

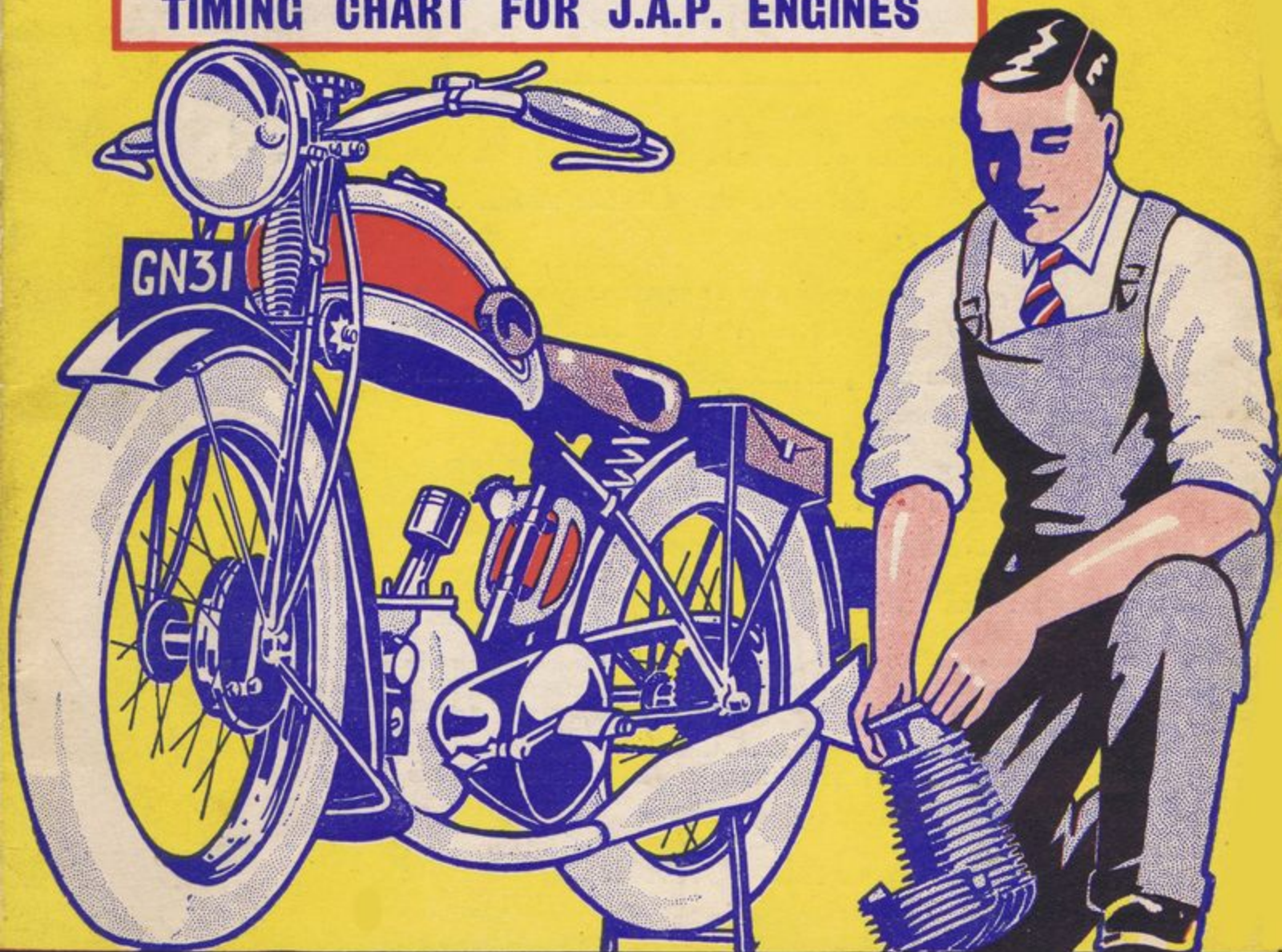
NEWNES

MOTOR CYCLE REPAIR AND UPKEEP

Advisory Editor:- J. EARNEY. M.I.M.T.

IN THIS PART

REPAIR NOTES ON VELOCETTE ENGINES—
OVERHAULING SPARKING PLUGS—ALBION
GEARBOXES: REPAIRS AND ADJUSTMENTS
TIMING CHART FOR J.A.P. ENGINES



1/6

WORTH POUNDS TO ALL INTERESTED
IN MOTOR CYCLE REPAIR

PART
6

ALBION GEARBOXES

REPAIRS AND ADJUSTMENTS

By F. A. CONEY

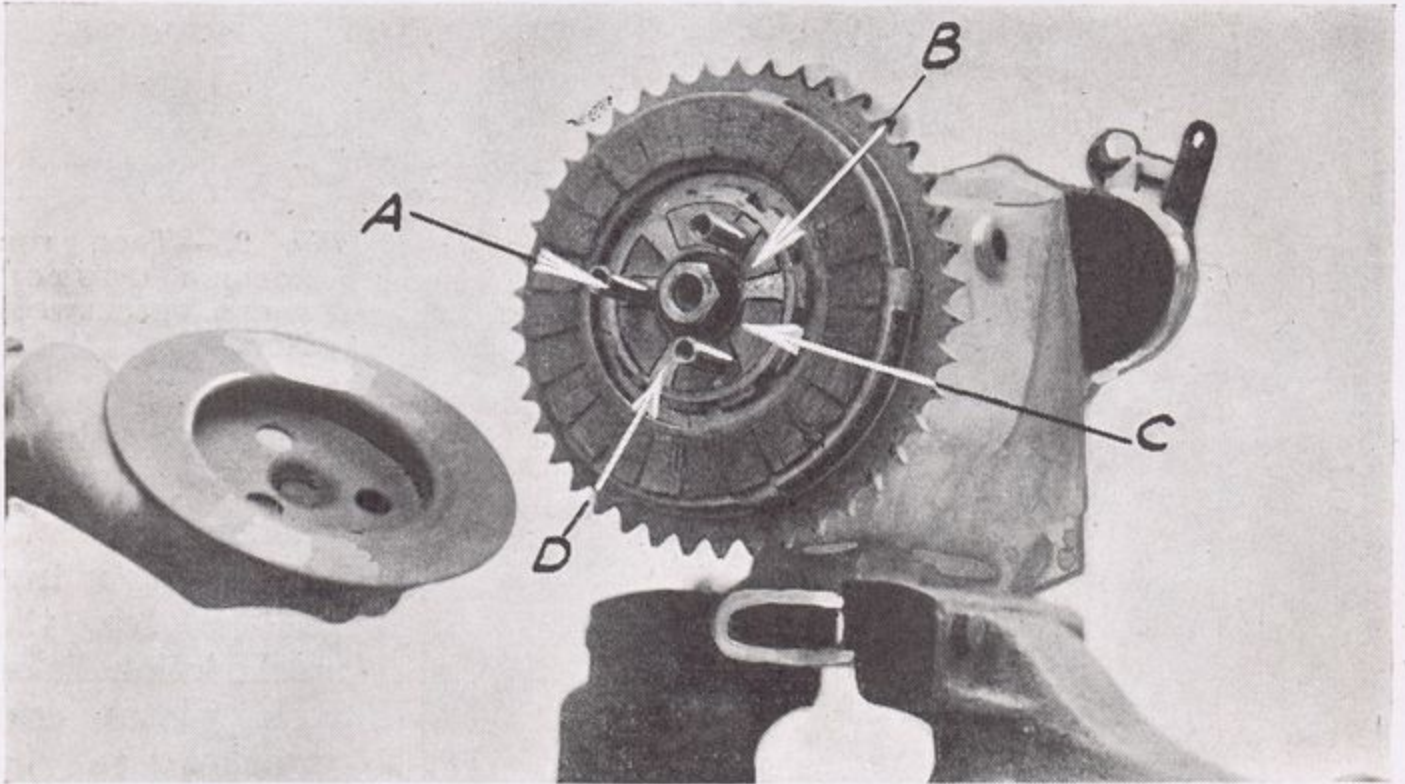


Fig. 1.—DISMANTLING THE CLUTCH.

Note position of large and small rubbers relative to studs.

A. Clutch stud. B. Small rubber. C. Large rubber. D. Clutch centre.

MODEL "H" FOUR-SPEED

WE will begin our description of the dismantling, repair and assembly of the Albion gearboxes with the four-speed, model "H." It is understood that the gearbox has been washed free from grease and dirt before starting to dismantle. The first operation is to remove the clutch, and this is done in the following manner.

DISMANTLING

Dismantling the Clutch

Unscrew the small pin in the middle of the disk on the clutch cap, this releases the disk which is there to prevent the three hexagon-headed screws from turning. Unscrew the three screws (all threads are right-hand, that is, are unscrewed in an anti-clockwise direction unless otherwise stated), which allow the cap to be taken off, followed by the clutch

springs and distance tubes from over the clutch studs and the outer or front clutch plate. This exposes a smaller plate which fits on the clutch studs, and is known as the

