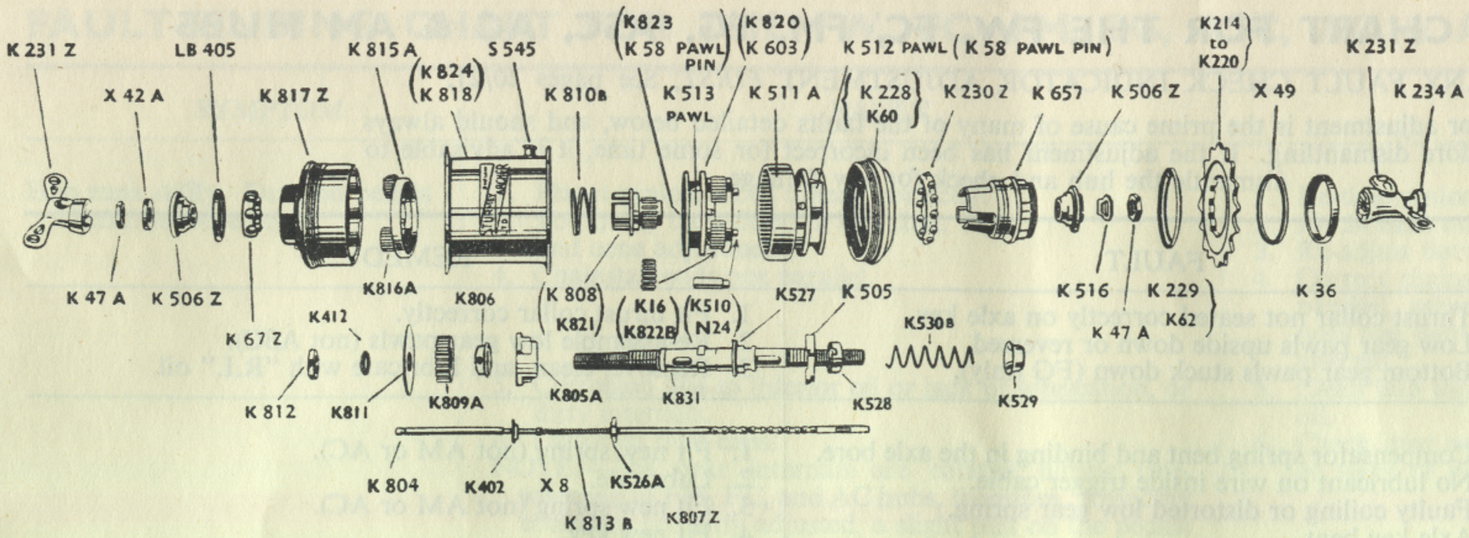
1. Remove L.H. locknut, any washers and L.H. cone, noting order and number of washers for re-assembly purposes.
2. Mark R.H. ball ring and shell (ball ring has two start thread, therefore, if these two marks do not register on re-assembly, the ball ring has been started on the wrong thread and must be unscrewed and re-started correctly). Loosen R.H. ball ring (R.H. thread) by inserting a punch into one of the ball ring notches and giving it a sharp blow with a hammer (Note, R.H. thread); unscrew and withdraw internal from shell.
3. Unscrew and withdraw indicator rod and chain.
4. Insert L.H. end of axle in vice and remove R.H. locknut, any other washers, lockwasher and cone, noting order for re-assembly purposes.
5. The driver, ball ring, gear ring, axle spring and cap can now be lifted off in that order.
6. The thrust ring is then removed and the axle key pushed out, so allowing clutch sleeve and sliding clutch to be removed.
7. Take off planet cage assembly, sun pinion, low gear spring, low gear clutch and intermediate planet cage and pinions in that order. (Planet cage assembly and compound cage and pinions—AC only.)
8. (Not AC.) Remove axle from vice. Compensator spring can now be slipped out of axle.
9. Hold sprocket end of axle in vice and take off L.H. locknut, locating plate, secondary sun pinion, low gear key and clutch sleeve. (No key or sleeve in AC.)
10. (Not ASC.) The L.H. ball cup may then be extracted from shell if necessary, by means of Tool GD514. See instructions for use on page 17.
11. Channel section dust caps in driver and L.H. ball cup are just a press-in fit and can be prised out (using a wide-bladed screwdriver to prevent damage). It is usually best to fit a new dust cap should replacement of ball retainer and balls be necessary.
12. Pawl pins in the gear ring and planet cage are not secured in position and may easily be pushed out in order to remove pawls and spring for replacement.

See Fault-Finding Chart on pages 14/15 for hints on trouble.

For sprocket removal and setting chain line, see page 18.

When examining the hub components the following points must be checked:—

1. (Not AC.) Compensator spring should drop freely through axle.
2. (Not AC.) Check length of compensator spring which should be at least 1 9/16 in., less collar.
3. Slide clutch up and down driver dogs to test for free movement.
4. Note that the number of balls in the ball ring must be 24.
5. Check gear ring for cracks and wear on internal splines and teeth.
6. (Not AC.) Check low gear dog splines for wear.
7. Check axle between centres for truth. Examine dogs for rounding off.
8. Check all races for pitting.
9. Check sliding clutch for "nosing" of engagement arms.
10. Examine all pinions for wear or chipping.
11. Examine planet cage dogs or ends of pinion pins for wear.
12. Fix X8 collar on to indicator rod and screw the rod and chain



together to check that the parts are mating correctly. This should be done in the axle as the slender threaded portion can easily be bent. Note particularly that these two parts should not be screwed together without collar.

IMPORTANT.—After this test, re-fit X8 collar into end of compensator spring. It must be a tight fit.

ASSEMBLY OF FC, FM, ASC, AND AC GEARS

Prepare the following sub-assemblies in advance:—

(a) Fit ball cages into L.H. ball cup and driver, with ring of ball retainer facing outwards. The recess in the dust caps should also face outwards.

b) Fit balls and retainer cap in R.H. ball ring; only 24 balls must be fitted.

(c) (Not ASC.) Fit pawls, pins and springs in gear ring. See page 17 for instructions on fitting.

(d) (AC only.) Fit pawls, pins and springs to planet cage. See page 16 for instructions on fitting.

(e) Smear grease in channels of dust caps in L.H. ball cup, driver and recess in R.H. ball ring. These are the only points where grease may be used.

MODIFICATION TO FM AND FC HUBS

It should be noted that we have introduced new springs which reduce considerably the pull required to engage bottom gear. These springs (K810B, K813B and K530B) are supplied in sets and *must be used in sets*. Mixing with older type springs, which look similar, will cause difficulty in engaging gears.

Main Assembly

1. (Not AC.) Hold axle in vice with small slot uppermost and fit low gear clutch sleeve (with its flange on top).
2. (Not AC.) Slip the small low gear key through holes of low gear clutch sleeve, taking care to see that hole through key is in line with bore of axle; hold the key temporarily in position by dropping indicator rod down axle and through key.
3. (Not AC.) Reverse axle, holding indicator rod in position with finger. Fit the low gear clutch on to axle (the four dogs pointing downwards) followed by the large low gear spring (see note in opposite column regarding springs) and the primary sun pinion which is also fitted with its four large legs pointing downwards, so engaging the low gear clutch. Slip the indicator rod out of the axle as the low gear clutch key will now retain its position and re-fit in vice.
   (AC only.) Fit compound cage complete.
4. Fit the primary planet cage assembly.
5. (Not AC.) Drop the compensator spring into the axle, collar first.
6. Fit clutch sleeve, flange first, and the sliding clutch; "S.A." mark upwards.
7. Fit the axle key through the clutch sleeve by lifting up the clutch sleeve and clutch until they are at the top of the long axle slot. The axle key will then slip easily through clutch sleeve. Care must be taken that the two flats on the key face upwards.
8. Fit the indicator coupling, passing rod down axle, through axle key and into compensator spring (no spring in AC). It is important that the indicator coupling is always fitted before the indicator rod. The axle assembly is now removed from vice and indicator rod pushed into low gear end of axle; the axle assembly must then be pressed down on a flat surface to force indicator rod into axle, at the same time pressing down on the sliding clutch. The indicator chain can then easily be rotated to screw indicator chain and rod together. The indicator rod can now be held by a *small* screwdriver and a *slight* extra pressure exerted on the indicator chain to make sure that both indicator and rod are fully screwed together. Care must be taken not to twist off the small threaded end.

FAULT-FINDING CHART FOR THE FW, FC, FM, FG, ASC, AC & AM HUBS

FOR ANY FAULT CHECK INDICATOR ADJUSTMENT *FIRST*, See pages 20/21.

Faulty indicator adjustment is the prime cause of many of the faults detailed below, and should always be checked before dismantling. If the adjustment has been incorrect for some time, it is advisable to dismantle the hub and check for any damage.

SYMPTOM	FAULT	REMEDY
No bottom gear.	1. Thrust collar not seated correctly on axle key. 2. Low gear pawls upside down or reversed. 3. Bottom gear pawls stuck down (FG only).	1. Fit thrust collar correctly. 2. Re-assemble low gear pawls (not ASC). 3. Remove, clean, and lubricate with "R.I." oil.
Difficulty in engaging bottom gear. NOTE.—This must not be confused with the fact that a stronger pull on the control wire is necessary to engage low gear than for high and middle gears.	1. Compensator spring bent and binding in the axle bore. 2. No lubricant on wire inside trigger cable. 3. Faulty coiling or distorted low gear spring. 4. Axle key bent.	1. Fit new spring (not AM or AC). 2. Lubricate. 3. Fit new spring (not AM or AC). 4. Fit new key.
Slips in bottom gear.	1. Bad trigger cable ends or kinks in trigger wire. 2. Compensator spring bent. 3. Faulty coiling of low gear spring. 4. Incorrectly fitted pawl springs.	1. Fit new control cable. 2. Fit new spring which should not be less than $1\frac{9}{16}$ in. overall (not AM or AC). 3. Fit new spring (not AM or AC). 4. Fit pawl springs correctly. See page 16 (not ASC).
Slips in 2nd gear in 4 speeds.	1. Compensator spring set too short.	1. Fit new compensator spring (not AM or AC).
Alternates between bottom or low gear and normal.	1. Faulty gear ring pawls.	1. Fit new pawls (not ASC).
Slips in low and top gears.	1. Dog ring locknut loose (FW and FG only). 2. Secondary sun pinion locknut loose. FM, FC, ASC. and AC only. 3. Weak low gear spring (FW only). 4. Dog ring teeth worn (FW only).	1. Examine dog ring teeth for damage. Tighten locknut. 2. Tighten locknut. 3. Fit new spring (K410B). 4. Fit new dog ring.
Slips in normal gear.	1. Gear ring and sliding clutch worn due to bad adjustment.	1. Fit new parts, and check clutch spring.
Slips in top gear.	1. Planet cage dogs and clutch worn due to bad adjustment or very weak clutch spring. 2. Incorrect R.H. cone adjustment. 3. Tight clutch spring or dirt clogging spring action.	1. Fit new parts, check clutch spring and re-adjust. 2. Re-adjust correctly. See page 21. 3. Clean hub and/or fit new clutch spring.

