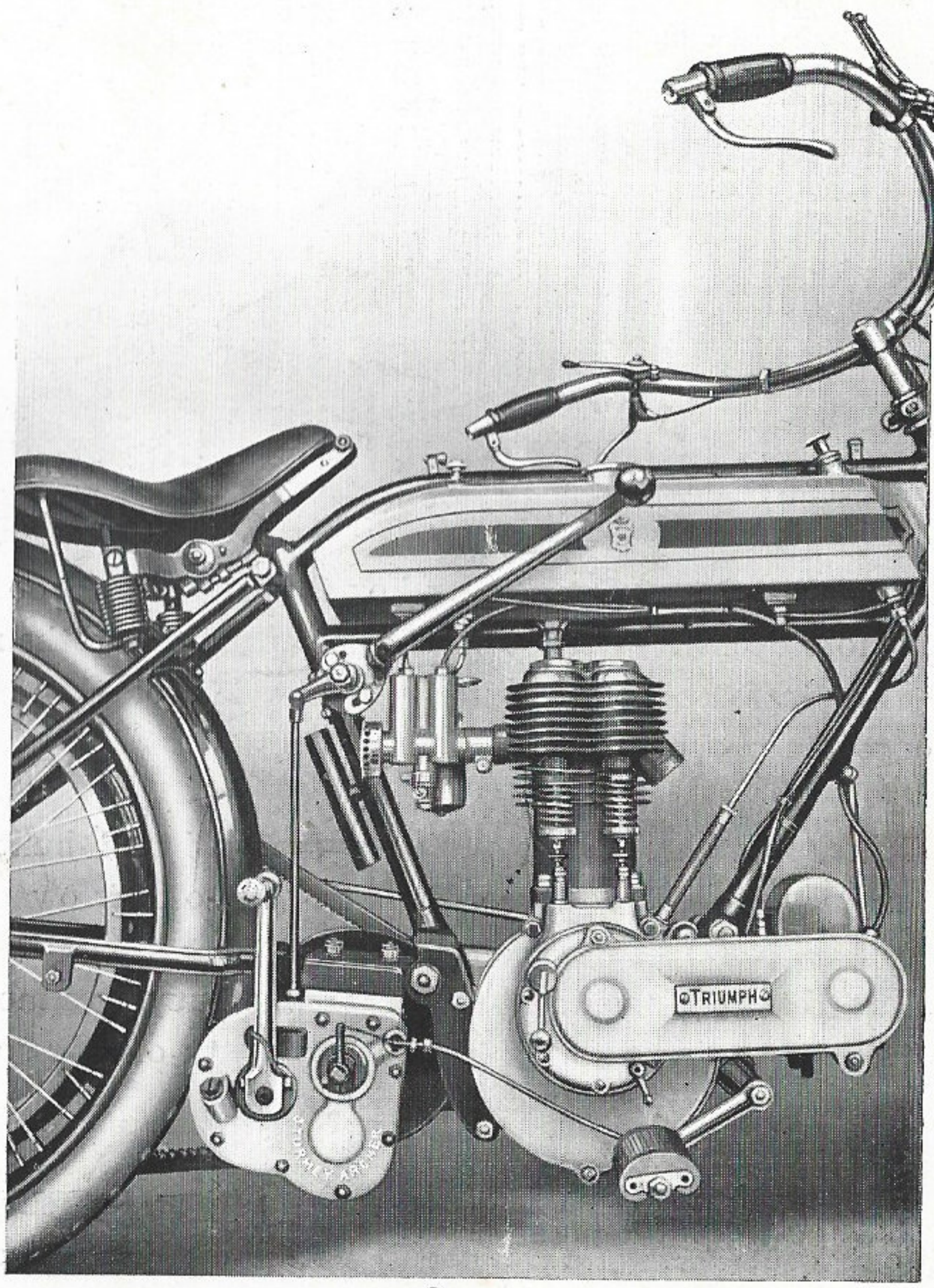
NOV. 1919.

Sturmey-Archer Countershaft Gears.

3-SPEED.