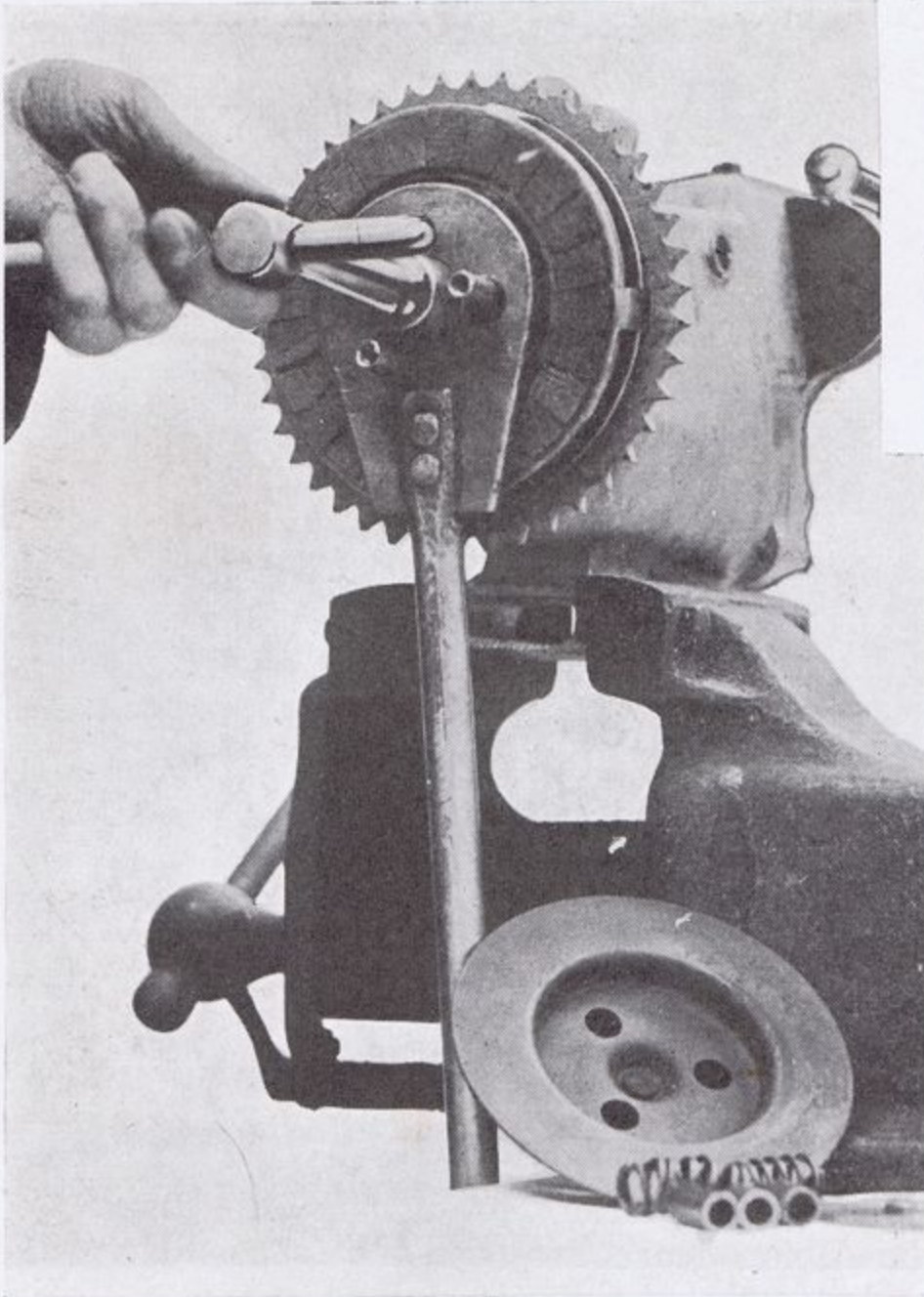


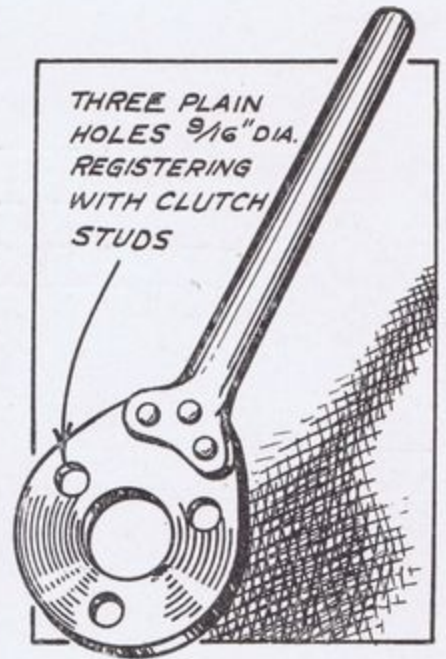
Fig. 3.—REMOVING A DIFFICULT NUT.

This shows how to use the tool illustrated in Fig. 2 for holding clutch centre still whilst the nut is being unscrewed.

and clutch centre, together with the nut holding the centre on to the mainshaft (see Fig. 1).

Overcoming the First Difficulty

The removal of this nut presents a certain amount of difficulty; in a service depot a special



THREE PLAIN HOLES $\frac{9}{16}$ " DIA. REGISTERING WITH CLUTCH STUDS

Fig. 2.—TOOL FOR HOLDING CLUTCH WHILE UNSCREWING NUT.

rubber - retaining washer. This washer is drawn off, leaving a free passage for the steel friction disks, cork plates and sprocket to be withdrawn, and at the same time shows the rubber shock absorbers

THREE PLAIN HOLES $\frac{9}{32}$ " DIA. REGISTERING WITH CLUTCH STUDS



$\frac{1}{2}$ " DIA. TAPPED SAME THREAD AS BOLT.

Fig. 4.—TOOL FOR WITHDRAWING CLUTCH.

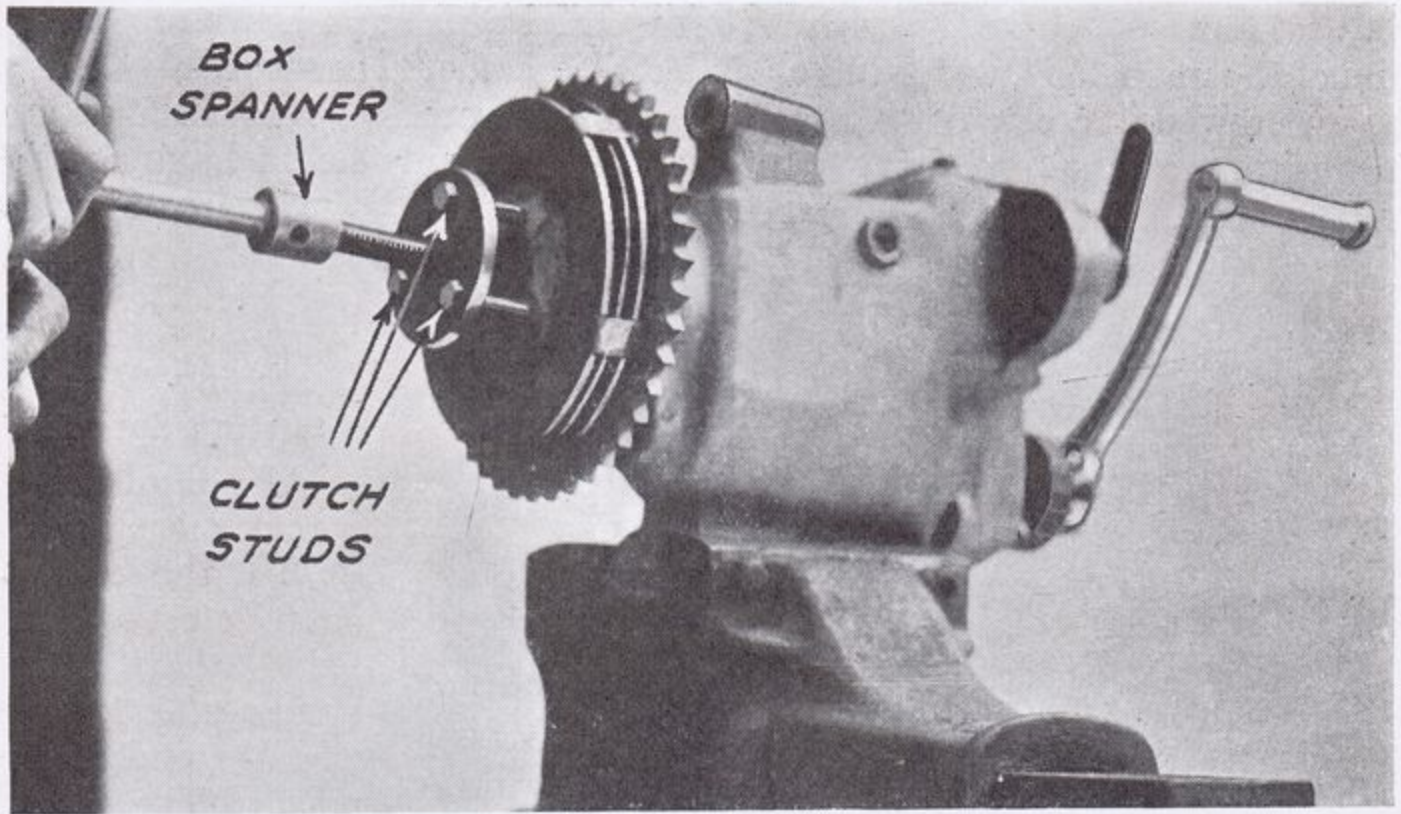


Fig. 5.—USING THE CLUTCH WITHDRAWAL TOOL.

tool is used for this (see Fig. 2). Failing this tool, wrap an odd length of chain round the final drive sprocket until it overlaps, and secure the end firmly; engage one of the gears, and then unscrew the nut anti-clockwise (see Fig. 3).

Two Methods of removing the Clutch Body

The clutch body is secured to the mainshaft by means of splines, and can usually be moved by jarring the end of the spindle with a brass hammer (do not use a steel hammer, as this will most certainly damage the thread). Assistance may be given by placing the curved ends of tyre levers at the back of the plate and levering gently. The best method, however, of withdrawing the clutch body is to use a tool after the description of a sprocket drawer (see Fig. 4). This is made in the following manner. Obtain a steel disk about $2\frac{1}{2}$ inches diameter and $\frac{1}{4}$ inch thick, three $\frac{1}{4} \times 26$ -inch thread pins and a $\frac{1}{2}$ -inch bolt about 2 inches long; drill three $\frac{9}{32}$ -inch diameter holes in the disk to correspond with the holes in the clutch studs, and in the centre of the plate drill and tap a $\frac{1}{2}$ -inch hole to suit the bolt. Place the disk on the clutch studs, and lock the three pins in the holes in the studs. Now screw the $\frac{1}{2}$ -inch bolt through until it touches the end of the spindle. Further screwing of the bolt will draw the back plate off the mainshaft (see Fig. 5).

At the Other End of the Mainshaft

Attention is now directed for a few moments to the kick-starter end of the box. Remove the two bolts holding the bearing cap (see Fig. 6),

and take off cap complete with clutch lever. This exposes a nut on the end of the mainshaft, which has a left-hand thread, and consequently must be unscrewed in a clockwise direction. To unscrew this, retain the chain in position on the final drive sprocket, the end firmly held; have one of the gears engaged and unscrew nut (see Fig. 7).



Fig. 6.—DEALING WITH THE KICK-STARTER END OF THE GEARBOX.

This shows the bearing cap bolts referred to in the text.

clear the washer and sprocket can be pulled off. Sometimes there is a thin washer or shim between the end of the boss on the final drive sprocket and the ballrace against which it abuts. Note carefully if there is one, and if so, replace it when assembling.

and unscrew nut (see Fig. 7).