FAULT-FINDING CHART FOR THE FW, FC, FM, FG, ASC, AC & AM HUBS—Contd.

SYMPTOM	FAULT	REMEDY
Hub runs stiffly. Drag on pedals when free-wheeling.	1. Planet pinions not "timed" correctly. 2. Too many balls fitted in ball ring. 3. Bad cone adjustment. 4. Chainstay ends not parallel. 5. Corrosion due to inferior oil or lack of lubrication, or dirty internals. 6. Distorted dust caps. NOTE.—The gear internals are rotated during free-wheeling in FM, FC, and AC hubs, therefore, providing cones are properly adjusted, a slight pull on the pedals and possibly rotation during freewheeling is in order.	1. Re-time pinions. See page 11 (FW, FG and AM only). 2. Fit 24 balls only. 3. Re-adjust both cones. See page 21. 4. Correct chainstay ends. It is essential that the ends are parallel, otherwise the axle will be strained when the nuts are tightened and the internals may be seriously affected. 5. Clean hub thoroughly, and use only R.I. "All Purpose" oil. 6. Check dust caps and replace those showing distortion or signs of binding.
No gear at all.	1. Indicator rod broken or very nearly unscrewed. 2. Pawls stuck by incorrect oil.	1. Fit indicator rod and re-adjust (not AM or AC). 2. Lubricate with R.I. "All Purpose" oil.
Sluggish gear change.	1. Distorted axle spring. 2. Bent axle. 3. Worn toggle chain link. 4. Guide pulley out of line so that wire tends to ride up side of pulley flange. 5. Lack of lubrication of "Flick control" or frayed control wire.	1. Replace axle spring. 2. Replace axle. 3. Replace indicator and chain. 4. Correct alignment of pulley on frame. 5. Lubricate control or replace wire.

9. The axle assembly is again fitted into the vice and indicator chain pulled up and down to make sure that the clutch slides quite freely on axle. THIS IS IMPORTANT.
10. Fit the thrust collar, making sure that both slots fit over flats of axle key; then fit axle spring, gear ring, ball ring, driver and clutch spring cap, in that order.
11. Fit R.H. cone and screw down finger tight, then screw back half a turn. It is followed by the locking washer and locknut. For correct adjustment see page 21.
12. (FM and FC only.) Fit low gear pawls as explained on Page 16.
13. (Not AC.) Reverse assembly in vice and fit secondary planet cage with the pins upwards and slots engaging with limbs of low gear dogs. Fit secondary planet pinions.
    (AC only.) Reverse assembly in vice and fit pinions to compound cage.
14. Fit secondary sun pinion (recess downwards) until the sun pinion engages with square flats on axle.
15. Fit locating plate and tab washer. Tighten locknut.
16. (Not ASC.) See that L.H. ball cup is fitted into shell—L.H. thread.
17. The whole internal can now be inserted into the shell and the ball ring screwed up tight, making sure that the two marks made when stripping down coincide.
18. Fit L.H. cone, washer and locknut. Adjust hub as detailed on page 21. Add any special washers as noted under No. 4 of "Dismantling".
19. If sprocket has been removed from driver, fit outer dust cap over driver before fitting sprocket. See that dust cap is properly centred—there is a small shoulder on flange of driver over which it must fit—and slide on sprocket, followed by spacing washers and lock ring (L.H. thread). See note on page 18 on obtaining correct chain line.

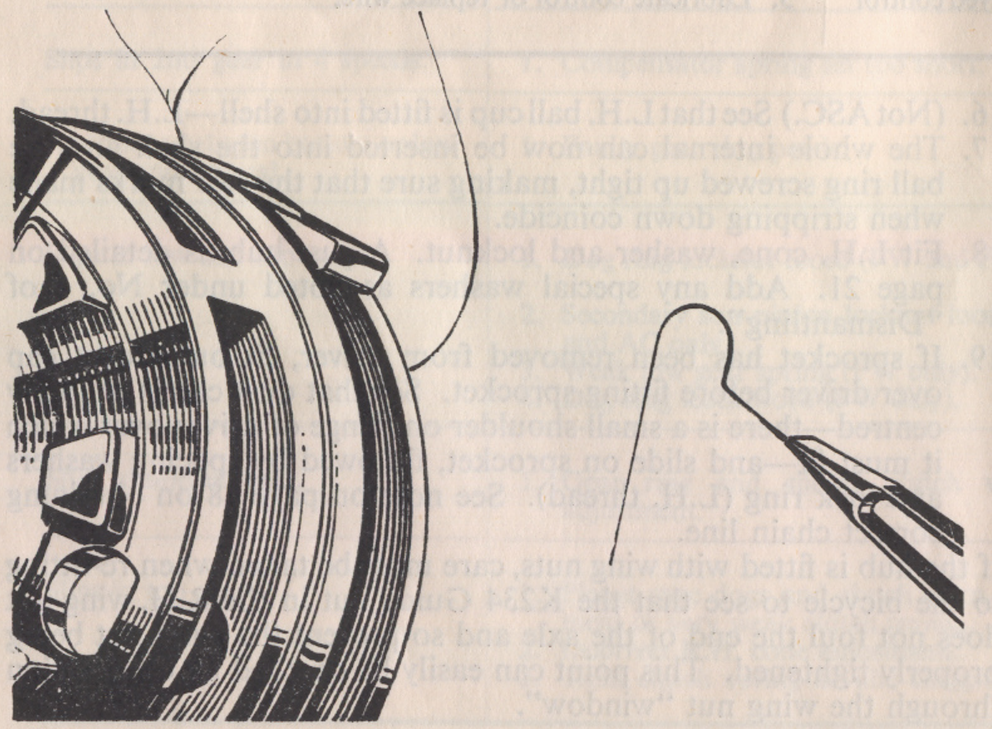
If the hub is fitted with wing nuts, care must be taken when re-fitting to the bicycle to see that the K234 Guide nut in the R.H. wing nut does not foul the end of the axle and so prevent the wing nut being properly tightened. This point can easily be checked by observation through the wing nut "window".

GENERAL NOTES ON SUB-ASSEMBLIES OF ALL HUBS

Fitting Planet Cage Pawls and Springs

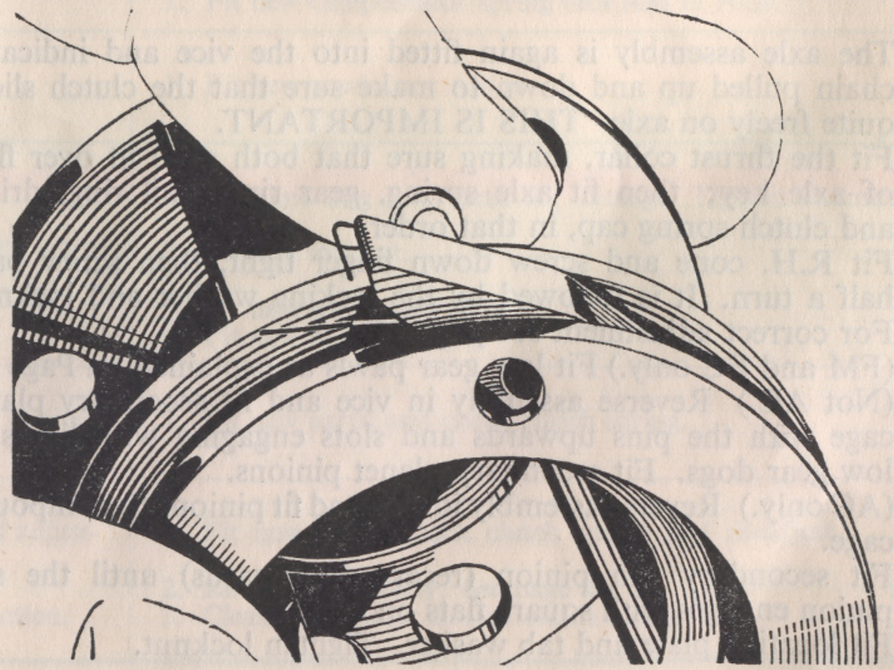
Method for all gears except FW:—

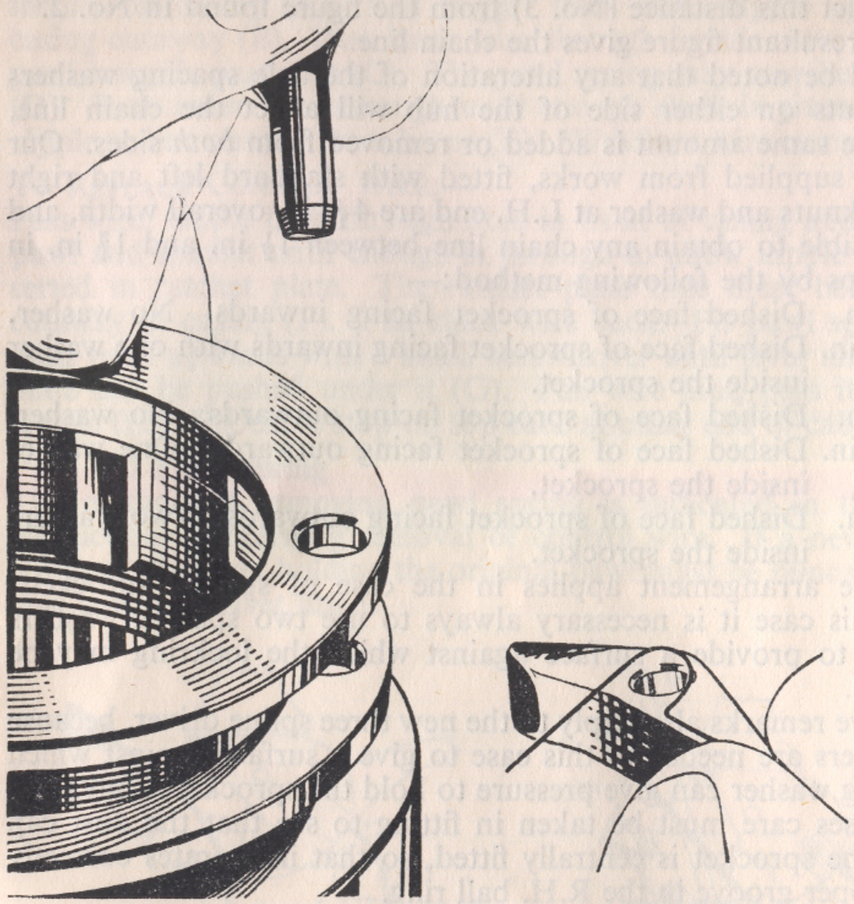
1. Hold planet cage in left hand so that the two flanges in which the low gear pawls fit are away from the body.
2. Fit pawl between flanges of planet cage (flat top surface pointing towards the right) and insert pawl pin through outside flange and halfway through pawl.
3. A pair of tweezers or thin-nosed pliers are then required to fit the "R" spring; grip the bent leg of the "R" spring with the tweezers in the right hand and pass the spring alongside of pawl until the loop of the "R" spring is in line with the hole through the pawl, and both legs of the spring are between the pawl and the planet cage. The pawl pin can now be thrust fully home when it will be found to enter the spring and keep it in position, the bent leg of the spring pressing against the pawl and keeping it projecting to the right. If tweezers are not available, it is possible to push the spring into position with a small rod about $\frac{1}{8}$ in. in diameter; a little practice will ensure that this job is done quickly and efficiently.
4. Check by holding planet cage with planet cage dogs towards the body. The low gear pawls should then be pointing towards the right with their flat surface uppermost.