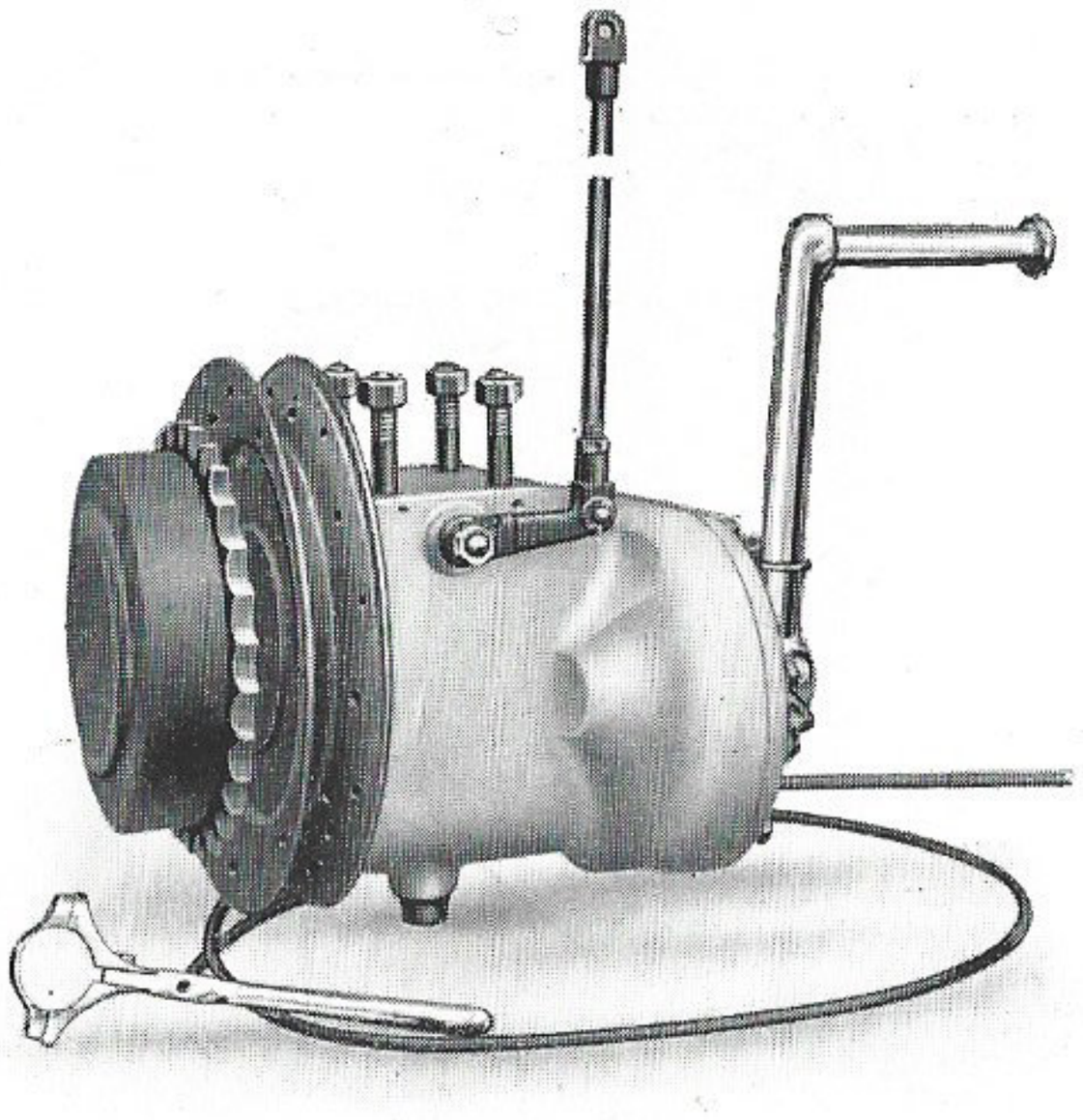


3 Speed Gear Box in position on frame

Sturmey-Archer Gears, Ltd.,

LENTON, NOTTINGHAM.

Sturmey-Archer Countershaft Gears.



3 Speed Gear Box

AN efficient 2 or 3 Speed Gear box is the greatest boon to the motorcyclist. With it fitted, the capabilities of the machine are increased enormously and the life of the engine is prolonged in proportion.

Gears, however, if not perfectly designed and built of the right metals can, and do give endless trouble to their owners.

Care therefore should be exercised when buying a motorcycle to be sure that the gear box is made by a firm of gear specialists and of great experience.

Sturmey-Archer Gears are the original, and their premier position for efficiency throughout has never been challenged. During the Great War these gears stood up to the bumping, jolting and jarring received in every battle area, and many Despatch Riders have added their letters of appreciation on the simplicity and hard wearing qualities of the Sturmey-Archer.

Features of the Sturmey-Archer.

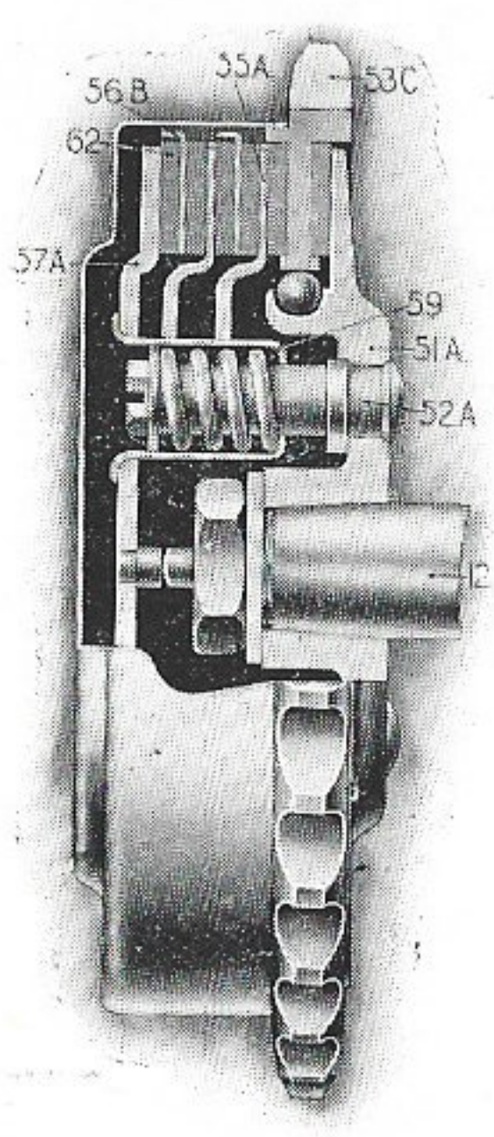
The gears are **constantly in mesh** for the full width of the teeth at all times and on all gears, the changes being effected by sliding dogs ; there is no danger of stripping the teeth when changing gear.

The clutch is of the dry plate type, operated by a very light pressure on a handle-bar lever, and will be found ideal for solo riding and traffic work.

The **CLUTCH** consists of the main body (51) keyed to the gear box axle, and four other driven plates, two of which (55 & 57) are coupled up to the main body by spring boxes(59) and studs (52.)

The driving plates are the sprocket(53) and the two plates (56) these are coupled to one another by tongues and grooves on the outer diameters. The sprocket runs on a ball bearing when free, so is frictionless.

The friction driving surfaces consist of 6 " Ferodo " rings (62) each interposed between a driving and a driven plate. The result is a clutch which for sweetness of engagement and durability is unequalled.



The Clutch.

The whole clutch may be readily dismantled by removing the spring box screws.