Detaching Countershaft Sprocket

The final drive sprocket is splined on to the mainshaft sleeve and held there by means of a keyed washer and lock ring. The lock ring has three slots cut in the outside diameter, into which has been forced part of the key washer to prevent the ring from turning (see Fig. 8). First obtain a flat-nosed punch, and tap in the slots to flatten the key washer. Retain the chain round the sprocket and, using the same square punch, tap the lock ring round, anti-clockwise, to unscrew it (see Fig. 9). When this is

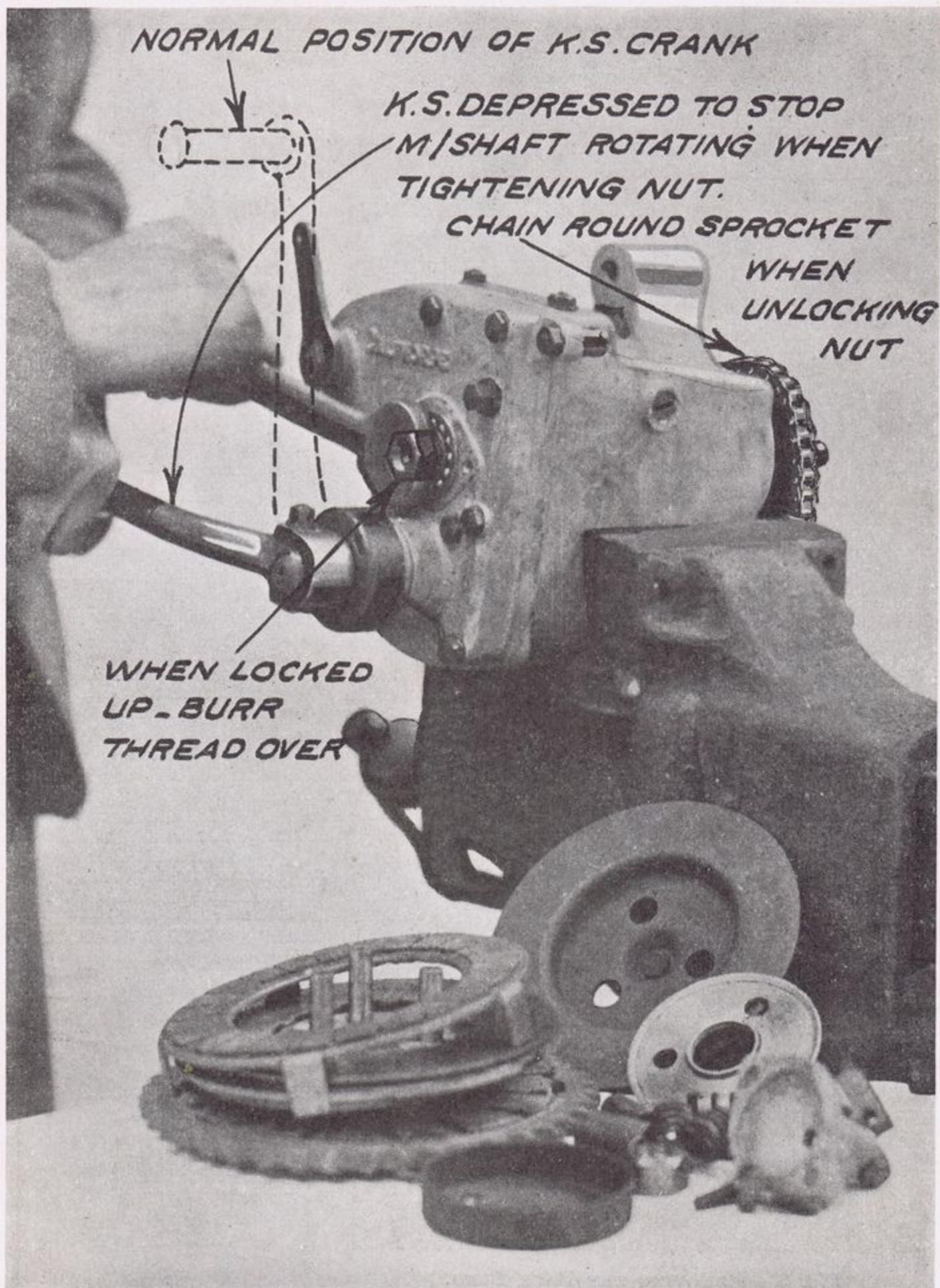


Fig. 7.—THIS SHOWS MORE ACCURATELY THE LOCKING UP OF THE NUT, USING THE KICK-STARTER CRANK TO KEEP SHAFT STILL.
To remove nut, chain should be held round final drive sprocket.

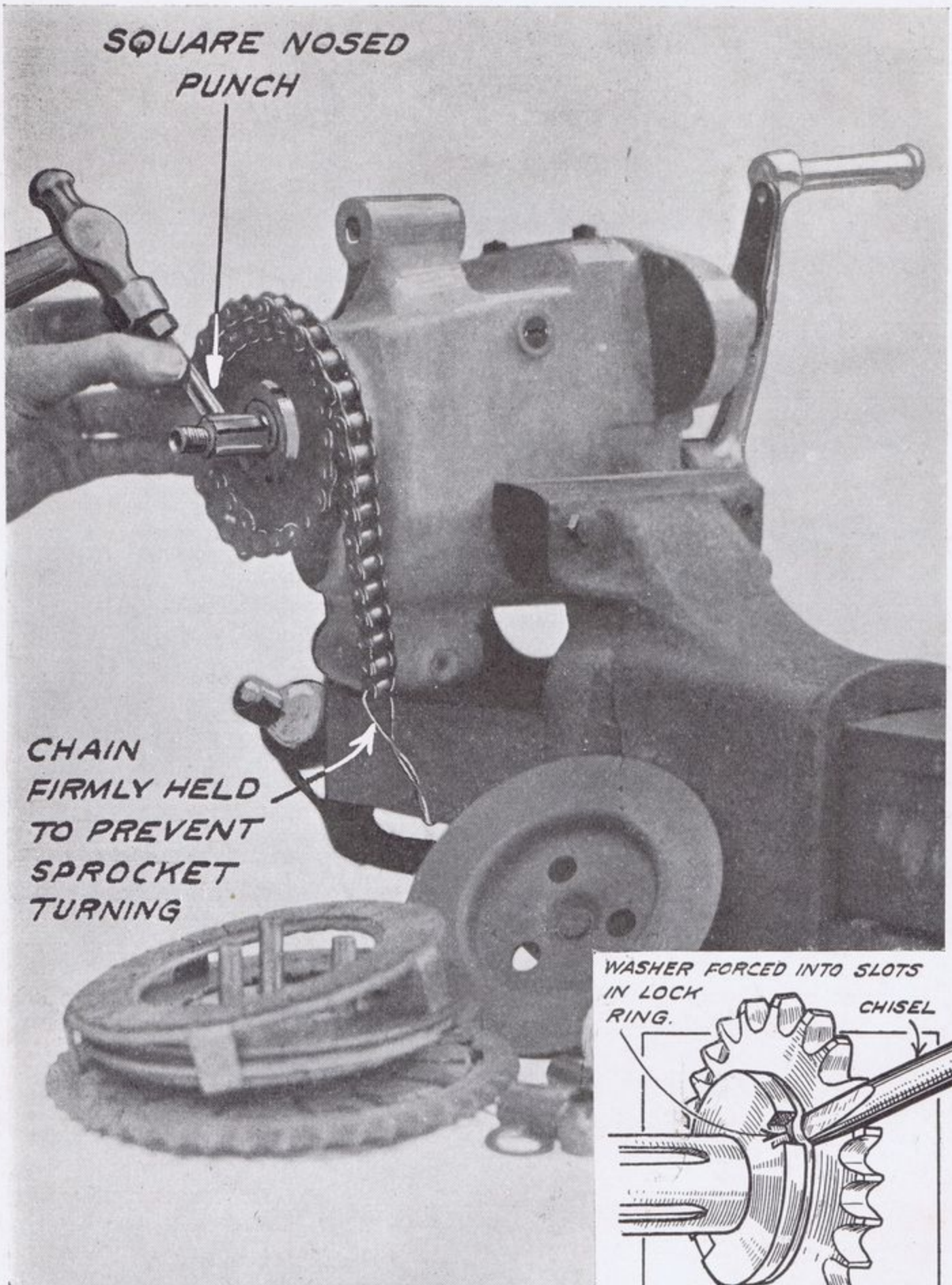


Fig. 9.—REMOVING THE BACK RING.
Note how the chain is being used to hold the sprocket still.

Fig. 8.—WASHER DRIVEN INTO SLOTS OF LOCK RING.

Another Useful Tool

A tool for unscrewing the lock ring can be made with a piece of steel tube, in the end of which are cut three dogs to correspond with the slots in the lock ring, and at the other end of the tube is drilled a hole to take a tommy bar (see Fig. 10). If driving round with a square punch, care must be taken not to swell the lock ring, otherwise when replaced it will not fit flat (see Fig. 11).

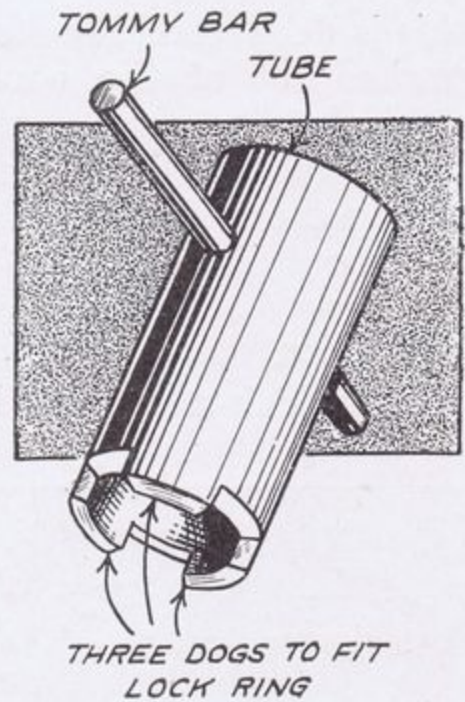


Fig. 10.—TOOL FOR REMOVING LOCK RING.