Method for FW Gear Only

1. Hold planet cage in left hand so that the two flanges in which the low gear pawls fit are away from the body.
2. Lay pawl in position (flat top surface pointing towards the right) but with pawl pin hole to left of pawl pin holes in flanges of planet cage. Push pawl pin through inner flange into contact with side of pawl and place thumb of left hand over its head, applying pressure to hold pawl in place. Take foot of pawl spring between thumb and forefinger of right hand and thread straight leg under pawl pin from rear and pull forward until loop of spring encircles pawl pin. Hold foot of spring under nose of pawl with one finger of right hand whilst advancing pawl with one finger of left hand until its hole comes into line with pawl pin, when pawl pin can be pushed home.
3. Check by holding planet cage with planet cage dogs towards body. The low gear pawls should then be pointing towards the right with their flat surface uppermost.
4. The pawl pin should be lightly rivetted over to hold it in place. This is a special pawl pin (K707) which is suitable for rivetting. The head of the pawl pin must be supported upon a piece of flat steel held in a vice for this purpose. It is important that the pawl pin head should not be distorted, since if it projects on the inside it will tend to foul the teeth of the planet pinions and cause serious damage.





Fitting Gear Ring Pawls and Springs

1. Place gear ring teeth downwards on a flat surface.
2. Place pawl spring alongside pawl so that loop of the "R" is over the pawl pin hole, and its foot is under the long nose of the pawl. Grip the nose of pawl and foot of spring between thumb and forefinger of right hand and have pawl pin ready in left hand. Slide pawl, tail first, between flanges of gear ring until hole in pawl and loop of spring register with holes in flanges; then push pawl pin into position. See illustration.

REMOVAL OF LEFT HAND BALL CUP

AW, AB, AM and FW

(a) Original pattern had outside flats and, except in the case of the AB, these can be gripped in a vice and the wheel spun in a clockwise direction to unscrew the ball cup. For the AB a special box spanner, DD911, is used for removal of the ball cup because the flats are below the level of the hub flange.

(b) The latest pattern for all four types has no flats on the outside but has two slots on the inside. To remove the ball cup a tool is available (DD10565) shown in the diagram. This is dropped through the hub shell with the shank passing through the L.H. ball cup, leaving the upper flanges of the tool in engagement with the slots in the ball cup. Hold the shank in the vice jaws with the outer end of the ball cup resting on the vice jaws, then spin off the wheel by turning in clockwise direction.

IMPORTANT NOTE.—If the L.H. Ball cup of an AB hub is removed, the joint between it and the hub shell must be cemented with a good quality sealing compound when re-fitting to prevent oil leaking through to the brake shoes. Either the slight recess in the shell, or the face of the shoulder on the ball cup which makes contact with the shell should be well painted over with sealing compound before screwing the ball cup home.

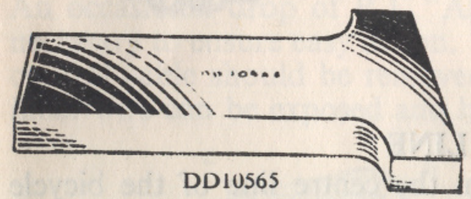
FM, FC and AC

For these three hubs a special tool (GD514) is required. Earlier types of this tool had a short stem which dropped inside the hub so that the flatted stem projected through the end of the ball cup. The present design has a longer stem to enable it to enter from the right hand end, thus avoiding the necessity for removing the dust cap and ball cage from the left hand ball cup. Note that the teeth of the two parts must be in full engagement. This is important, both when removing and when re-fitting the ball cup. Remember this ball cup has a left hand thread.

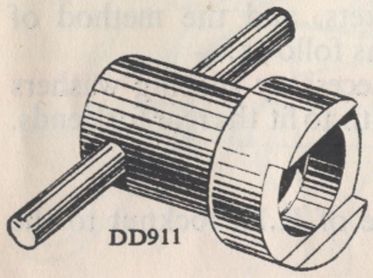
Where the hub has been removed from the wheel, a peg spanner to fit the spoke holes in the hub flange will be necessary, but it is better and easier to remove before cutting the hub out of the wheel.

ASC

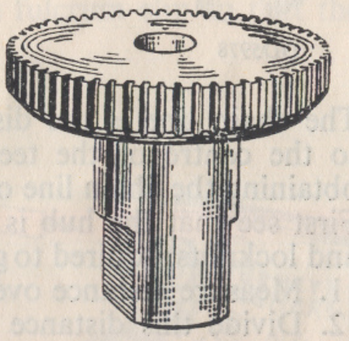
NOTE.—**The ball cup on this hub is a fixture and no attempt should be made to remove it.**



DD10565



DD911



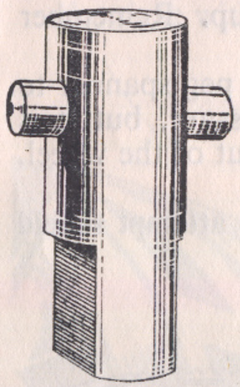
GD514

REMOVAL OF SPROCKETS

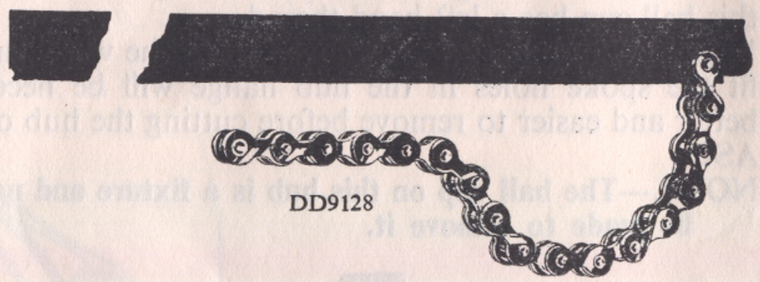
Screwed-on sprockets are used on our AW, AB and FW hubs. To remove the sprocket, the driver must be removed from the hub. The driver is then held with Tool No. DD5978 and the sprocket removed with the sprocket chain wrench, DD9128. Note particularly that the driver must not be held in any other way than by this tool, otherwise distortion of the prongs will occur.

Splined sprockets are used on the AM, ASC, FM and FC hubs. In this case it is only necessary to remove the lock ring (L.H. thread), and the sprocket then slides off. See notes in next column on use of spacing washers to obtain chain line.

The latest type has three small semi-circular splines with corresponding grooves in the driver, but instead of a threaded lockring, the sprocket is secured by a spring ring which clips into a narrow groove cut round the outside of the driver boss. Such sprockets slide into position, using spacing washers as explained for the original type of splined sprocket, and the spring ring is finally sprung into its groove. When it is required to change the sprocket, turn the spring ring so that the join is about $\frac{1}{4}$ in. from one of the grooves and use a thin screwdriver to prise it off. The spacing washers and sprocket may then be lifted away. Note particularly that two $\frac{1}{16}$ in. or one $\frac{1}{8}$ in. washers must always be used with this pattern.



DD5978



DD9128

CHAIN LINE

The chain line is the distance from the centre line of the bicycle to the centre of the teeth on the sprockets, and the method of obtaining the chain line of the rear hub is as follows:—

First see that the hub is fitted with any necessary spacing washers and locknuts required to give the proper width to fit the rear fork ends.

1. Measure distance over locknuts.
2. Divide this distance by two.
3. Measure the distance from the outside of R.H. locknut to the centre of the sprocket teeth.
4. Deduct this distance (No. 3) from the figure found in No. 2.
5. The resultant figure gives the chain line.

It should be noted that any alteration of the axle spacing washers or locknuts on either side of the hub will affect the chain line, unless the same amount is added or removed from *both* sides. Our hubs, as supplied from works, fitted with standard left and right hand locknuts and washer at L.H. end are $4\frac{5}{16}$ in. overall width, and it is possible to obtain any chain line between $1\frac{1}{2}$ in. and $1\frac{3}{4}$ in. in $\frac{1}{16}$ in steps by the following method:—

- $1\frac{1}{2}$ in. Dished face of sprocket facing inwards. No washer.
- $1\frac{9}{16}$ in. Dished face of sprocket facing inwards with one washer inside the sprocket.
- $1\frac{5}{8}$ in. Dished face of sprocket facing outwards. No washer.
- $1\frac{11}{16}$ in. Dished face of sprocket facing outwards. One washer inside the sprocket.
- $1\frac{3}{4}$ in. Dished face of sprocket facing outwards. Two washers inside the sprocket.

The same arrangement applies in the case of splined sprockets, but in this case it is necessary always to use two spacing washers in order to provide a surface against which the lockring may be tightened.

The above remarks also apply to the new three spline driver, because the washers are needed in this case to give a surface against which the spring washer can give pressure to hold the sprocket firmly.

In all cases care must be taken in fitting to see that the dust cap behind the sprocket is centrally fitted, so that it operates correctly in its proper groove in the R.H. ball ring.

TRIGGER CONTROLS

Four different types of trigger control are in use and very little maintenance is required on any type.

The early type controls were known as GC3 for three-speed hubs and GC4 for four-speeds. These can be recognised by the pawl spring, the top loop of which stands clear of the control casing. (See Fig. 2, opposite.) In this case a slotted ferrule or cable guide is fitted in the control casing, and should not be disturbed or loosened. If it should be forced out, a new one must be fitted and rivetted lightly into position by spreading the split end; this entails removal of the internal mechanism and when re-assembling, new rivets must be used.

The following notes cover all the points which normally require attention.

GC3 and GC4 Maintenance

To Remove Control Wire:—

Detach complete control from handlebar. Pull outer cable clear of

ferrule on casing (A). Pull trigger back until nipple appears at casing cutaway (B). Pass inner wire through ferrule slots and push pawl inwards past wire (C). The pawl spring may now be removed (D). Push inner wire through until enough slack is given to allow nipple to be removed from home (E). Withdraw wire complete.

To Replace Control Wire:—
Pass wire, nipple first, through hole in front of casing and between pawl and ratchet until enough is through to allow nipple to be inserted in ratchet plate. The ratchet plate hole must be opposite cutaway in casing (F). Pull slack wire back. Fit pawl spring and push pawl upwards with a small screwdriver until lever and ratchet plate can be pushed under it (G). Pull wire taut, pass it through ferrule (H). Fix cable stop on top tube at other end of cable.