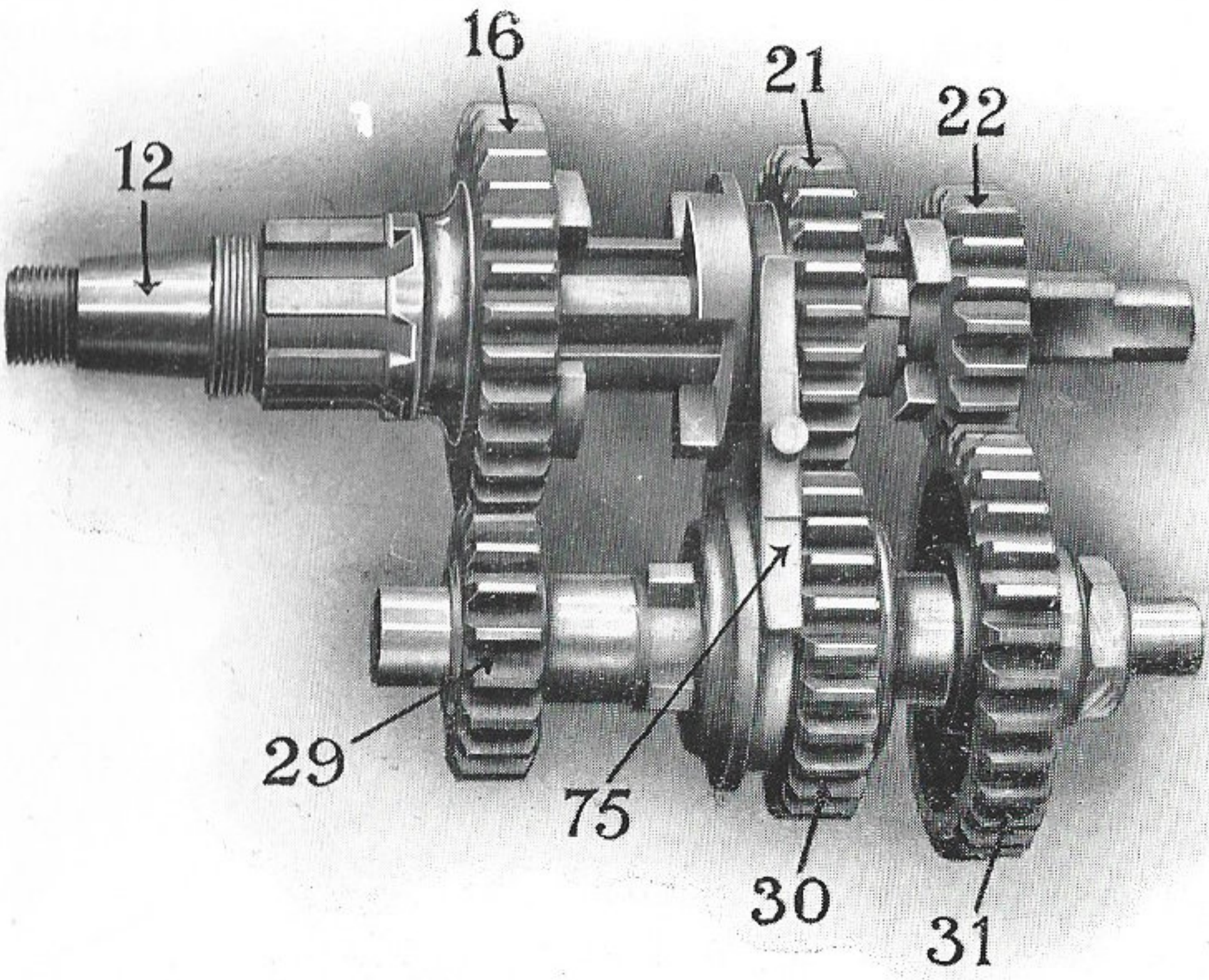
It is advisable to declutch when changing gear, but not absolutely necessary, as the gear may be changed by lifting the exhaust valve momentarily when operating the gear lever. When declutching it is advisable to completely declutch instead of attempting to change with the clutch partly gripping, especially when changing down from top to middle, or middle to low.

TO ADJUST THE CLUTCH, the wire stop screw should be screwed up until there is about $\frac{3}{16}$-in. to $\frac{1}{4}$in. of idle movement in the clutch worm lever. In extreme cases it may be necessary to loosen the clutch worm lever from the worm to find a more convenient operating position. The only parts of the clutch liable to wear are the friction plates, which are easily replaced. The clutch should be adjusted immediately any sign of slipping is felt. Should oil get on the clutch, as may occur when newly assembled, this will cause slipping ; to overcome, inject petrol. A sure sign of slipping is given by the clutch becoming very warm whilst driving. In the case of a combined chain and belt drive, the belt should be suspected of slipping before interfering with the clutch.

When fitting up the control wire for the clutch, ease off the bends as much as possible to ensure long life and easy movement of the wire.

GEARS.

The clutch body (51) is keyed on the taper end of the main axle (12), the central portion of which is formed with six keyways cut from the solid metal. The central pinion (21) has corresponding keyways, and consequently is always rotated with the axle, although free to slide longitudinally. The gear wheel (16), to which the pulley is fixed revolves freely on the axle, as does also the small pinion (22).



The layshaft (29) has keyed upon it at one end the gear wheel (31), and is also formed with four clutch dogs in the centre, into which may be engaged at will a corresponding set of clutch dogs in the sliding pinion (30).