If the Kick-starter is Difficult to Remove

The kick-starter crank may now be removed by unscrewing the nut on the cotter pin and giving the threaded end of the cotter pin a sharp tap with a brass hammer to loosen it and allow it to be withdrawn. The crank will now pull off unless the cotter slot on the shaft is burred over, which is due to allowing the cotter pin

to become loose, and if this is so the crank must be left in position for awhile. The plunger box should now be unscrewed from the cover; this is in the cover face and looks like a cover bolt, except that it has a collar below the hexagon. Inside the plunger box will be found a plunger and spring (see Fig. 12); if they do not come out with the box, look for them immediately the gearbox is opened, as otherwise they may get lost. The cover bolts can now be taken out and cover

SWELLING OF LOCK RING BY CHISELLING

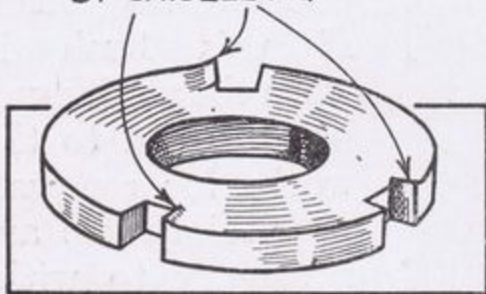


Fig. 11.—SWELLING OF LOCK RING.

lifted off complete with kick-starter mechanism. Do not use a screwdriver or similar tool to prise the cover off, as this will tend to destroy the joint and cause oil leaks; a few light taps on the back of the operator box and the clutch end of the mainshaft will loosen it sufficiently to allow it to be drawn off. If the crank could not be removed, the end of the shaft just showing through the crank (Fig. 13) should be tapped to free, meanwhile holding the crank firmly on something solid. When the crank is removed, smooth the shaft by the cotter slot, where marks will be seen showing the digging in of the cotter pin. When

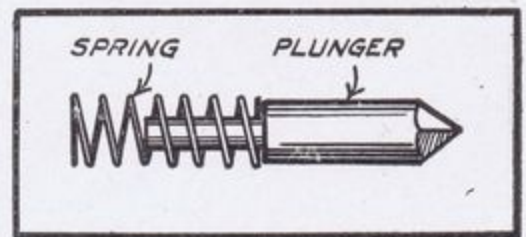


Fig. 12.—THE PLUNGER AND SPRING.

These are contained in the plunger box indicated in Fig. 6. Take care they are not lost when the gearbox is dismantled.

this is done, the kick-starter shaft can be pushed out of the cover. Take off the steel plate on the back of the operator by removing the two holding screws, and the operator shaft and lever can then be taken out (see Fig. 14).

Rebushing the Kick-starter Bearing

The kick-starter shaft consists of the

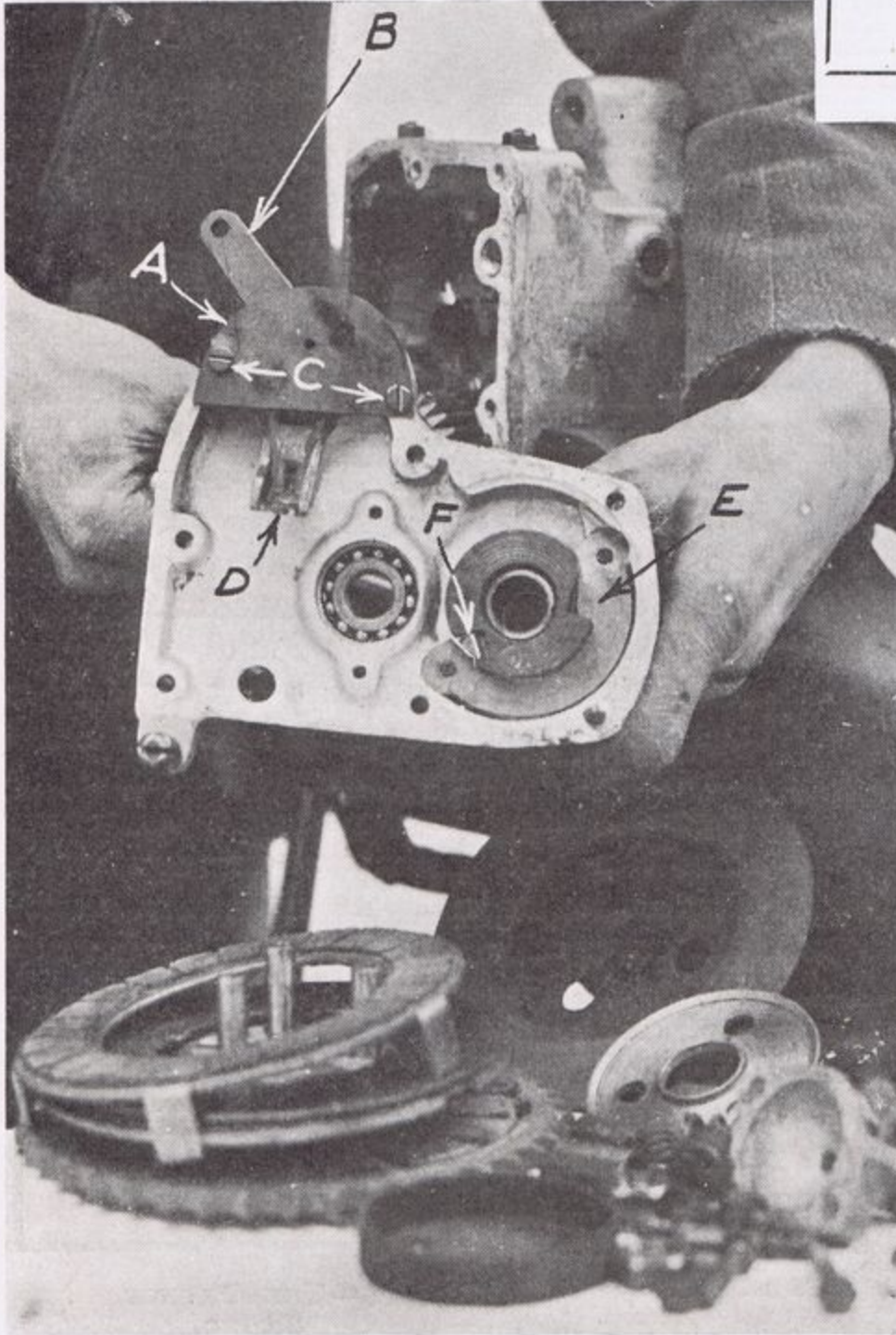


Fig. 14.—THE FINAL STAGE IN DISMANTLING THE KICK-STARTER.

- | | |
|--|-----------------------------|
| A. Operator box. | D. Spoon of operator lever. |
| B. Lever on operator shaft. | E. Kick-starter stop. |
| C. Screws securing operator cover plate. | F. Nose of pawl. |

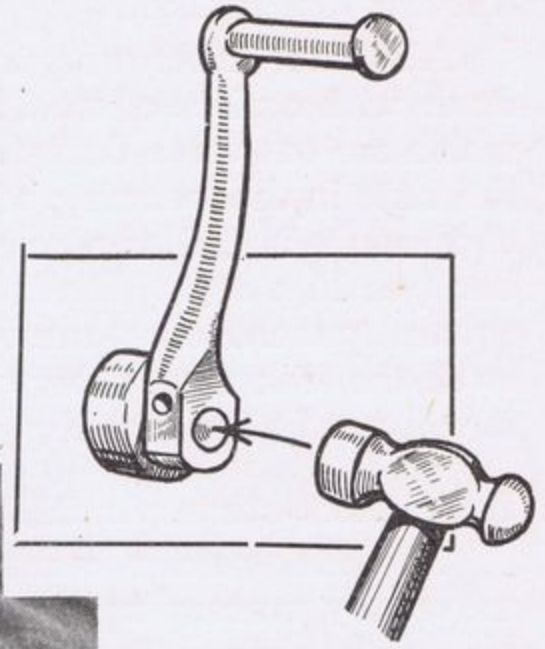


Fig. 13.—TO REMOVE KICK-STARTER CRANK. Tapping the end of the shaft to free the crank.

main body, inside which is a phosphor-bronze bush. If this bush is worn the shaft must be returned to the works for renewal, as special tools are necessary to withdraw the old bush and insert and ream the new one to size.

The Kick-starter Pawl

Between the two flanges on the shaft is the kick-starter pawl, which pivots on a pin, and is held out by a spring directly under the broad part or nose of the pawl. The pin is pushed in from the open end

of the shaft up to a shoulder and the end is burred over to retain it in position. In order to remove the pawl it is necessary first of all to grind off the burred-over portion and tap the pin out from the kick-starter crank end (see Fig. 15). When

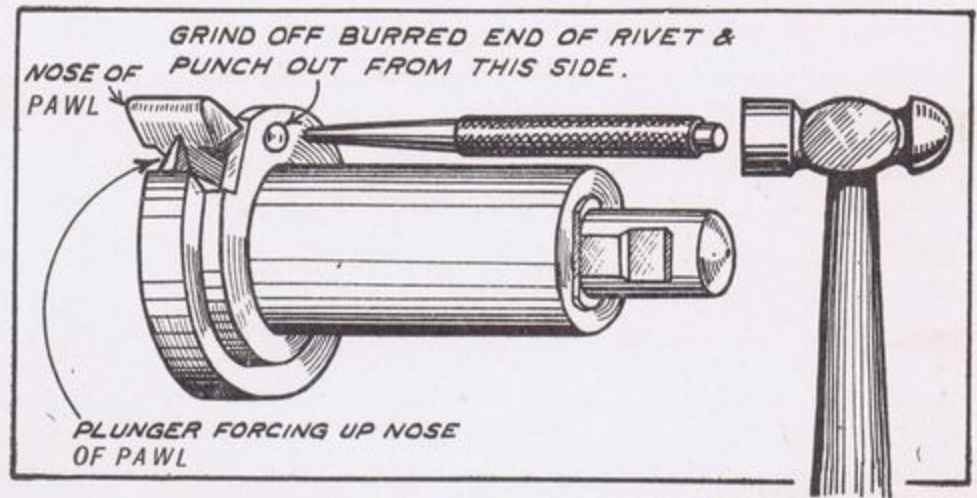


Fig. 15.—HOW TO REMOVE THE KICK-STARTER PAWL.

the pin is nearly out, hold one finger over the pawl to prevent the spring from pushing it out and allowing it to fall and possibly get lost. The spring rests in the hole and is not retained in any way.

And Trip Plate

Inside the cover is a semicircular piece of steel with a hooked end (see Fig. 16). This is the kick-starter stop and trip plate, and it is held in position by means of two screws, the heads of which are on the outside of the cover. The plate will not fall out when the pins are removed owing to the fact that it is a light press fit at each end in the cover, but with a little levering it will come out quite easily.