Pawl and Pawl Spring
The method of removing pawl spring is indicated in the above instructions concerning removal of control wire. If a new pawl is required, the rivet holding the original pawl must be removed and a new pawl and rivet fitted.

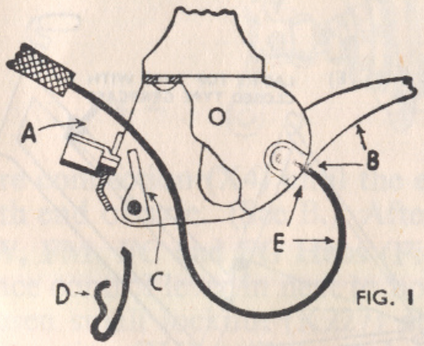


FIG. 1

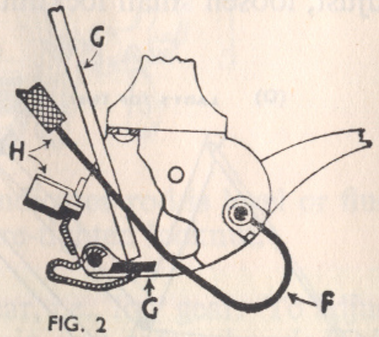


FIG. 2

GC2 Maintenance
The present type of control is known as GC2 and is used for either 3- or 4-speed gears. This type can be recognised by the marking on the quadrant which states, "3- or 4-speed", and by the cable guide or ferrule which is part of the control wire and unscrews from the casing.
Models issued since the end of 1949 have a small window in the outside casing, and letters stamped upon the control lever appear in this window to indicate which gear is engaged. Both window and non-visible types are known as the GC2 type since there is no other difference in the working parts.

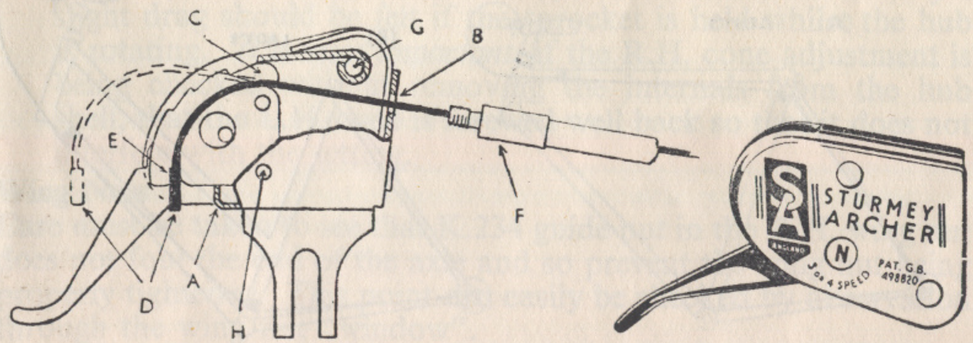
To Remove Control Wire:—
It is not usually necessary to remove control from handlebar as the lever can be pulled far enough back to allow cable nipple to pass between pawl and ratchet plate. Procedure is: Detach (1) inner wire from indicator chain at hub; (2) outer casing from fulcrum clip. Pull cable ferrule (F) upward until screw thread engages that of control casing at (B), then unscrew ferrule.
Pull lever right back beyond gear position to stop (A) push inner wire through to detach nipple from ratchet plate, then pull wire out between pawl and ratchet at (C) and finally through threaded hole (B).

To Fit Control Wire:—
Pull lever right back beyond bottom gear position to stop (A) and insert wire through threaded hole (B) and between pawl and ratchet plate at (C). Wire nipple (D) is then fitted into notch (E) and cable ferrule (F) screwed into (B) until it rotates freely. Keeping tension on wire, push lever forward into top gear position. Control is then ready for re-connection.

Pawl and Pawl Spring
These two parts are designed so that they cannot drop out through breakage of control wire, or during removal or replacement. They should not normally need renewal, therefore, they are not readily detachable.
If a new part is required, both rivets (G and H) must be removed and the complete trigger mechanism withdrawn. New rivets must be used in re-assembly.

Control Type GC2A for ASC Hub Only
The maintenance instructions for this control are exactly the same as those for the GC2. The pawl, pawl spring and lever are the same as those in the GC2 *but the other internal parts are not interchangeable.* This control is distinguishable from the GC2 by the medallion which bears type letters "ASC" and the ratchet is marked "3".
We have a service scheme for trigger control repairs, details of which can be obtained from our depot.

Lubrication of Trigger Controls
An occasional drop of R.I. "All Purpose" Oil on moving parts is necessary to ensure easy action. Occasionally the outer casing of the control cable should be removed from the fulcrum clip so that the inner wire can be exposed and lubricated.



GEAR CONTROL FITTING

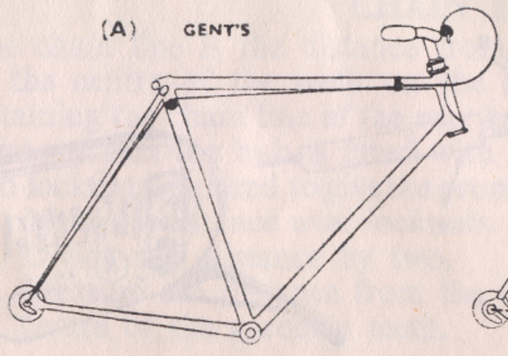
Top Tube Control
It is important that the control wire runs parallel to the tube to which the quadrant is fitted (in the case of curved tubes it must run parallel to the portion of the tube to which the control is fitted).

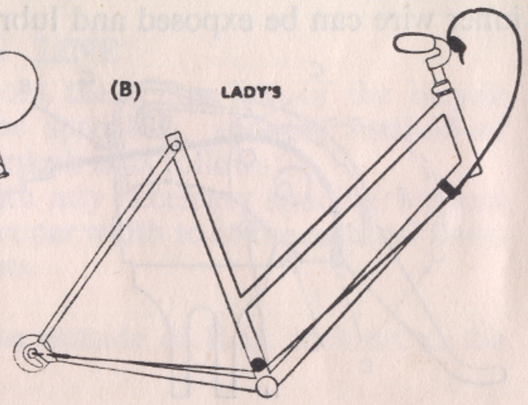
Trigger Control
Illustrations A and B show the best method for arranging the control wire on gent's and ladies' frames, but where a closed type gearcase is fitted to a lady's model, an extra guide pulley is necessary as shown in illustration C.

IMPORTANT NOTE.—The outer cable should allow full movement of the handlebars but otherwise should be kept as short as possible, as it tends to compress in lower gears and any length over 21½ inches may affect the gear adjustment adversely.

Control wires are supplied in varying lengths which should be stated, if possible, when ordering. As a general standard we supply a 54½ in. inner wire and 17½ in. outer cable, which is suitable for the majority of frame sizes. Longer wires, up to 58½ in., and outer cables up to 21½ in. are available for any special cases, and we can also supply shorter wires for very small frames and for Junior models.

Top Tube Control
For gent's machines, the arrangement is the same as illustration A, attaching the Quadrant in position shown for the fulcrum clip.
For ladies' frames we recommend the arrangement shown in illustration D, or with closed gearcase as illustration E, but this latter is less efficient and should never be employed if D can possibly be adopted.
IT IS IMPORTANT that the control wire runs parallel to the tube to which the quadrant is attached. In the case of curved tube ladies' frames it must run parallel to the portion of the tube to which it is fitted.
WIRE LENGTHS offered for top tube controls are 32 in., 34 in. or 36 in.



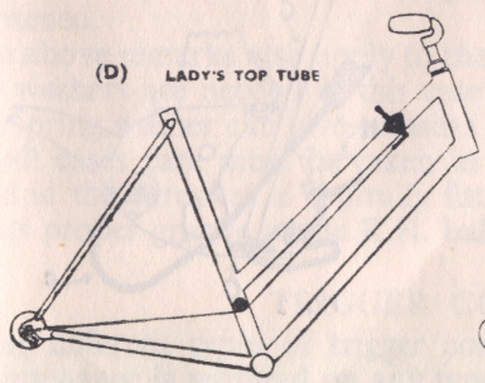


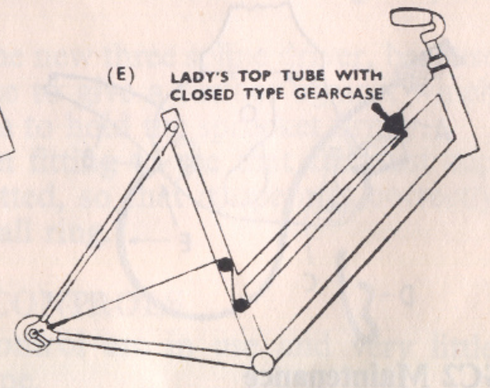
Note for Connecting Indicator Chain on AW and AB Hubs
This must be screwed up fully, but not overtightened. The effect of over-tightening is shown in the illustration. Indicator must be unscrewed to line up; note particularly that it need never be unscrewed more than half a turn. Moreover, unscrewing more than half a turn will detrimentally affect gear engagement. This only applies on AW and AB hubs because in all other types the indicator rod is free to revolve and line itself up automatically.

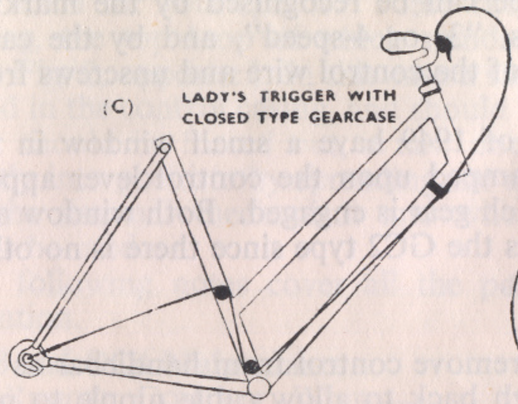
INDICATOR ADJUSTMENT

AW, AB and AG Hubs (Fig. 1.)
Place control lever in middle gear position, i.e., normal gear. To adjust, loosen small locknut (K227) above chain and rotate knurled wire connection (X4) until the outer shoulder on indicator attached to small chain at sprocket side is level or flush with end of axle (See B). Afterwards re-tighten locknut.