The two sliding pinions are connected by a forked plate (75), and so are operated simultaneously. The action is as follows :—

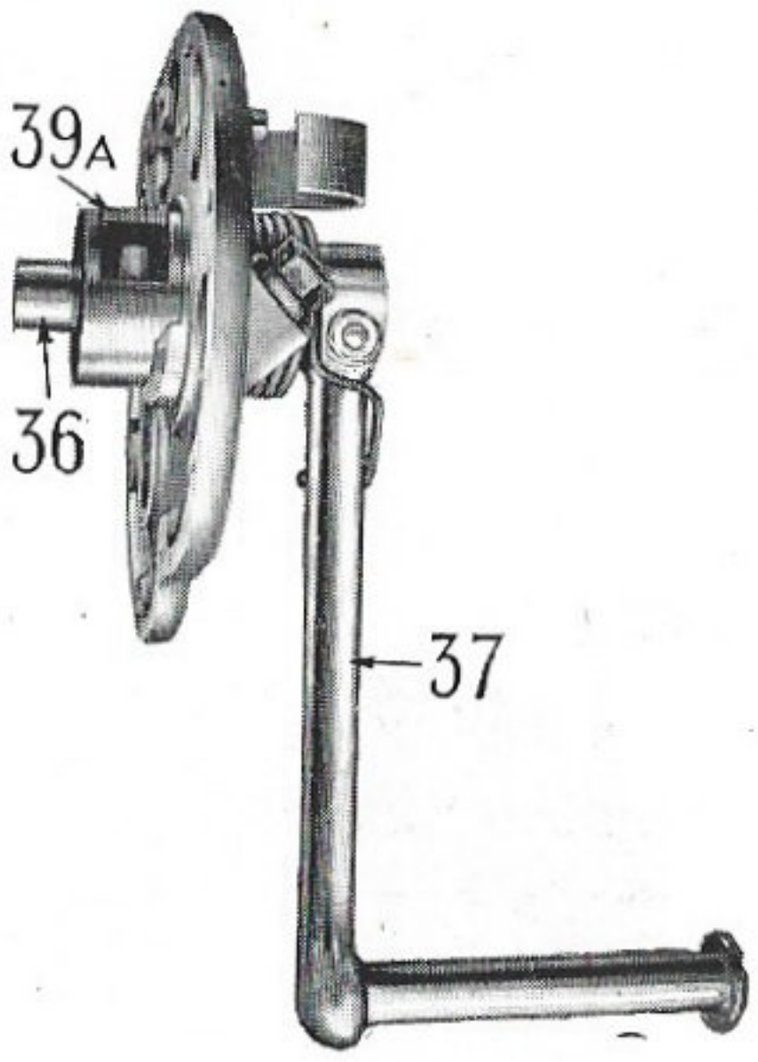
HIGH GEAR,—The sliding pinions are moved to the left, so that the clutch teeth on pinion (21) engage with corresponding clutch teeth on gear wheel (16), thus locking the latter to the axle and giving a solid top gear drive. A recess formed within the pinion (30) ensures that the latter is free from driving engagement with the lay shaft.

MIDDLE GEAR.—The sliding pinions are moved to the central position, releasing the high gear dog clutch, and permitting the clutch dogs on the layshaft (29) to engage with the internal clutch teeth in the layshaft sliding pinion (30). The drive is then transmitted from the axle through the sliding pinions to the layshaft, thence by the layshaft pinion (29) to the main gear wheel (16).

LOW GEAR.—The sliding pinions are moved to the right, engaging the right-hand clutch on the axle sliding pinion with the clutch teeth on low gear pinion (22), and releasing the clutch dogs on the layshaft (29) from the layshaft sliding pinion (30). The drive is effected through the pinion (22) to the layshaft gear wheel (31), and thence to the main gear wheel (16) by the layshaft pinion (29).

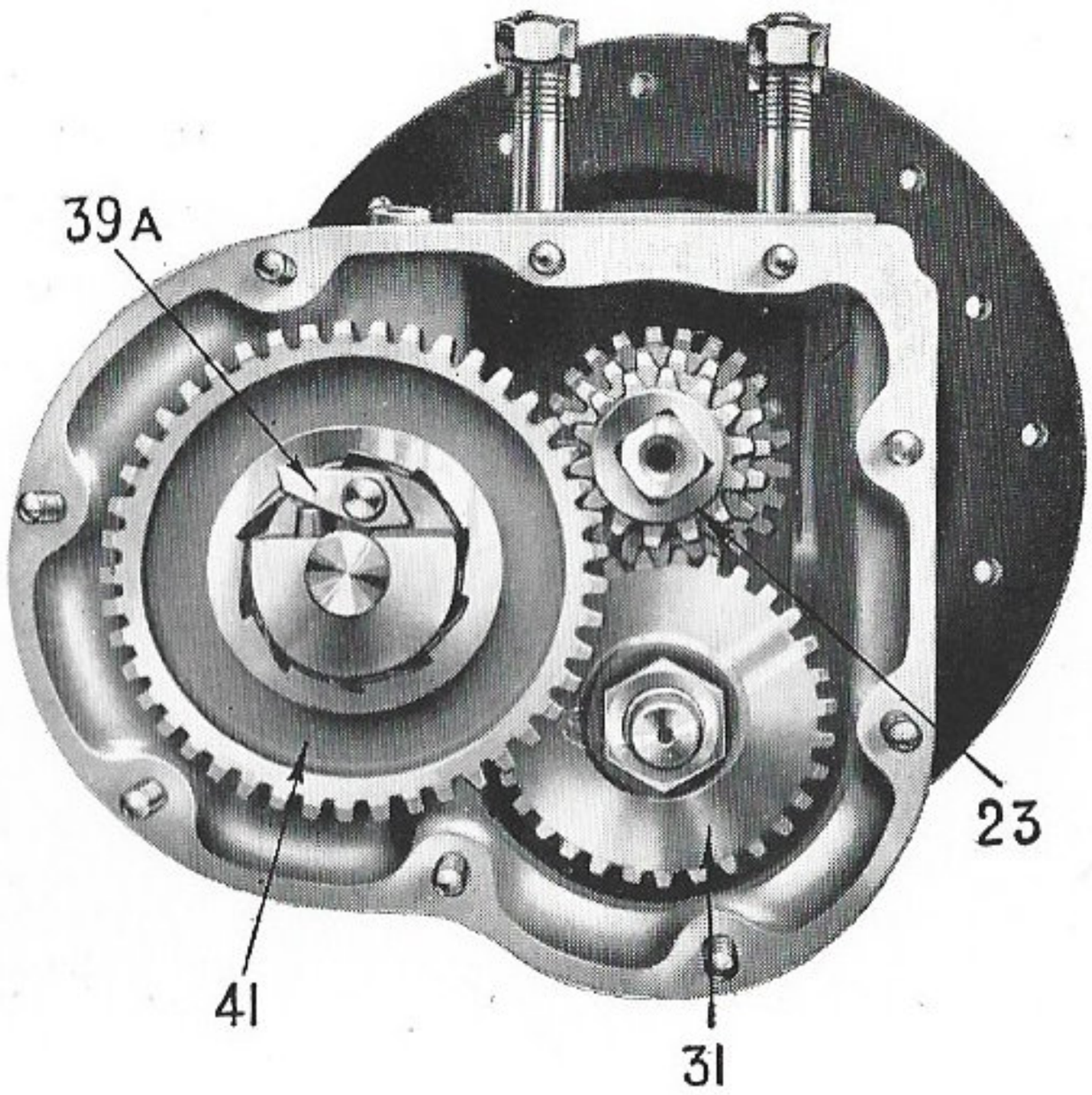
In all three gears it will be noticed that each pair of pinions is continuously in mesh, so that there is no risk of chipping off portions of the gear teeth, which would eventually damage the whole gear box.