Withdrawing the Gears

The cover is now stripped, and this leaves us with the gearbox and gears. The mainshaft is withdrawn complete with oil thrower—a round disk with a worm thread cut on the outside—a small gear and dog. Do not attempt to remove these latter two if either is broken, as the shaft must be returned to the works so that the new gear or dog, whichever is necessary, can be put on dead true. Just jutting outside the open end of the box at the top is a small ball-shaped end of a lever; push this to the right (see Fig. 17), and it will bring the sliding gears towards the open end of the box. Grasp the layshaft and mainshaft sliding gears with the fork between them, and draw the whole as a block out of the gearbox. The mainshaft sleeve and large low-gear pinion can now be taken out, leaving inside the box only the inside operator and bearings. The inside operator is held at the top and bottom by anchor pins (see Fig. 18). The anchor pins have screwdriver slots in their

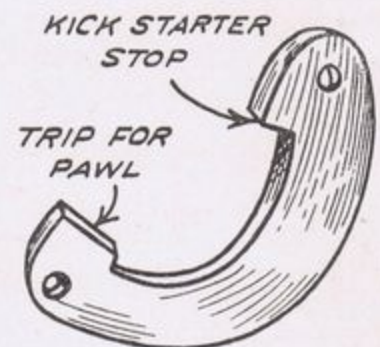


Fig. 16.—KICK-STARTER STOP AND TRIP PLATE.

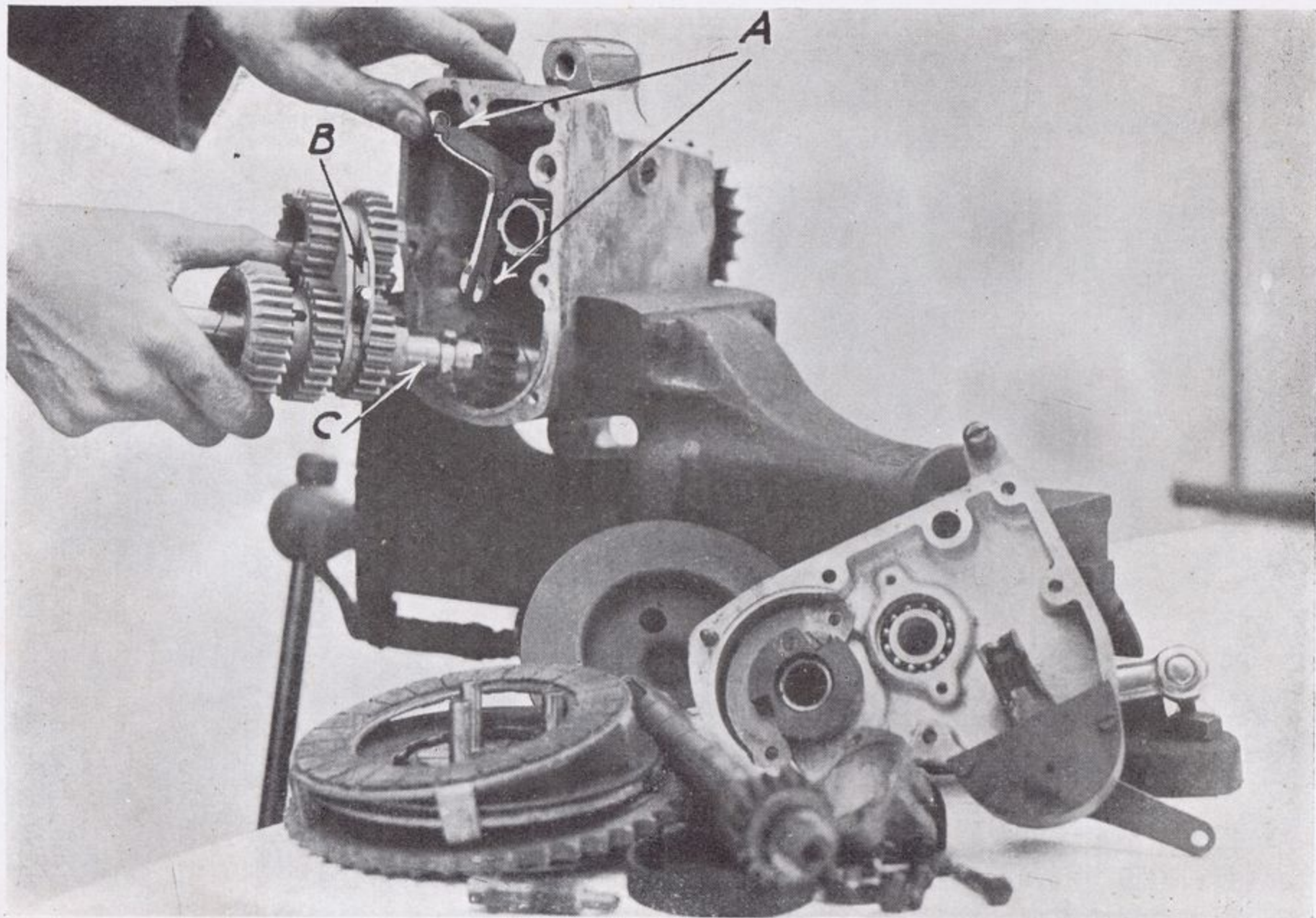


Fig. 17.—WITHDRAWING THE GEARS.

Note how the upper end of the lever A is being raised by the thumb.
A. Operator lever. B. Long flat on fork towards mainshaft. C. Layshaft.

heads, into which a little aluminium of the case has been driven to prevent their turning (see Fig. 19). This must be chipped out and the screws withdrawn, and this will allow the operator to be taken out. The box is now stripped down, and everything should be washed in paraffin for examination.

INSPECTION AND REPAIR

Attention to Bushes and Bearings

If the main ballrace has worn, it should be driven out from the clutch end (see Fig. 20) and a new one inserted. This should be caulked in by giving the aluminium immediately round it a blow with the chisel to force a little in round the radius, thus holding the bearing firmly (see Fig. 21). If the brushes are worn in the cover or box, no attempt should be made to renew them; they should be sent back to the service depot, as they have to be inserted correctly and reamed in a jig to get the correct diameter and alignment (as bushes are a press fit they contract a little, and cannot therefore be sent out to the correct size).

CHISEL FORCING
ALUMINIUM INTO
SLOT OF SCREW

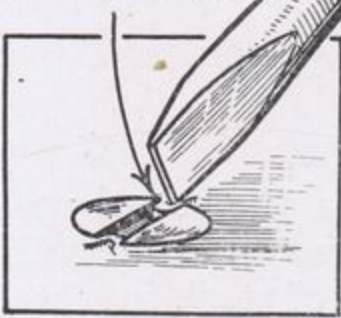


Fig. 19.—ALUMINIUM IN ANCHOR-PIN HEADS.

What to look for in the Layshaft Assembly

The layshaft assembly consists of the shaft, the large kick-starter pinion which is pressed on splines, two sliding pinions and the small low-gear pinion followed by a steel bush. Any replacements necessary for this shaft require the shaft to be sent complete to the works, because, as pointed out when dealing with the mainshaft, the fitting of new pinions necessitates great care to get the correct line. The small dogs on the layshaft are rounded, and the dogs on the sliding gears, which are internal dogs, are rounded to fit. If the gears have been jumping out of second and third, look at the dogs on the sliding gears, and if they are rounded outwards (see Fig. 22) the shaft should be returned to the works to have the gears replaced.

LOOK FOR CRACKS IF GEAR
HAS BEEN STRAINED.

HOLE FOR ANCHOR
PIN.

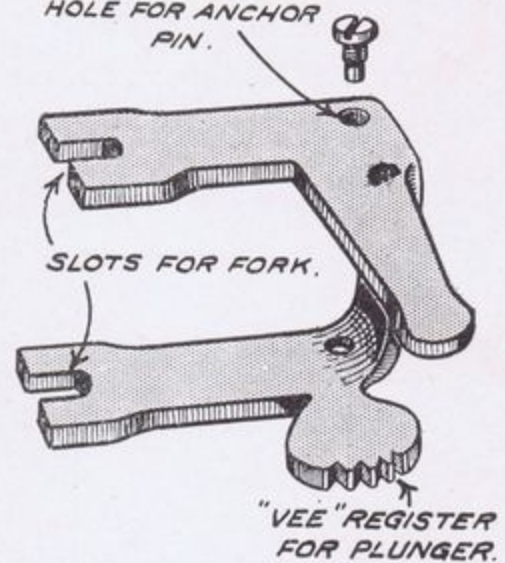


Fig. 18.—INSIDE OPERATOR.

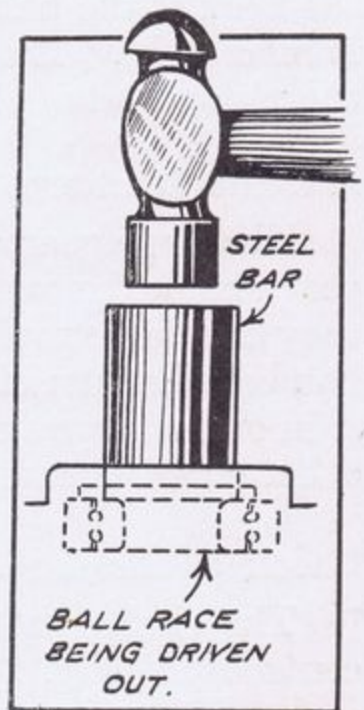


Fig. 20.—DRIVING WORN MAIN BALL-RACE OUT FROM CLUTCH END.