AM, ASC and AC Hubs (Fig. 2.)
Place control lever in middle gear position, i.e., normal gear. To adjust, loosen small locknut (K227) above chain and rotate knurled







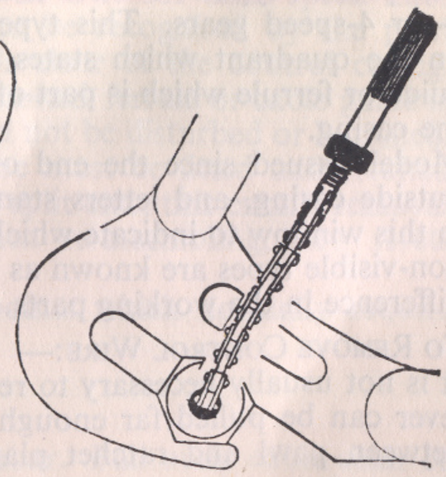
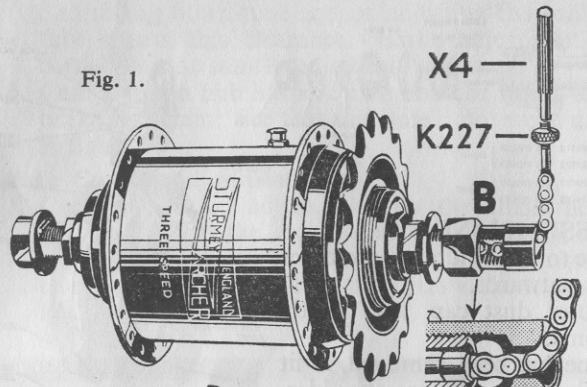


Fig. 1.



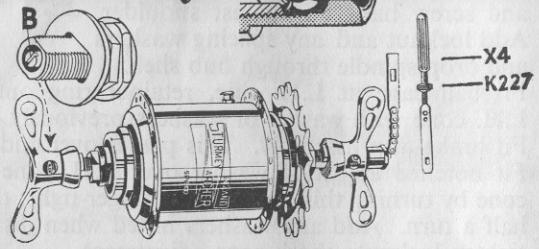


Fig. 2.

wire connection (X4) until the end of indicator rod is level or flush with end of axle. (See B.) Afterwards re-tighten locknut.

FW, FM, FC and FG Hubs (Fig. 2.)

Place control lever in next to bottom gear, i.e., low gear. To adjust, loosen small locknut (K227) above chain and rotate knurled wire connection (X4) until the end of indicator rod is level or flush with end of axle. (See B.) Afterwards re-tighten locknut.

In all cases if insufficient adjustment is obtained by this means, move the quadrant (or fulcrum clip in the case of handlebar control) along the top tube in the required direction, and make the final adjustment on the chain connection as described above.

Should gears slip, check and re-adjust immediately.

GENERAL MAINTENANCE OF STURMEY-ARCHER HUBS

Lubrication

It is essential that a good quality thin oil be used for lubricating purposes in all Sturmey-Archer hubs. The best oil is R.I. "All Purpose" Oil, which is perfectly blended for the purpose, and this should always be used. Thick oils or grease must not be used as they tend to clog the pawls and springs in the hub, and may cause the gears to slip. When the hub is dismantled, a small amount of light grease or Vaseline may be put on the ball races only.

The policy of lubrication should be "little and often"; two or three squirts from an oil-can each week will keep the hub in excellent running order.

Brake hubs have a drain hole in the brake plate to enable surplus oil to drain away. This hole must be kept clear, otherwise oil will reach the brake linings and affect the efficiency of the brakes. Oil must not be injected through this hole.

A new hub should always be oiled before use. It may be several weeks after manufacture before a hub reaches the user, during which time oil can drain from it.

Gear Change

Gear change must be made smartly to avoid the possibility of chipping the gear dogs. When changing gear continue pedalling, but ease the pressure on the pedals. Should it be necessary to change gear whilst stationary, the pedals must be rotated so that the internals will line up correctly and allow easy engagement.

Adjustment: Hub Bearings

Cone adjustment is carried out on the L.H. cone (opposite to the sprocket) which automatically adjusts all the hub bearings. This cone should be adjusted so that there is a just perceptible sideways movement at the wheel rim. On brake hubs the L.H. cone projects through the brake plate and is fitted with a slotted adjusting washer. Turning this washer adjusts the cone which must be re-locked by the locknut after adjustment.

The R.H. cone (sprocket side) is fixed when the hub is assembled, and must not be disturbed for normal wheel adjustment. During re-assembly of the internals the procedure for fitting the R.H. cone is as follows:—

1. Screw R.H. cone home until it is finger tight, then unscrew it half a turn and secure it with the special lockwasher and locknut. On no account must the cone be unscrewed more than half a turn or the correct setting of the gears will be affected.
2. Wheel adjustment should then be made in the normal way on the L.H. cone, and if the bearings are correctly set, the hub should be capable of rotation in its normal direction and only a slight drag should be felt if the sprocket is held whilst the hub is rotating. *It is most important*, if the R.H. cone adjustment is being checked without removing the internals from the hub shell, that the L.H. cone is screwed well back so that it does not interfere with the setting.

Wing Nuts

Care must be taken to see that K.234 guide nut in the R.H. wing nut does not foul the end of the axle and so prevent the wing nut being properly tightened. This point can easily be checked by observation through the wing nut "window".

AM

C/Wheel	Sprocket	26 in. Wheel			27 in. Wheel		
		Low	Normal	High	Low	Normal	High
40	14	64·3	74·2	85·6	66·9	77·1	88·8
	15	60·0	69·3	80·2	62·4	72·0	83·2
	16	56·4	65·0	75·1	58·5	67·5	77·9
	17	53·1	61·2	70·6	55·0	63·5	73·4
	18	50·1	57·8	66·8	52·1	60·0	69·3
	19	47·2	54·7	63·3	49·0	56·8	65·8
	20	45·0	52·0	60·2	46·6	54·0	62·4
	24	37·5	43·3	50·0	38·9	45·0	52·0
44	14	70·7	81·7	94·2	73·6	84·8	97·9
	15	66·2	76·3	87·9	68·7	79·2	91·3
	16	62·1	71·5	82·6	64·3	74·2	86·6
	17	58·3	67·3	77·7	60·7	69·9	80·8
	18	55·2	63·6	73·5	57·2	66·0	76·2
	19	51·1	60·2	69·6	54·0	62·5	72·3
	20	49·5	57·2	66·2	51·5	59·4	68·8
	24	41·2	47·6	55·0	42·8	49·5	57·2
46	14	74·0	85·4	98·6	77·0	88·7	102·5
	15	69·1	79·7	92·0	71·8	82·8	95·6
	16	64·8	74·7	86·2	67·3	77·6	89·5
	17	61·2	70·3	81·3	63·3	73·0	84·2
	18	57·6	66·4	76·8	59·8	69·0	79·6
	19	54·3	62·9	72·7	56·5	65·4	75·6
	20	51·8	59·8	69·2	53·8	62·1	71·9
	24	43·1	49·8	57·6	44·8	51·8	59·9
48	14	77·4	89·1	103·0	80·3	92·5	107·0
	15	72·1	83·2	96·0	75·0	86·4	100·0
	16	67·7	78·0	90·0	70·2	81·0	93·5
	17	63·7	73·5	85·0	66·1	76·2	88·0
	18	60·0	69·3	80·2	62·5	72·0	83·2
	19	56·8	65·7	76·0	59·0	68·2	78·9
	20	54·0	62·4	72·2	55·9	64·8	74·9
	24	45·0	52·0	60·1	46·7	54·0	62·4

ASC

C/Wheel	Sprocket	26 in. Wheel			27 in. Wheel		
		Low	Normal	High	Low	Normal	High
40	14	55·7	66·8	74·2	57·8	69·4	77·1
	15	52·0	62·4	69·3	54·0	64·8	72·0
	16	48·8	58·5	65·0	50·7	60·8	67·5
	17	45·9	55·1	61·2	47·7	57·2	63·5
	18	43·4	52·0	57·8	45·0	54·0	60·0
	19	41·0	49·2	54·7	42·6	51·1	56·8
	20	39·0	46·8	52·0	40·5	48·6	54·0
	24	32·5	39·0	43·3	33·7	40·5	45·0
44	14	61·3	73·5	81·7	63·6	76·3	84·8
	15	57·3	68·7	76·3	59·4	71·2	79·2
	16	53·6	64·3	71·5	55·7	66·8	74·2
	17	50·5	60·6	67·3	52·4	62·9	69·9
	18	47·7	57·2	63·6	49·5	59·4	66·0
	19	45·2	54·2	60·2	46·8	56·2	62·5
	20	42·9	51·5	57·2	44·5	53·4	59·4
	24	35·7	42·8	47·6	37·1	44·6	49·5
46	14	64·0	76·9	85·4	66·5	79·9	88·7
	15	59·8	71·7	79·7	62·1	74·5	82·8
	16	56·0	67·2	74·7	58·2	69·8	77·6
	17	52·7	63·3	70·3	54·8	65·7	73·0
	18	49·8	59·8	66·4	51·7	62·1	69·0
	19	47·2	56·6	62·9	48·9	58·8	65·4
	20	44·9	53·0	59·8	46·5	55·9	62·1
	24	37·3	44·8	49·8	38·8	46·6	51·8
48	14	66·8	80·1	89·1	69·3	83·2	92·5
	15	62·4	74·9	83·2	64·8	77·8	86·4
	16	58·5	70·2	78·0	60·7	72·9	81·0
	17	55·1	66·1	73·5	57·1	68·6	76·2
	18	52·0	62·4	69·3	54·0	64·8	72·0
	19	49·3	59·1	65·7	51·1	61·4	68·2
	20	46·8	56·2	62·4	48·6	58·3	64·8
	24	39·0	46·8	52·0	40·5	48·6	54·0

AC

C/Wheel	Sprocket	26 in. Wheel			27 in. Wheel		
		Low	Normal	High	Low	Normal	High
40	14	68·5	74·2	79·1	71·2	77·1	82·2
	15	64·0	69·3	73·9	66·4	72·0	76·8
	16	60·0	65·0	69·3	62·3	67·5	72·0
	17	56·5	61·2	65·2	58·6	63·5	67·7
	18	53·4	57·8	61·6	55·2	60·0	64·0
	19	50·5	54·7	58·3	52·4	56·8	60·6
	20	48·0	52·0	55·4	49·8	54·0	57·6
	24	40·0	43·3	46·2	41·5	45·0	48·0
44	14	75·4	81·7	87·1	78·3	84·8	90·4
	15	70·4	76·3	81·4	73·1	79·2	84·4
	16	66·0	71·5	76·2	68·5	74·2	79·1
	17	62·1	67·3	71·8	64·5	69·9	74·6
	18	58·7	63·6	67·8	60·9	66·0	70·4
	19	55·6	60·2	64·2	57·7	62·5	66·6
	20	52·8	57·2	61·0	54·8	59·4	63·3
	24	43·9	47·6	50·8	45·7	49·5	52·8
46	14	78·8	85·4	91·0	81·8	88·7	94·6
	15	73·6	79·7	85·0	76·4	82·8	88·3
	16	69·0	74·7	79·6	71·6	77·6	82·8
	17	64·9	70·3	75·0	67·4	73·0	77·8
	18	61·3	66·4	70·8	63·7	69·0	73·6
	19	58·1	62·9	67·0	60·4	65·4	69·7
	20	55·2	59·8	63·8	57·3	62·1	66·2
	24	46·0	49·8	53·1	47·8	51·8	55·3
48	14	82·2	89·1	95·0	85·4	92·5	98·6
	15	76·8	83·2	88·7	79·7	86·4	92·2
	16	72·0	78·0	83·2	74·8	81·0	86·4
	17	67·8	73·5	78·4	70·3	76·2	81·3
	18	64·0	69·3	73·9	66·4	72·0	76·8
	19	60·6	65·7	70·0	62·9	68·2	72·7
	20	57·6	62·4	66·5	59·8	64·8	69·1
	24	48·0	52·0	55·5	49·8	54·0	57·6