Both the layshaft and the main gear wheel (16) revolve on ball bearings, reducing friction to a minimum.

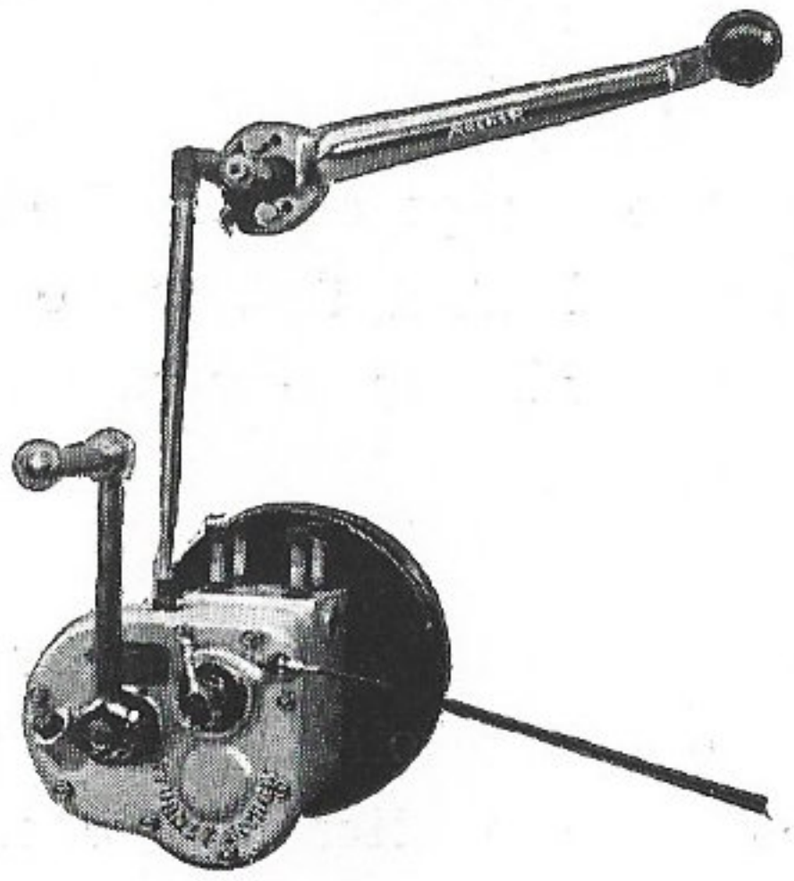


Kick Starter

The **KICK STARTER** enclosed in the gear box, consists of a crank lever (37) fastened by a taper cotter to a short shaft (36), which is machined out to receive a free wheel pawl (39). This communicates movement to a large gear wheel (41) in mesh with a small pinion (23), mounted on a squared portion of the main axle. When the return spring brings the crank back to its normal vertical position, a projection on the free wheel pawl comes into engagement with a fixed cam mounted in the gear box cover and positively depresses the pawl out of action.



Internal Mechanism of 3 Speed



Gear Control

The **GEAR CONTROL** is separate from the gear box and is adjustable to suit any machine. The forward position is low gear, then neutral (for starting-up), middle and high gear.

STARTING.—When starting the engine by means of the kick starter, the gear behaves in all respects like a motor car gear.

Place the gear lever in the neutral position with the clutch in engagement, start the engine by the kick starter, then declutch before engaging the low gear, after which the clutch may be re-engaged and other gears operated as desired.

A little practice with the kick starter will probably be required before the engine can be relied upon to start at the first kick. The best method of procedure is to gently push down the pedal lever until a resistance due to engine compression is felt ; allow the pedal to return to its upright position, raise the exhaust lifter and force the pedal right to the full extent of it, movement with a vigorous push, remembering to drop the exhaust lifter immediately the downward movement of the pedal commences and not to wait until nearly the end of the stroke.

Where the engine is fitted with a decompresser, or in the case of a low-powered engine, particularly a twin cylinder engine, it will often be found possible to start without touching the exhaust lifter.

In obstinate cases a little petrol injected into the cylinder head will facilitate starting.

Don't forget to declutch before moving gear lever from neutral position. If the gears are engaged **from rest** without having previously declutched, the machine will leap forward and possibly lead to serious accident.

LUBRICATION.—The gear box is designed to retain ordinary engine oil. After a first injection of about three oil gun charges it should run over 1,000 miles before further attention, when another oil gunful may be injected.

If thin oil is used, it will require replenishing more often. It is not advisable to use grease as it may prevent the free operation of the kick starter pawl.

The spring plunger and various joints in the gear changing lever mechanism should be kept oiled regularly to ensure freedom of action.