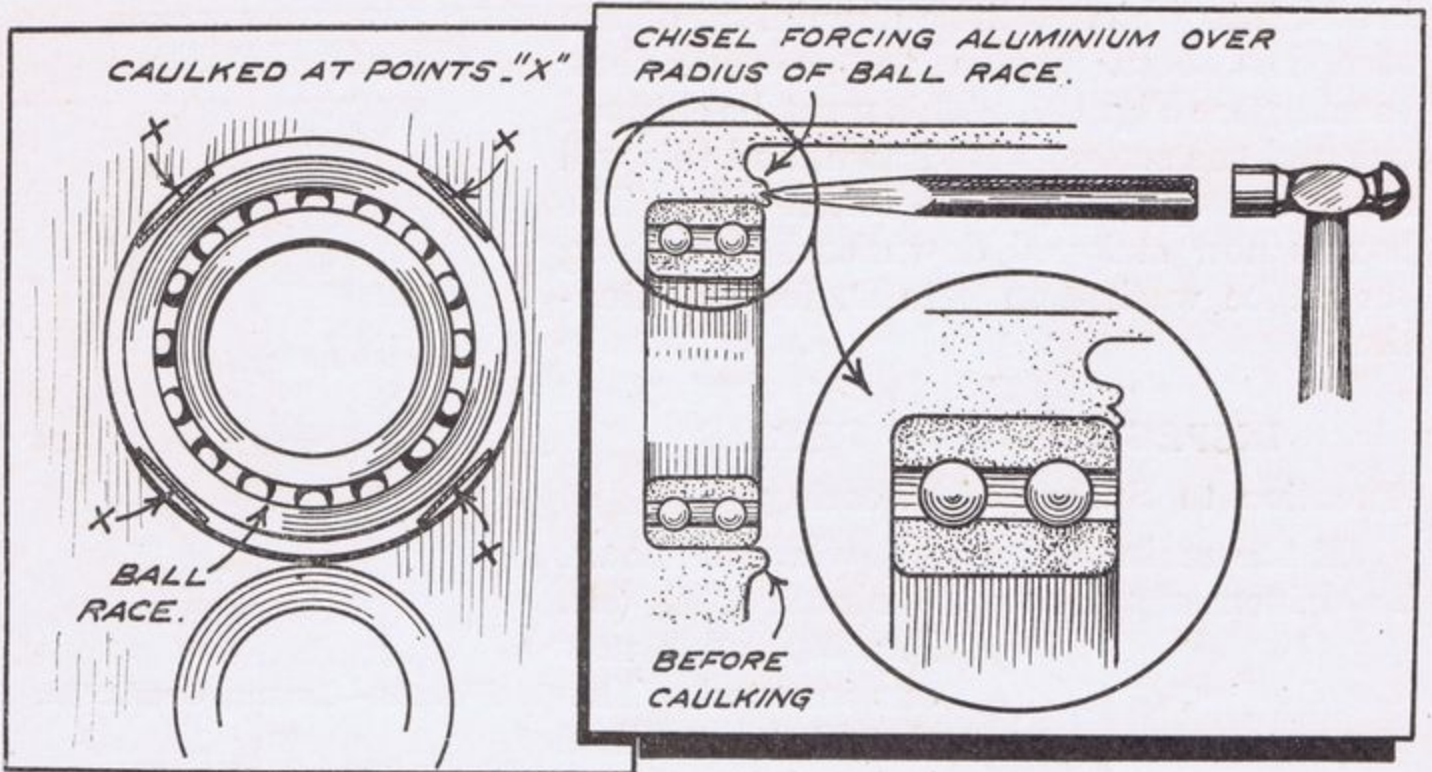


Fig. 21.—CAULKING IN THE BEARING.

Check the Inside Operator

Troubles do not arise much from the inside operator, the bow-shaped steel strip, with an arm terminating in a ball shape at one end and at the top extension, and on the lower extension a flat piece of steel, in which notches are cut (see Fig. 18). If the gears have been forced at any time, for instance when the machine has been standing stationary, then look in the neck of the ball to see if there are any cracks; if there are, replace it immediately. The notches are the registrations for gears into which the plunger fits.

A Little Dentistry

The large gear on the mainshaft sleeve and also the mainshaft sliding gear should be examined for rounded dogs; if these exist (see Fig. 23), they should be replaced, as they will cause gears to jump out. If a tooth has been broken off any of the gears, careful search should be made for it in order to prevent it remaining in the box and getting mixed up with other gears, thereby causing other breakages.

Check Shafts for Truth

The shafts should, if possible, be examined for truth by means of centres (see Fig. 24). The shaft should be placed between the centres and spun slowly against a white background. If the shaft moves up and down it is bent slightly, and should be returned to the works for straightening. Bending of the shafts is usually due to a tooth breaking off and getting between two other gears, forcing them apart. If no centres are

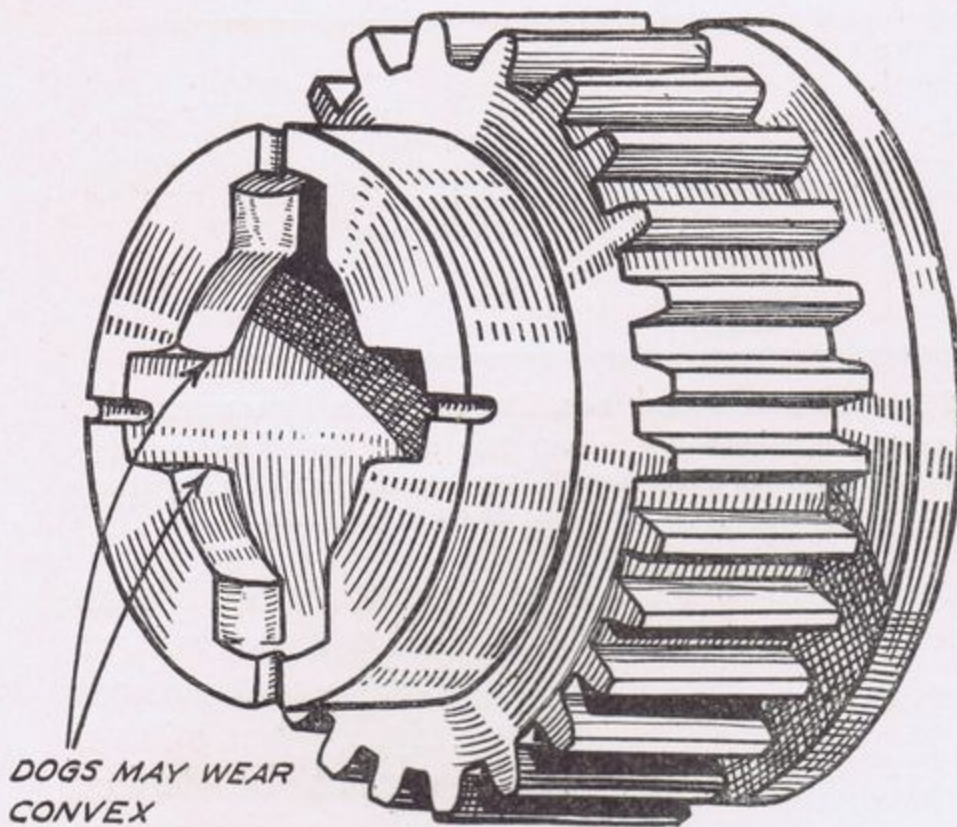


Fig. 22.—ROUNDING OF DOGS IN SLIDING GEAR.

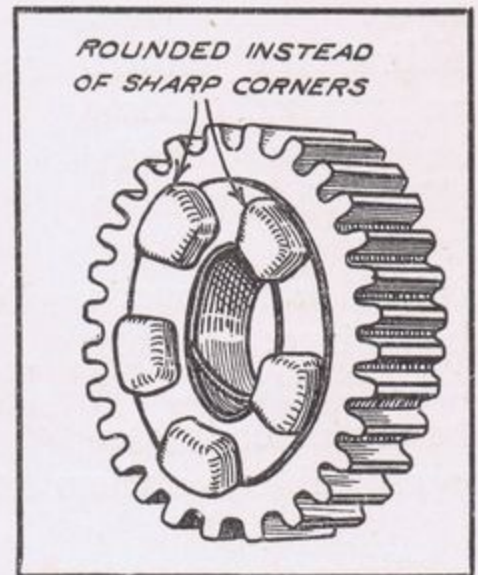


Fig. 23.—ROUNDING OF DOGS ON PINIONS.

available, a rough-and-ready method is to place a straightedge (one that is straight) along the shaft in three or four positions round the diameter, and holding it up to the light to see if there is any bending taking place (see Fig. 25).

The Need for Precision

The mainshaft should now be measured for wear by means of a micrometer. The diameter should not be more than .006 inch below the nearest nominal size above, and assuming that the shaft in question measures .806 inch, the obvious nominal size above is $\frac{1}{8}$ — .8125 inch. The shaft is therefore .0065 inch below and getting near to renewal time. Excessive clearance between the shaft and sleeve causes oscillation and oil leaks. There should not be more than .010 inch between the shaft and the sleeve (see Fig. 26). This can be measured by means of a feeler gauge. This .010 inch is, of course, considerably magnified at the clutch, when this is gripped and rocked. At the clutch end of the spindle will be seen the splines on which the clutch body is secured; these should

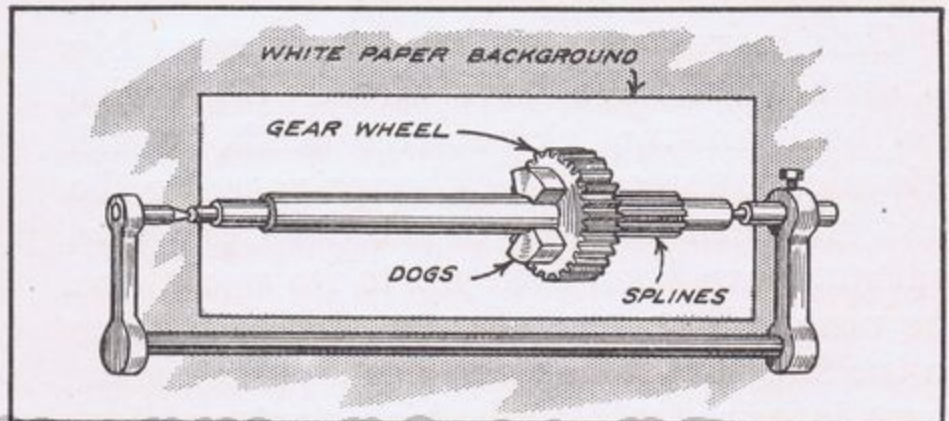


Fig. 24.—MAINSHAFT IN CENTRES.

be examined because, if for some reason the nut holding the clutch has worked loose, the clutch body will probably have crept a little, rocked and worn the splines, possibly distorting them. If the clutch body can

be assembled on them and locked up so that it is absolutely rigid, then

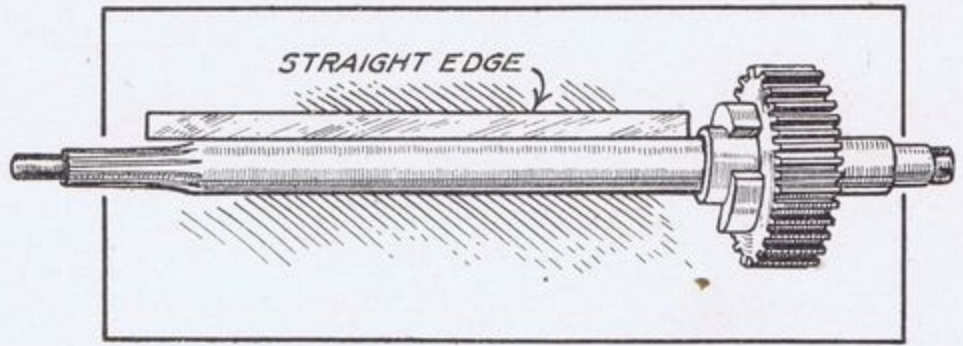


Fig. 25.—TESTING SHAFT FOR TRUTH WITH STRAIGHTEDGE.