FC

C/Wheel	Sprocket	26 in. Wheel				27 in. Wheel			
		Bot'm.	Low	N'mal.	High	Bot'm.	Low	N'mal.	High
40	14	55·7	66·8	74·2	81·4	57·8	69·4	77·1	84·1
	15	52·0	62·4	69·3	75·7	54·0	64·8	72·0	78·6
	16	48·8	58·5	65·0	70·9	50·7	60·8	67·5	73·6
	17	45·9	55·1	61·2	66·8	47·7	57·2	63·5	69·3
	18	43·4	52·0	57·8	63·2	45·0	54·0	60·0	65·4
	19	41·0	49·2	54·7	59·7	42·6	51·1	56·8	62·0
	20	39·0	46·8	52·0	56·7	40·5	48·6	54·0	58·9
	24	32·5	39·0	43·3	47·2	33·7	40·5	45·0	49·1
44	14	61·3	73·5	81·7	89·2	63·6	76·3	84·8	92·6
	15	57·3	68·7	76·3	83·3	59·4	71·2	79·2	86·5
	16	53·6	64·3	71·5	78·1	55·7	66·8	74·2	80·9
	17	50·5	60·6	67·3	73·4	52·4	62·9	69·9	76·2
	18	47·7	57·2	63·6	69·3	49·5	59·4	66·0	72·0
	19	45·2	54·2	60·2	65·7	46·8	56·2	62·5	68·2
	20	42·9	51·5	57·2	62·4	44·5	53·4	59·4	64·8
	24	35·7	42·8	47·6	51·9	37·1	44·6	49·5	54·0
46	14	64·0	76·9	85·4	93·2	66·5	79·9	88·7	96·7
	15	59·8	71·7	79·7	87·0	62·1	74·5	82·8	90·4
	16	56·0	67·2	74·7	81·5	58·2	69·8	77·6	84·7
	17	52·7	63·3	70·3	76·8	54·8	65·7	73·0	79·7
	18	49·8	59·8	66·4	72·4	51·7	62·1	69·0	75·3
	19	47·2	56·6	62·9	68·6	48·9	58·8	65·4	71·4
	20	44·9	53·0	59·8	65·3	46·5	55·9	62·1	67·8
	24	37·3	44·8	49·8	54·3	38·8	46·6	51·8	56·5
48	14	66·8	80·1	89·1	97·2	69·3	83·2	92·5	100·4
	15	62·4	74·9	83·2	90·8	64·8	77·8	86·4	94·3
	16	58·5	70·2	78·0	85·1	60·7	72·9	81·0	88·5
	17	55·1	66·1	73·5	80·2	57·1	68·6	76·2	83·1
	18	52·0	62·4	69·3	75·6	54·0	64·8	72·0	78·5
	19	49·3	59·1	65·7	71·7	51·1	61·4	68·2	74·4
	20	46·8	56·2	62·4	68·1	48·6	58·3	64·8	70·7
	24	39·0	46·8	52·0	56·7	40·5	48·6	54·0	58·9

FM

C/Wheel	Sprocket	26 in. Wheel				27 in. Wheel			
		Bot'm.	Low	N'mal.	High	Bot'm.	Low	N'mal.	High
40	14	49·5	63·6	74·2	83·4	51·4	66·0	77·1	86·7
	15	46·2	59·4	69·3	77·9	48·0	61·8	72·0	81·0
	16	43·3	55·7	65·0	73·1	45·0	57·8	67·5	75·9
	17	40·8	52·5	61·2	68·9	42·3	54·4	63·5	71·4
	18	38·5	49·6	57·8	65·0	40·0	51·4	60·0	67·5
	19	36·5	46·5	54·7	61·5	37·9	48·6	56·8	63·6
	20	34·7	44·6	52·0	58·5	36·0	46·2	54·0	60·7
	24	28·8	37·1	43·3	48·7	30·0	38·5	45·0	50·6
44	14	54·5	70·1	81·7	91·9	56·5	72·6	84·8	95·5
	15	50·9	65·4	76·3	85·8	52·8	67·8	79·2	89·1
	16	47·7	61·3	71·5	80·4	49·5	63·6	74·2	83·5
	17	44·9	57·7	67·3	75·7	46·6	59·9	69·9	78·6
	18	42·4	54·5	63·6	71·5	44·0	56·5	66·0	74·2
	19	40·1	51·6	60·2	68·2	41·7	53·6	62·5	70·3
	20	38·1	49·1	57·2	64·3	39·6	50·9	59·4	66·8
	24	31·7	40·8	47·6	53·6	33·0	42·5	49·5	55·7
46	14	56·9	73·2	85·4	96·1	59·1	76·0	88·7	99·7
	15	53·1	68·4	79·7	89·7	55·2	70·9	82·8	93·1
	16	49·8	64·1	74·7	84·0	51·7	66·5	77·6	87·3
	17	46·9	60·3	70·3	79·1	48·7	62·4	73·0	81·9
	18	44·3	56·9	66·4	74·7	46·0	59·1	69·0	77·6
	19	41·6	53·9	62·9	70·8	43·6	55·8	65·4	73·3
	20	39·9	51·3	59·8	67·3	41·4	53·2	62·1	69·8
	24	33·2	42·7	49·8	56·0	34·5	44·9	51·8	58·3
48	14	59·4	76·4	89·1	100·2	61·7	79·3	92·5	104·1
	15	55·5	71·3	83·2	93·6	57·6	74·0	86·4	97·2
	16	52·0	66·9	78·0	87·7	54·0	69·4	81·0	91·0
	17	49·0	63·0	73·5	82·7	50·8	65·3	76·2	85·0
	18	46·2	59·4	69·3	78·0	48·0	61·7	72·0	81·0
	19	43·8	56·3	65·7	73·9	45·5	58·4	68·2	76·7
	20	41·6	53·5	62·4	70·2	43·2	55·5	64·8	72·9
	24	34·8	45·1	52·0	58·5	36·0	46·3	54·0	60·8

FW & FG

C/Wheel	Sprocket	26 in. Wheel				28 in. Wheel			
		Bot'm.	Low	N'mal.	High	Bot'm.	Low	N'mal.	High
40	14	49·5	58·7	74·3	84·1	53·3	63·2	80·0	101·3
	15	46·2	54·7	69·3	87·7	49·8	59·0	74·7	94·6
	16	43·3	51·3	65·0	82·3	46·7	55·3	70·0	88·6
	17	40·8	48·3	61·2	77·5	43·9	52·1	65·9	83·4
	18	38·5	45·7	57·8	73·2	41·5	49·1	62·2	78·7
	19	36·5	43·2	54·7	69·2	39·3	46·5	58·9	74·6
	20	34·7	41·1	52·0	65·8	37·3	44·2	56·0	70·9
	22	31·5	37·4	47·3	59·9	33·9	40·2	50·9	64·4
44	14	54·4	64·5	81·7	103·5	58·6	69·5	88·0	111·4
	15	50·8	60·3	76·3	96·6	54·7	64·9	82·1	104·0
	16	47·7	56·5	71·5	90·5	51·3	60·8	77·0	97·5
	17	44·9	53·2	67·3	85·2	48·3	57·3	72·5	91·8
	18	42·4	50·2	63·6	80·5	45·6	54·0	68·4	86·6
	19	40·1	47·6	60·2	76·2	43·2	51·2	64·8	82·0
	20	38·1	45·2	57·2	72·4	41·1	48·6	61·6	78·0
	22	34·7	41·1	52·0	65·8	37·3	44·2	56·0	70·9
46	14	56·9	67·5	85·4	108·1	61·3	72·7	92·0	116·5
	15	53·1	63·0	79·7	100·9	57·2	67·9	85·9	108·7
	16	49·8	59·0	74·7	94·5	53·7	63·6	80·5	101·9
	17	46·9	55·5	70·3	89·0	50·5	59·9	75·8	95·9
	18	44·3	52·5	66·4	84·0	47·7	56·5	71·5	90·5
	19	41·9	49·7	62·9	79·6	45·2	53·6	67·8	85·8
	20	39·9	47·2	59·8	75·7	42·9	50·9	64·4	81·5
	22	36·3	43·1	54·5	69·0	39·1	46·3	58·6	74·2
48	14	59·3	70·4	89·1	112·8	64·0	75·8	96·0	121·5
	15	55·4	65·7	83·2	105·3	59·7	70·8	89·6	113·4
	16	52·0	61·6	78·0	98·7	56·0	66·4	84·0	106·3
	17	49·0	58·0	73·5	93·0	52·7	62·5	79·1	100·2
	18	46·2	54·7	69·3	87·7	49·8	59·0	74·7	94·6
	19	43·8	51·9	65·7	83·2	47·1	55·8	70·7	89·5
	20	41·6	49·3	62·4	79·0	44·8	53·1	67·2	85·0
	22	37·8	44·8	56·7	71·8	40·7	48·3	61·1	77·3

STURMEY-ARCHER LIGHTING UNITS

The Generator consists of a special circular 20-pole magnet fixed by four screws into the hub shell, which revolves around the stationary armature, also having 20 poles, mounted on an extension of the left hand cone. There is only one central winding in this armature, and the two ends of this winding are brought out to two terminals fixed in an insulated plate outside the hub. No repair can be carried out if trouble should occur in the armature winding, but this is most unlikely.

Current from these two fixed terminals is transmitted by flex wires to the head and tail lamps. A dry battery unit (D.B.U.) can also be supplied, and the flex wiring so arranged that the lamps may be switched over from Dynamo to Batteries to obtain light when the cycle is not moving.

The output is 6 volts .34 amps. (2 watts) when the cycle reaches a speed of 12 miles per hour, and the design prevents the output rising seriously beyond this at any higher speed. Provided the correct bulbs are used, lights will be visible when speed reaches three to four miles per hour.

Dynohubs are offered in three forms as follows:—

Type GH6 consists of front hub with dyno unit only, together with headlamp, tail lamp and flex wires.

Type AG consists of rear hub combining our AW three-speed gear and dyno unit, together with headlamp, tail lamp and flex wires.

Type FG consists of rear hub combining our FW four-speed gear and dyno unit, together with headlamp, tail lamp and flex wires.

In every case the D.B.U. is available as an extra.