DO NOT lubricate the clutch, as this is designed to run dry.

TO TAKE THE GEAR APART remove the nine cover nuts and gently pull off the cover plates. Do not use a screwdriver or similar tool to part the joint or the latter will fail to retain oil when reassembled. If the plate sticks, one or two light blows inside the kick starter crank will loosen it. This will expose the complete interior to view, and the kick starter wheels as well as low gear pinion, may be lifted out

To remove the layshaft, it is necessary to uncouple the gear control, when the complete layshaft, together with the sliding wheel on main axle, may be easily taken out.

When replacing, take care that the ball bearings are not tilted, and on no account must the layshaft spring washer be omitted. No forcing should be necessary when replacing the cover plate.

PARTICULARS FOR ORDERING GEARS.—The standard 3-speed gear box (unless specially ordered otherwise) is supplied with a clutch suitable for a 4 H.P. single or 8 H.P. twin engine.

Dimensions are as follows :—

Engine chain line, $3\frac{7}{16}$in.
Clutch sprocket, 30 teeth, $\frac{5}{8}$-in. pitch, $\frac{3}{8}$in. wide.
Belt pulley, 8-in. diameter, for 1-in. belt, $2\frac{3}{8}$-in. belt line.
For all chain drive, the rear sprocket has 17 teeth for $\frac{5}{8}$-in.:
by $\frac{3}{8}$-in. roller chain, with a chain line of $2\frac{7}{16}$-in.

WHEN ORDERING GEARS please give following particulars :

Make of Machine.

H.P. of Engine.

No. of Cylinders.

Type of Drive { Chain and Belt. / All Chain.

Diameter of Handle Bar.

Is Frame Bracket required ? (*This will involve an extra charge*).

LIST OF AVAILABLE GEARS.

TOP.	MIDDLE.	LOW.	TOP.	MIDDLE.	LOW.
3	4.9	8	4¾	7.75	12.65
3¼	5.3	8.65	5	8.15	13.3
3½	5.7	9.3	5¼	8.56	14
3¾	6.13	10	5½	8.96	14.65
4	6.5	10.7	5¾	9.38	15.3
4¼	6.93	11.3	6	9.78	16
4½	7.34	12	6¼	10.2	16.65

Sturmey-Archer Countershaft Gears

2-SPEED

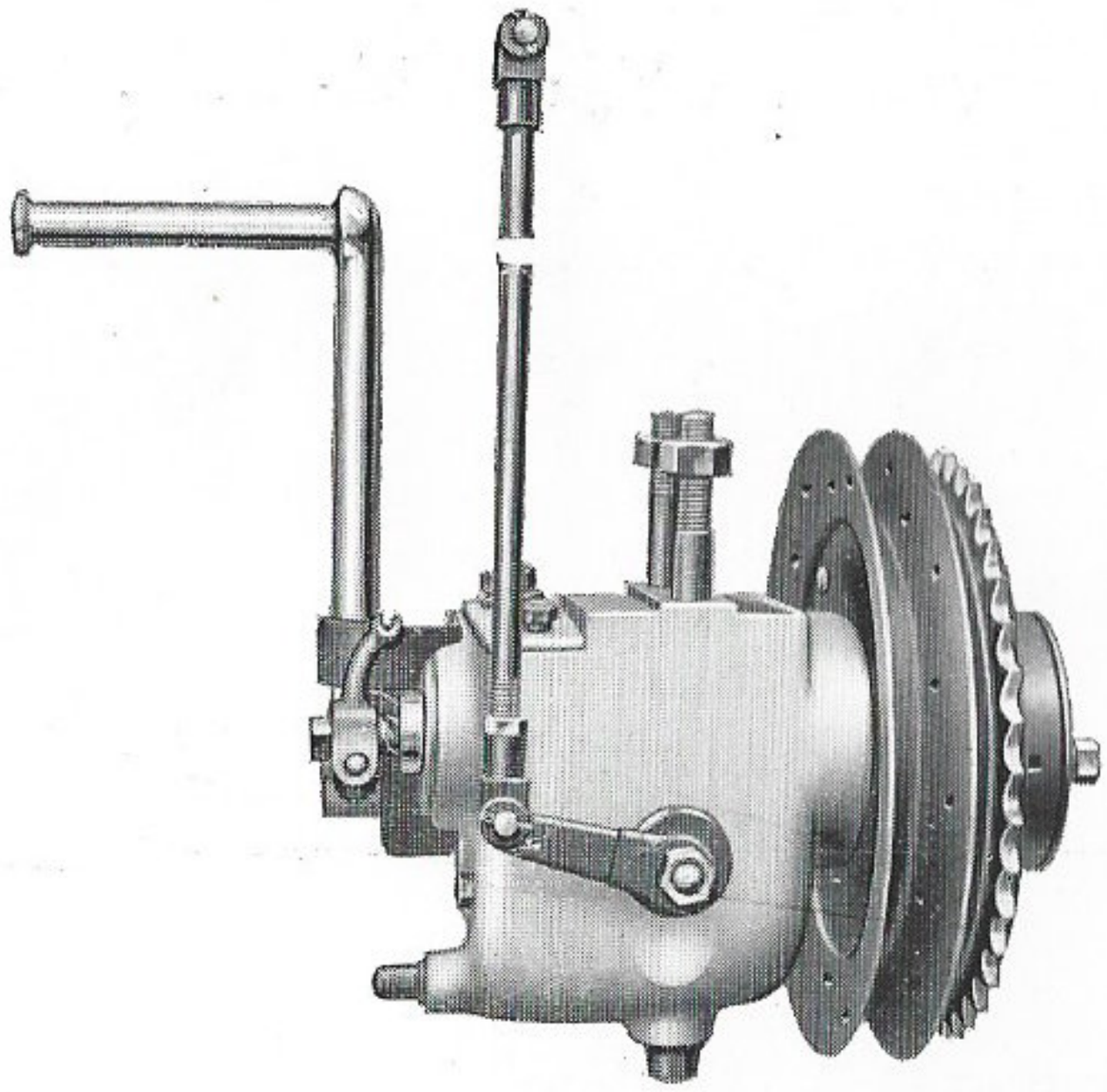
With or without Kick-starter.