Place the straightedge along the shaft in three or four positions round the diameter. Any bending will be apparent if the shaft is held up to the light at each position.

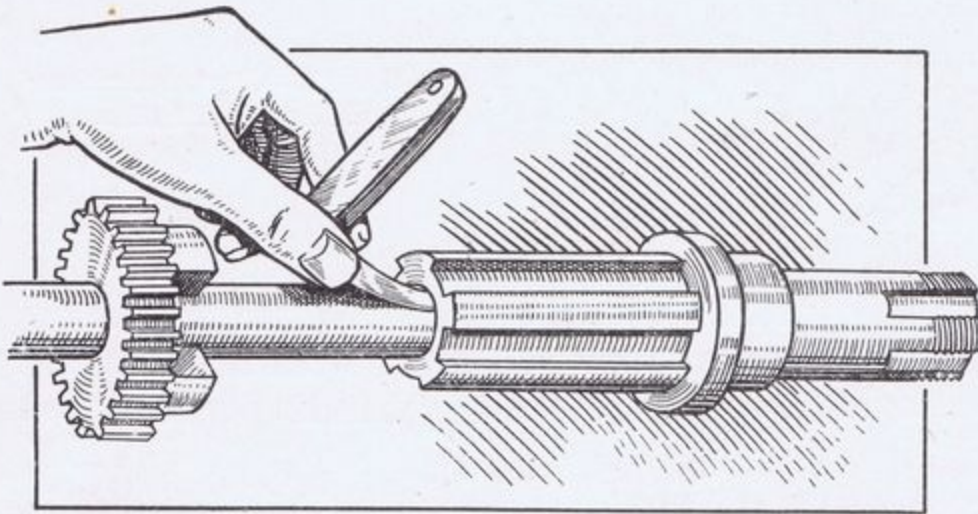


Fig. 26.—CLEARANCE BETWEEN SHAFT AND SLEEVE.

all will be well, as long as it is kept rigid, but if it cannot be locked solid, or if it works loose quickly, a new shaft is indicated.

little trouble is anticipated here owing to the fact that it is not really heavily stressed. The only troubles will be due to wear on the pegs and the blades actually in contact with the gears. If the box has seen a lot of use, and there is an appreciable amount of wear, the fork should be replaced (see Fig. 27).

Should the Pawl be Replaced?

This leaves us with the cover assembly to deal with. We have already dealt with the bush in the kick-starter shaft, which brings us to the pawl. If the spring under the pawl has been jamming or is broken, the pawl will not have been held up to its work, and the nose will be burred over very badly, due to the fact that it has not been pushed right home into the teeth of the kick-starter pinion. In this case it must be renewed. If, however,

Examine the Fork

The fork between the sliding gears should be examined, but

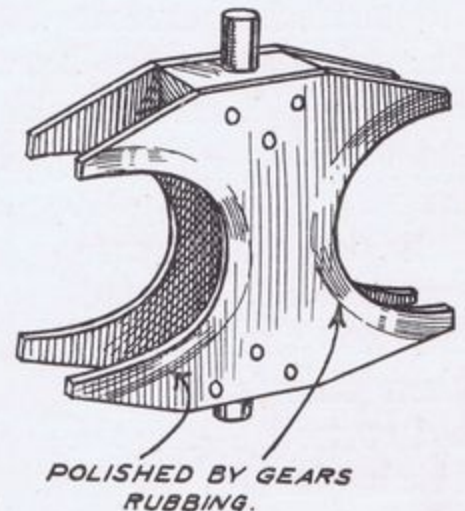


Fig. 27.—FORK, SHOWING PEGS AND BLADES, WHICH SHOULD BE EXAMINED FOR WEAR.

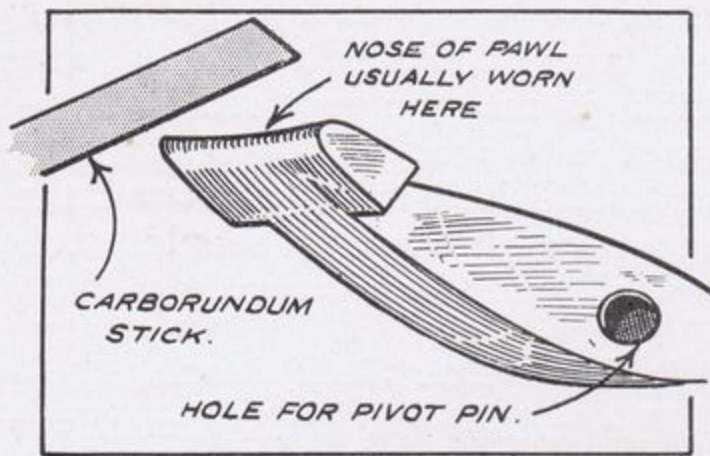


Fig. 28.—IF NOSE OF PAWL IS ONLY SLIGHTLY BURRED OVER, RESHAPE IT WITH A CARBORUNDUM STICK.

the shaft, small diameter first, as far as it will go, and rivet the small end over. A useful sort of anvil on which to hold the one end of the pin is a $\frac{1}{4}$ -inch ball or a piece of $\frac{1}{4}$ -inch round steel (see Fig. 29).

Check the Kick-starter Shaft

At the end of the kick-starter shaft is cut a slot into which the cotter pin fits (see Fig. 30). If this is badly worn, it means that the nut on the cotter pin has been allowed to work loose, and the pin has slacked off, with the result that the wedging action has been lost, and as the kick-starter crank has been depressed to start the engine, a little

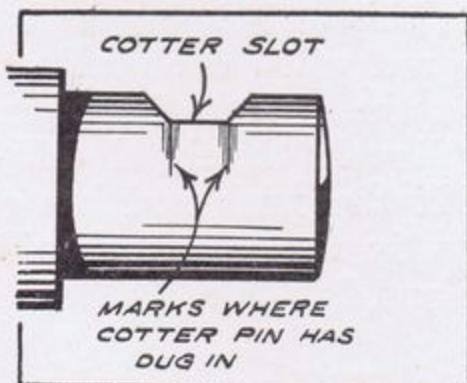


Fig. 30.—WEAR ON KICK-STARTER SHAFT.

Caused through loose cotter pin.

it is only slightly burred over, it can be brought to its original shape by touching up with a carborundum stick (see Fig. 28).

Fitting the Pawl

If the spring has been jamming, but is not broken, then cleaning the hole out will cure this. To assemble, place the spring in the hole, followed by pawl plunger, then the pawl in position, and push the pivot pin through from the open end of

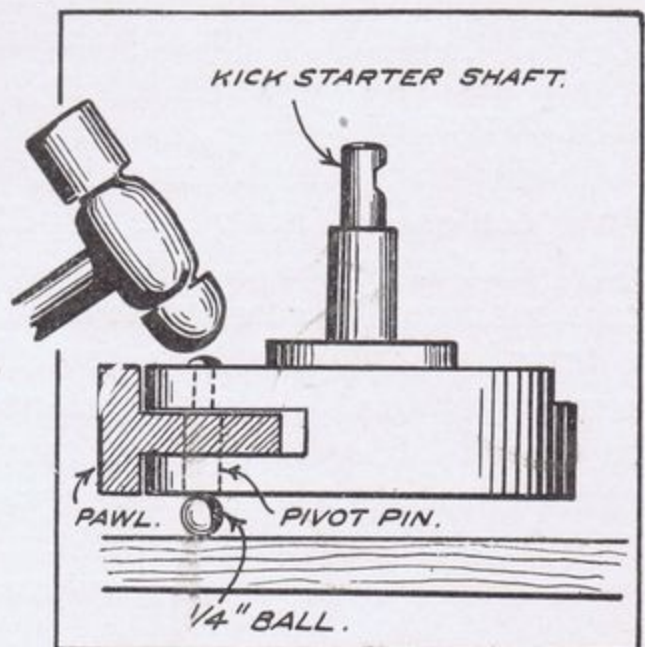


Fig. 29.—RIVETING PIVOT PIN FOR PAWL.

Note the ball, which is used as an anvil.

play has been allowed. This rapidly grows, and the cotter pin gradually cuts its way into the shaft, thereby spoiling both shaft and cotter pin. If the shaft is badly worn, a new one is necessary, but if it is not too badly worn the swelling should be taken out with a file.

Refitting the Trip Plate

The kick-starter stop and trip plate should be examined to see if it is swelled at all at the hook end (see Fig. 31); if so, it

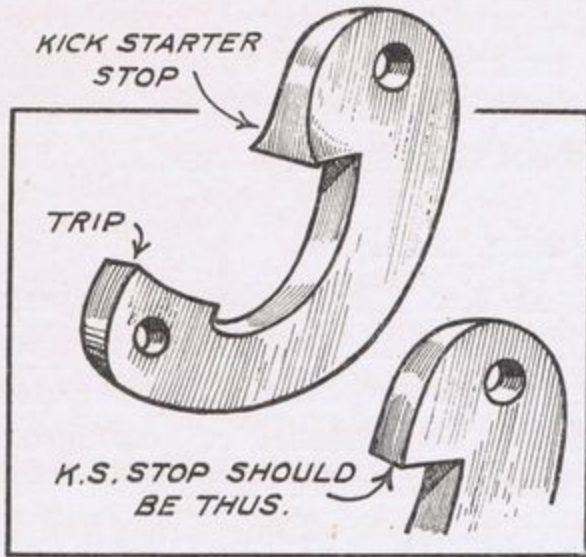


Fig. 31.—SWELLING ON KICK-STARTER STOP AND TRIP PLATE.

should be smoothed off by rubbing with a stick of carborundum, after which it may be replaced by fitting into the cover and tapping gently down until it is flat on the two bosses supporting it; the bolts should now be screwed in and locked tightly.