DISMANTLING DYNO UNIT—ALL TYPES

1. Detach flex wires from hub terminals.
2. Remove axle nuts and washers and remove wheel from cycle frame.
3. Remove dynamo cone locknut and note carefully order and position of any spacing washers and adjusting washers for correct re-assembly.
4. Remove four magnet fixing nuts and washers from back of hub drum. Then remove four magnet fixing screws.
5. Hold wheel with dynamo downwards just above bench, and a few light taps with a mallet on end of spindle will cause dyno unit to drop out complete. A shim washer may be fitted between cone and armature which must be replaced.
6. Magnet spacing ring may now be lifted out of hub drum.
7. To separate magnet and armature hold dyno unit in left hand with terminal plate against palm. Fit keeper ring over armature and lightly tap keeper with palm of right hand. This will cause magnet to slide off armature and on to the keeper.

Unless it is essential to do so, the armature and magnet should never be separated. To separate them a KEEPER RING IS NECESSARY because, if the magnet is to retain its full magnetism, there must always be iron within the magnet. A spanner placed across the magnet is NOT a satisfactory substitute. Separation, even for a fraction of a second, will cause loss of magnetism.

At this point it is wise to test armature with a test meter for continuity of winding. Connect leads from meter to armature terminal according to instructions on meter. A reading should be obtained. No reading indicates a broken winding.

If a terminal is damaged or the terminal plate is broken, the repair can be difficult and we strongly advise making use of our service replacement armature scheme, operated through our depots, whereby we supply a new armature against return of the original one at a retail charge of 5/6.

ASSEMBLY

1. Take magnet and keeper ring in left hand and lay armature alongside with right hand. Then, holding magnet, push armature and keeper through so that magnet slides from keeper on to armature.
   NOTE.—Chamfer on magnet should face outwards, the chamfer being designed to aid entry into the cover plate.
2. Fit card disc carrying patent numbers inside cover plate with its notches opposite magnet notches.
3. Fit cover plate over magnet, taking care that the four holes in cover plate line up with the card and magnet notches.
4. Fit metal spacing ring in hub shell.
5. Fit shim washer, if originally used (Always fitted on AG).
6. Push complete dyno unit into hub shell, noting that holes in cover plate must line up with those in hub shell.
7. Fit magnet fixing screws, washers and nuts.
8. Note that extension from left hand cone now projects through armature. Fit spacing washers and adjusting washer in same order as when dismantled.

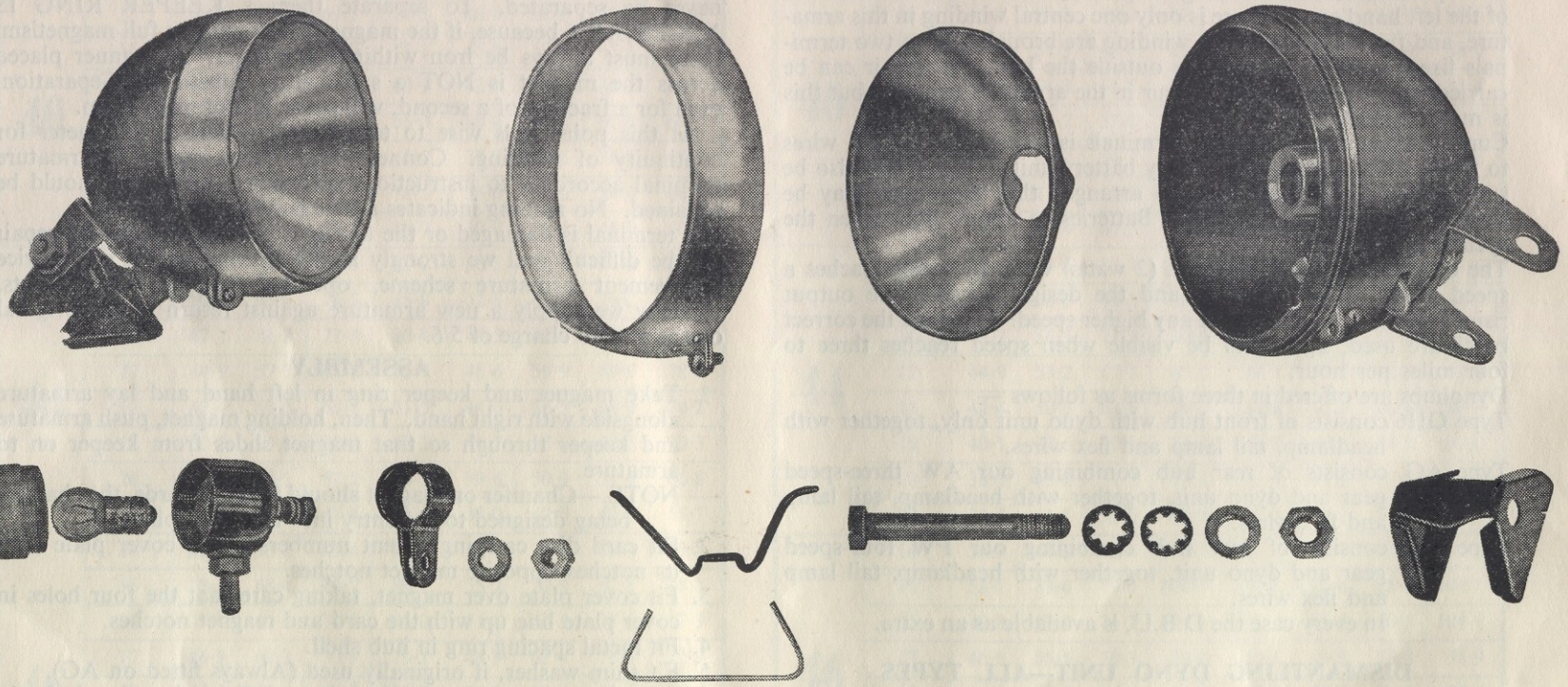
DISMANTLING GH.6 HUB

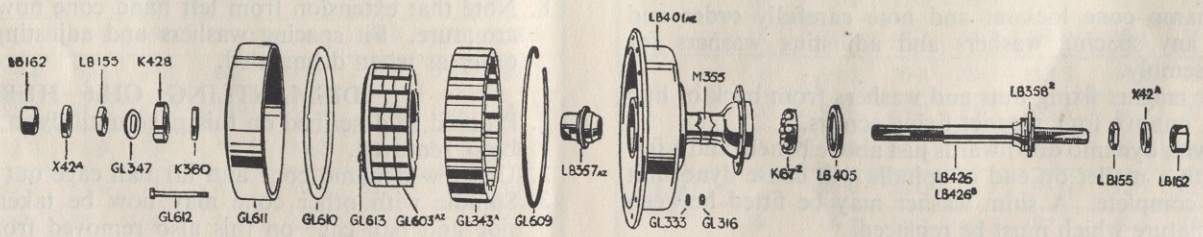
1. Proceed as described on this page until dyno unit complete has been removed.
2. Unscrew dynamo cone and lift ball cage out of hub shell.
3. Spindle with other cone may now be taken out from other side and ball cage on this also removed from hub shell after removing dust cap.

See Fault-finding Chart on Page 32 for hints on trouble.

EXPLODED VIEWS OF HEADLAMP, TAIL LAMP AND G.H.6 DYNOHUB

(SHEWING OLD AND NEW TYPES OF HEADLAMP SPRING)





When examining hub components, the following points must be checked:—

1. See that bearing surfaces of both cones are in satisfactory condition, and that ball cages and balls are not distorted or worn.
2. Examine bearing surfaces at each end of hub barrel. These cups are not removable and, if bearing surfaces are worn, a new hub shell will be necessary.
3. Examine threads on axle and in nuts which screw on axle.

ASSEMBLY

1. Fit cone LB358Z to spindle and tighten against shoulder on spindle. Add cone locknut and tighten. This cone must be firmly fitted to the axle.
2. Fit ball cage in small flange side of shell with cage outwards.
3. Fit dust cap over ball cage and lightly tap home with hammer.
4. Fit spindle and cone into hub shell.
5. Fit ball cage in hub cup on dyno side—cage outwards—and screw up dynamo cone.
6. Assemble dyno unit as described on page 27 and adjust wheel bearings by means of left hand notched adjusting washer, secured by cone locknut. (See Service Notes, page 31.)

   IMPORTANT.—A correctly adjusted wheel must have a slight trace of play at the wheel rim. The pull of the magnet disguises the wheel adjustment and if this point is not watched, overtightening and consequent damage to the races can occur.

DISMANTLING AG HUB

1. Proceed as described on page 27 until dyno unit complete has been removed.
2. Remove dynamo cone.
3. Mark right hand ball ring and hub shell and proceed exactly as described for dismantling the AW hub (shown on page 6) from No. 2 onwards.

ASSEMBLY

This is exactly the same as for AW hub on page 8 from No. 1 to No. 6. Then screw up left hand cone. Assemble and fit dyno unit as explained on page 27. (See Service Notes, page 31.)

Note that left hand Ball Cup for AG hub *must* be the slotted pattern (K604A).

IMPORTANT.—A correctly adjusted wheel must have a slight trace of play at the wheel rim. The pull of the magnet disguises the wheel adjustment, and if this point is not watched, overtightening and consequent damage to the races can occur.

DISMANTLING FG HUB

1. Proceed as described on page 27 until dyno unit complete has been removed.
2. Remove dynamo cone.
3. Now dismantle the gears exactly as described for the FW hub on page 8. There is some difference, however, in the planet cage, the low gear pawls and springs, and in the left hand ball cup, as noted below:—

   The planet cage is shorter than the FW part, so as to make room for the dyno parts in the same width of hub shell. To achieve this the low gear pawls take the form of plunger pins operated by coil springs, and the holes for these are drilled through the webbs of the planet cage. These holes, three in number, are drilled right through but the hole is very slightly smaller at the end away from the left hand ball cup. These are assembled after the internal has been built up. First, a $\frac{3}{16}$-in. ball bearing is dropped into the hole; it cannot fall through. Then add the coil spring and pawl. The end of the pawl is shaped to fit into the end of the spring.

   The left hand ball cup is provided with ratchets in its inner face instead of in an outer rim. This ball cup does not screw into the hub shell as does the FW part, but it is secured by four small screws and its outer flange is square in shape so as not to foul the magnet fixing screws.

   Assembly details are not affected by these differences.

ASSEMBLY

1. Prepare sub-assemblies as described for FW hub, except that planet cage should not be fitted with low gear pawls and springs.
2. Assemble gears exactly as described for FW hub on pages 8/9.
3. Drop $\frac{3}{16}$-in. ball bearing down each of the three pawl pin holes of planet cage, then drop one coil-type pawl spring down each hole and add the three plunger-type pawls. These pawls have their inner end shaped to engage inside the pawl springs.
4. Hold wheel with left hand ball cup uppermost and insert gear assembly from below so as to ensure that low gear pawls do not become displaced and screw up right hand ball ring in shell, checking to make sure that the marks made when dismantling on ball ring and on hub shell flange, coincide.
5. Fit left hand cone, after making sure that ball cage and dust cap are fitted in ball cup.
6. Assemble dyno unit as described on page 27 and fit complete assembly to wheel.
7. Adjust left hand cone by means of notched washer and secure cone locknut. (See Service Notes, page 31.)
8. If sprocket has been removed from driver, fit outer dust cap over driver before fitting sprocket. See that dust cap is properly centred—there is a small shoulder on flange of driver over

which it must fit—and screw on sprocket. See note on page 18 on obtaining correct chain line.
Indicator adjustment after re-fitting to machine is dealt with on page 21.