2 Speed Gear Box in position

STURMEY-ARCHER GEARS, LTD., LENTON, NOTTINGHAM.

The 2-Speed Gear.

This Gear has been specially designed for light-weight Motor Cycles with a view to lightness, efficiency and simplicity. The box is cast in one piece. The Gears (excepting the Kick-starter Wheel) being threaded through the hole for main bearing.



2 Speed Gear Box

LIST OF AVAILABLE GEARS.

HIGH.	LOW.	HIGH.	LOW.
4	7.1	5½	9.75
4¼	7.55	5¾	10.2
4½	8.0	6	10.65
4¾	8.4	6¼	11.2
5	8.85	6½	11.55
5¼	9.3	6¾	12

The Main Axle is mounted on ball bearings and has a dog-clutch splined in the centre. The dog-clutch engages high and low gear wheels by means of a forked lever (made in one piece) and extending through the front of the box.

The Clutch is of the Cork insert type, large in diameter, giving a reserve of gripping power combined with durability.

The Sprocket has 40 teeth, $\frac{3}{16}$ x $\frac{1}{2}$" pitch, and is mounted on balls. The Clutch is extremely easy to dismantle, using only an ordinary spanner, and is the work of only two minutes. A Handle Bar Control is used for the Clutch, and it will be found extremely sweet and easy to operate.

The Belt Pulley is 7" diameter to take $\frac{3}{4}$" Belt, and is splined to the Main Gear Wheel instead of being screwed on. This will be much appreciated by the ordinary Motorist and repairer, as it requires no special tools to unlock it.

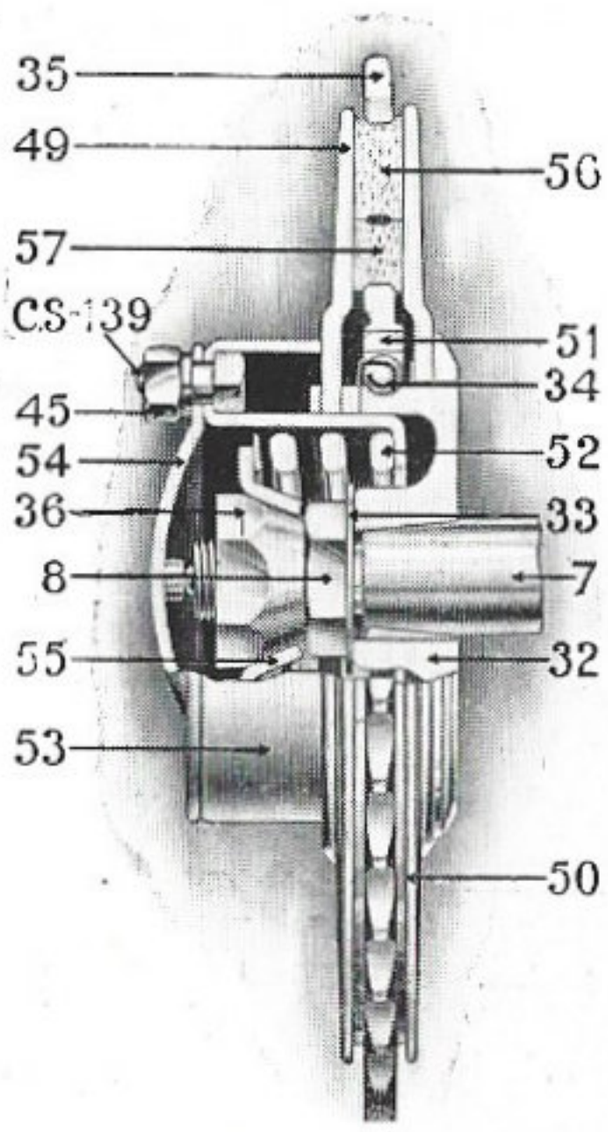
The Kick-starter is the same in principle as used on our 3-speed Gear. It is of ample strength and entirely enclosed. The Kick-starter Crank Return Spring is also provided with a cover.

The Kick-starter Wheel is put into place through the opening in the top of the Box, and must be put in before the Axle.

The Box is secured to the frame by two $\frac{7}{16}$" Studs in the top. We have not designed a special bracket for the frame, preferring makers to design this to suit their own particular requirements.

The Belt Line is $2\frac{1}{8}$" and Chain Line 3". Gear Ratio, 1 : 1·777

THE CLUTCH.—The clutch consists of the main body (32) keyed to the gear box axle, and two driven plates (49 & 50) coupled up to the main body by tongues and grooves on their inner diameter.



Clutch 2 Speed

The driving sprocket (35) is pierced with a large number of holes in which are inserted cork discs, these provide the friction surface. The sprocket runs on a ball bearing when free so is frictionless. The clutch spring (52) is adjustable by means of nut (36) which is accessible on removing the outer plate (54) held in position by three nuts (139).

To adjust the clutch control the wire stop screw should be screwed back until there is about $\frac{3}{16}$" to $\frac{1}{4}$" idle movement in the clutch worm lever.

Low Gear.—The sliding dog clutch is moved to the right, so that the clutch teeth engage with corresponding clutch teeth on pinion (14) the drive is then effected through this pinion to the layshaft and from the layshaft to the main gear wheel (12). The main shaft revolves on ball bearings (9) and (24) and the layshaft on a plain bearing.

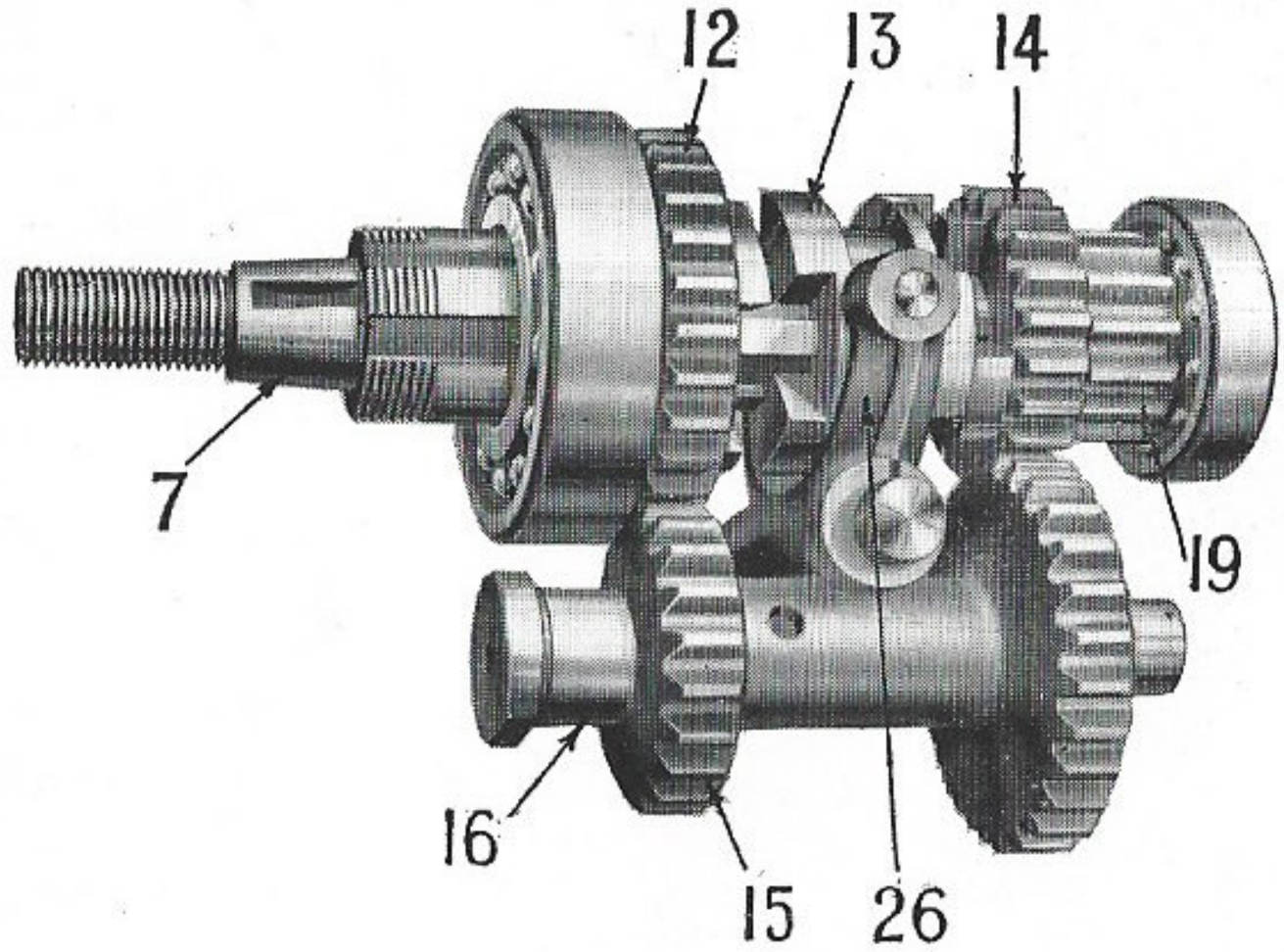
The Kick-starter on this model is exactly the same as that on our 3-speed model (see page 6).

The Gear Control is also the same as on the 3-speed with the exception that the notches are arranged to suit two gears instead of three (see page 7).

The 2-speed Countershaft Gear is also supplied without the kick-starting mechanism.

All the parts of this gear box with the exception of the aluminium casting of the box itself are interchangeable with those of the kick-starter.

GEARS.—The clutch body (32) is keyed on the taper end of the main axle (7) the central portion of which is formed with six keyways cut in the solid metal. The sliding dog clutch (13) has corresponding keyways and is always rotated with the axle but free to slide longitudinally. The gear wheel (12) to which the pulley (30) is fixed, revolves freely on the axle as does also the pinion (14). The layshaft (15) is turned from the solid bar and has cut upon it two pinions one of which engages with pinion (14) and the other with the wheel (12) remaining constantly in mesh.



Gears 2 Speed

The action is as follows :—

High Gear.—The sliding dog clutch (13) is moved to the left so that the clutch teeth engage with corresponding clutch teeth on gear wheel (12) thus locking the latter to the axle and giving a solid top gear drive.

PARTICULARS FOR ORDERING GEARS.—The gear box is suitable for a $2\frac{3}{4}$ H.P. single or $3\frac{1}{2}$ H.P. twin cylinder engine. Dimensions are as follows :—

Engine chain line, 3-in.
Clutch sprocket 40 teeth $\frac{1}{2}$-in. pitch, $\frac{3}{16}$-in. wide.
Belt pulley, 7-in. diameter, for $\frac{3}{4}$-in. belt. $2\frac{1}{8}$-in. belt line.
For all chain drive the gear box sprocket has 20 teeth for $\frac{1}{2}$-in. by $\frac{3}{16}$-in. roller chain, with a chain line of $2\frac{3}{16}$-in.

WHEN ORDERING GEARS please give following particulars :

Make of Machine. H.P. of Engine.
No. of cylinders With or without kick-starter.
Type of Drive—Chain and Belt or All Chain.
Diameter of Handle Bar.

Sturmey-Archer Gears, Limited,

LENTON, NOTTINGHAM.

Telegrams—
"Triple, Nottingham."

Telephone—
4154