HEADLAMP

The headlamp is fitted to lamp bracket by means of a single clamping bolt. Its angle to the road surface can be adjusted, but this must not be attempted without first loosening the clamping bolt.
The front of the lamp is detachable by unscrewing a small screw at the bottom of the lamp rim to give access to bulb and terminals. This screw is fitted with circlip at the back of lamp rim so that it does not fall out to become lost.
The switch is fitted at the base of the lamp body and is secured by means of the lower switch terminal screw. The switch lever passes through a slot in the body and moves across the lamp. It has three positions, which are, viewed from the saddle: Battery—left, Dynamo —right, Off—central. When D.B.U. is not fitted, the left hand position can be used as "Off" and the switch treated as a straight two-way switch, the central position being ignored. Switch terminals have coloured washers for identification.
The front end of the switch body is bent downward through another slot in lamp body, and a threaded hole in this part forms the anchorage for the screw which secures the lamp front.
The light beam may be focussed by turning the sunk screw at rear of headlamp. This screw has a wide slot and may be turned by a coin or a screwdriver. Once properly adjusted this need not be touched again until a new bulb is fitted, when re-focussing may be necessary.

REAR OR TAIL LAMP

This is fixed to the rear stay by a suitable clip. Four types of clip are offered, to suit $\frac{3}{8}$ in. diam. round, $\frac{1}{2}$ in. diam. round, oval or "D" shaped tubing, respectively. The red dome unscrews to give access to the bulb.

DRY BATTERY UNIT (D.B.U.)

This is fitted to the seat tube. The battery container has a loose base plate, fitted with terminal to secure it to the base of the container. The container takes three $1\frac{1}{2}$ volt dry cells. These are not re-chargable and must be replaced with new cells when exhausted.

Batteries

Standard equipment is Drydex T.20 or Ever-Ready U2, but any equivalent is suitable. They fit one above another as in an ordinary torch.
Batteries must be removed immediately they are exhausted or they will cause corrosion in inner container surface.

The Battery Cap

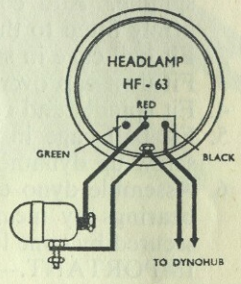
The battery cap at top of battery container has wiring connections beneath a bakelite cover, which is easily detachable. There are only two terminals and these are of different sizes so that the wires cannot be wrongly connected.
If the batteries are removed without replacing with new ones, the dynamo lighting will still function normally, but the stand-by light will not be available.

WIRING

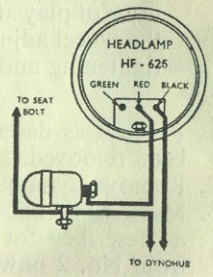
Wiring connections are inside headlamp. Wires enter through a hole in fixing bracket. To reach terminals the lamp front must be removed.

Flex connections are:—

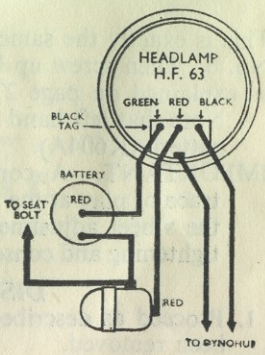
1. For Front Dynohub (GH6):
   One hub terminal to upper R.H. switch terminal when looking into the lamp from the front.
   Other hub terminal to lower centre terminal.
   Upper centre terminal to rear lamp terminal.
   Lower centre terminal to rear lamp clip screw.

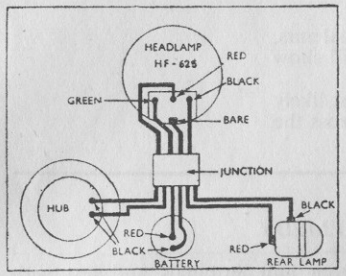


2. For Dynothree (AG) and Dynofour (FG) Rear Hubs:
   One hub terminal to upper R.H. switch terminal.
   Upper centre terminal to rear lamp terminal.
   Other hub terminal to rear lamp clip screw.
   Rear lamp clip screw to seat bolt.



3. GH6 Hub with D.B.U.
   There are three separate Flex Wires used:
   GL229Z Dynohub to upper R.H. Switch terminal (black). Other hub terminal to lower centre terminal.
   GL229CZ Centre Switch terminal (red) to tail lamp terminal (red). Upper L.H. switch terminal (green) (NOTE: Flex tag is coloured black) to centre terminal of Battery Cap. Other Battery Cap terminal to tail lamp fixing clip.
   GL229JZ Tail lamp clip to seat bolt.





4. AG or FG hub with D.B.U.: Wiring assembly (GL229GZ) is supplied complete. Four wires enter headlamp, tags have coloured sleeves which match the washers under switch terminals. The bare tag fits to the lower earth terminal. The wiring junction which is covered by rubber sleeve lies next to the seat lug and three twin leads from it go to battery case, rear lamp and Dynohub respectively. The wire lengths and tag sizes are such that no confusion in fitting can arise.

This wiring is supplied as complete unit with the several lengths of twin flex soldered together and the joints covered by rubber sleeve. A smaller sleeve covers each soldered joint under this rubber sleeve. If at any time it is necessary to examine beneath this junction sleeve, take care that all these coverings are carefully replaced.

Note that flex leads to headlamp have coloured sleeves to correspond with coloured washers under headlamp terminals.

In ALL cases the lead from the main bulb holder is attached to the centre terminal (red). This lead is not shown in the above diagrams.

BULBS

Correct bulbs for the different sets are listed below:

Front Dynohubs: Headlamp 6v. .3 amp. No. GL471
Tail lamp 6v. .04 amp. No. GL228

Rear Dynohubs: Headlamp 6v. .25 amp. No.GL448
Tail lamp 6v. .04 amp. No. GL228

It will be noticed that although the dyno unit in both front and rear hubs is exactly the same, we recommend a slightly less powerful bulb for the rear hubs. This is because, owing to the greater amount of metal within the hub shell, there is some slight magnetic loss. We give this explanation here, since it is possible that some of your customers may be curious as to why different bulb ratings should be necessary.

LUBRICATION

The Dynamo has no bearings of its own and the only lubrication required is for the hub bearings and the gear mechanism. See pages 19 and 21 for details. Note that oil will not harm the dynamo. There is therefore no danger to it in oiling the hub.

TOOLS

TEST METER. This is a special instrument, with internal resistance adjusted to match the load imposed on the Dynohub in normal use on the cycle, to ensure that accurate readings are obtained direct, without need to correct the readings according to resistance of the meter used. This enables the voltage of the hub to be checked without wiring up the lamp bulbs into the circuit.

For this reason we strongly advise that this Test Meter should be used in preference to other meters which are obtainable. Its accuracy for this particular purpose well repays the first cost, and because of the relatively small currents which are being measured, this adjustment of the load is of much greater importance than is generally recognised.

DD11241 Box Spanner for ball cup fixing screws (FG).
DD9763 6BA Tube Spanner for magnet fixing screw nuts.
DD6839 Cone Spanner.
GD495 Keeper Ring.
DD10565 Ball Cup Remover (AG) see page 17.

SERVICE NOTES

Note that the GH6 Front Dynohub functions with the Dynamo on either the right or left hand side.

It is essential to see that the cone locknuts are properly tightened in order to maintain correct cone adjustment.

When securing cone adjustment by means of notched washer on Dyno side, it is important that the position of the armature terminals be carefully located before cone locknut is finally tightened. For GH.6 hubs and for all roadster models, the terminals should lie parallel with one of the flats on the end of the axle, but with forward drop-out rear lugs they should be turned 30° clockwise from parallel with the flats.

Tighten axle nuts before spinning wheel to test output, because, if the axle is able to turn, the terminals may foul frame tubes and uffer damage.

FAULT-FINDING CHART FOR LIGHTING UNITS

To test whether Dynohub is generating, remove flex wires from armature terminals, re-tighten terminal nuts, place Test Meter leads across armature terminals and spin wheel smartly. The meter reading will show output, which should be 6—6.25 volts.

No reading will indicate either a short-circuit or a break in the armature winding. This will most likely be near one of the terminals. A rough check can be made by holding a bulb, known to work, across the terminals and spinning the wheel.

ELECTRICAL FAULTS: FAULT	CAUSE	REMEDY
Total failure	1. Short in armature or broken winding.	1. Remove twin flex from hub terminals and test with Test Meter for continuity across terminals. A reading should be obtained. If no reading, see page 27 for details of service replacement scheme.
	2. Broken wire in twin flex.	2. Test each wire for continuity with Test Meter.
	3. Burnt out bulb or bulbs.	3. Test each bulb with battery known to be in good condition or test for continuity of filament with Test Meter.
	4. Incorrect wiring connections.	4. Check wiring against appropriate diagrams.
Low output.	1. Magnet de-magnetised.	1. Send magnet for re-magnetising. This can only be done at Works and unless keeper ring or armature is sent with magnet, we have to supply a keeper in order to return magnet.
	2. Bulbs which have been in use for a long time may not be 100 per cent. efficient.	2. Test bulbs with battery against new ones.
	3. Incorrect bulbs.	3. Check bulb ratings and see that they are correct. See page 31 for details.
	4. Incorrect wiring connections.	4. Check wiring against appropriate diagram.
Partial Failure.	1. Loose bulb or bulbs.	1. Check if bulbs are screwed fully home.
	2. Frayed ends of twin flex.	2. Check each terminal point.
	3. Terminal nuts loose.	3. Check nuts for tightness but be careful not to use too much force.
Dim lights.	1. Dirty connections.	1. Inspect all terminals and wire tags.
	2. Magnet de-magnetised.	2. Check output of Dynohub with Test Meter. Magnet must be returned for re-magnetising as this can only be done at Works, and unless keeper ring or armature is sent with magnet we have to supply a keeper in order to return magnet.

MECHANICAL FAULTS: FAULT	CAUSE	REMEDY
Rubbing.	1. Usually caused by grit between cover plate and inner dust cap.	1. The groove should be cleaned and filled with light grease.
	2. Loose cones may permit armature and magnet to rub.	2. Correct adjustment of cones will cure this fault.
	3. Dirt between armature and magnet.	3. The hub should be dismantled and cleaned if this is the cause.
	4. The omission of the card disc carrying the patent numbers which must be fitted between magnet and cover plate.	4. Ensure that disc is fitted.