Test Kick-starter Shaft Bearing

The kick-starter shaft should now be inserted into its bush and tested for play. There should be no more than is necessary to allow it to turn. Much clearance here will allow a slight oil leak; this, though not serious, is unsightly, especially as in many cases the exhaust pipe is under the shaft.

Very Important Check

In the top part of the cover is the operator shaft and lever. This consists of a spoon-shaped lever (see Fig 32) welded on to a round shaft, which is squared on the outside to accommodate the gearbox lever. The bush should be tested for play, only a few thousandths being permissible, and if a new one is necessary, unless in the hands of a competent man, it should be returned to works for exchange. The lever and shaft should be absolutely solid, and if there is any movement between them they must be replaced.

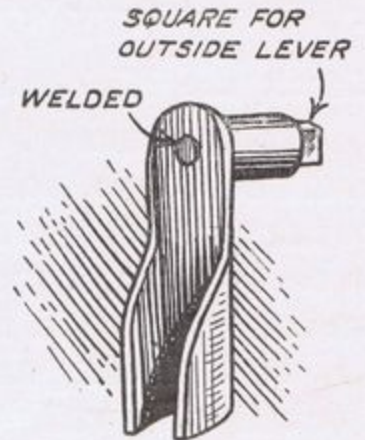


Fig. 32.—OPERATOR SHAFT AND LEVER.

If the Clutch is Difficult to Operate

In the clutch lever will be found a short hardened screw locked in position by a nut. The nose of the screw is polished and ground (see Fig. 33); if the nose has any flats worn on it, it must be exchanged, as this small pin presses against the push rod when declutching, and unevenness on the surface of the pin or the push rod will make the clutch difficult to operate. If the push rod has a small round hollow in the end, it should be ground square and flat (see Fig. 33).

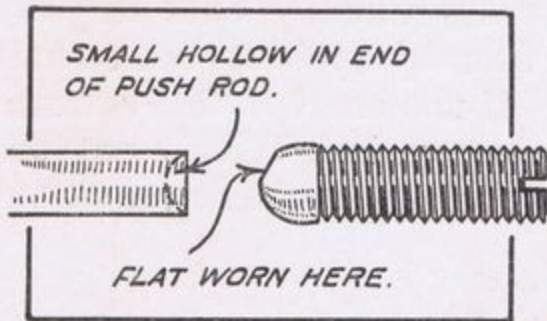


Fig. 33.—WEAR AT END OF CLUTCH PUSH ROD AND PIN.

End of push rod should be ground flat and the pin renewed.

Where to look for Cracks

In the case of a gearbox of the top fixing type, that is, with the studs on the top of the box, it may have had a knock

whilst traversing rough roads. The shell should therefore be examined for cracks, and if any are seen a new case is the best remedy. Welding will mend a crack, but unfortunately the heat causes distortion.

Attention to the Sprockets

That completes the box and cover, and attention must now be paid to the clutch and sprockets.

If the sprockets are showing distinct signs of hooking (see Fig. 34), they should be replaced, as this hooking will rapidly ruin a chain. If the sprockets are wearing away badly down one side only of the teeth (see Fig. 36), then look to the chain alignment, as this wear shows that it is not running square and true with its corresponding sprocket. If the sprockets are worn down quite regularly, they must, of course, be renewed.

How to Recork the Clutch Plates

The clutch is built up of cork inserts which will wear many thousands of miles if treated properly, that is, not slipped. If the corks in either the sprocket or any of the intermediate plates show signs of "charring" or are brittle and "chippy," have them recorked, and look to the clutch adjustment when putting the box back on the machine. It is quite easy to put new corks in a sprocket or plate; soak them for a few minutes in boiling water and they will become pliable; they should then be pushed into the holes, the edges tucked in with a screwdriver, and the faces tapped as flat and level as possible (see Fig. 38). It is far better to return them to the works to be corked, so that they can be ground to their correct thickness.

The Shock Absorbers

The rubbers should now be inspected, but these again last many miles, but since they perform a very important function, namely, that of absorbing the shocks transmitted from the engine, they should be replaced when the edges start to fray and pile up against the retaining washer.

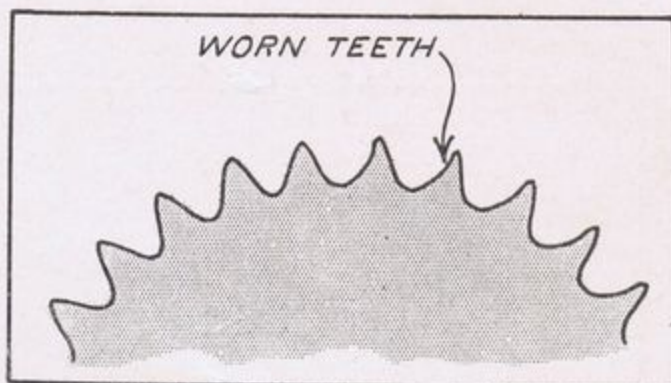
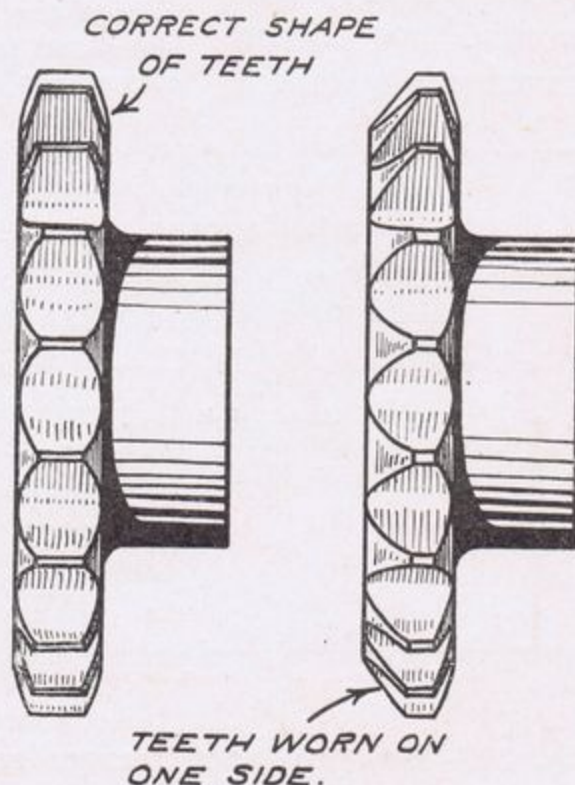


Fig. 34.—WEAR ON SPROCKETS. Distinguished by the hook-like appearance of the teeth.



Figs. 35 and 36.—EFFECT ON SPROCKETS OF CHAIN OUT OF LINE.

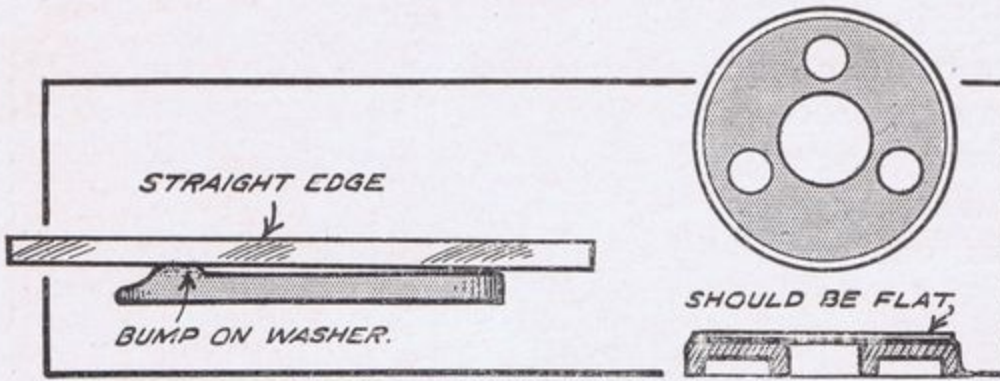


Fig. 37.—TESTING FOR FLATNESS OF RUBBER RETAINING WASHER. USING A STRAIGHTEDGE.

Shows how unevenness is discovered.

Fig. 37). If it has buckled it will allow a certain amount of play on the clutch unit, and consequently should be replaced.

Studs and Springs

If a clutch stud has to be replaced it should be returned to the works, as after riveting it must



Fig. 38.—RECORKING THE CLUTCH PLATES.

Soak the corks in boiling water for a few minutes, push into holes and tuck into edges with a screwdriver. The faces must afterwards be ground level.

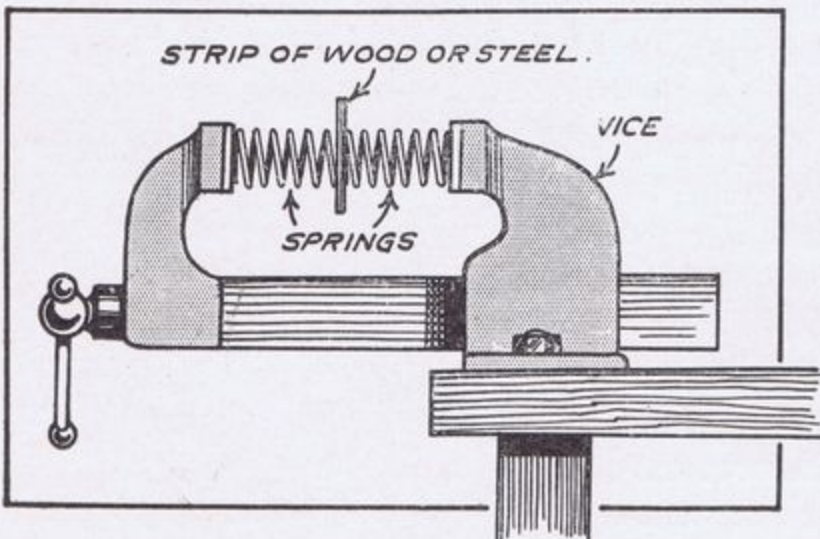


Fig. 39.—HOW TO TEST SPRINGS FOR WEAKNESS.

Weakness of spring is indicated when one coil binds or closes before the other.

The Retaining Washer must be True

The retaining washer should be checked by placing a straightedge across its surface in several places to ascertain whether it is dead flat or not (see

be recessed true to the clutch body. Lastly come the springs; in due course these are bound to lose some of their resiliency, and as a test two should be placed in a vice end to end with a strip of flat steel between them and the vice gradually tightened. Care must be taken that they are dead square and opposite each other, or they may fly up and do the operator some facial injury. If one close-coils, that is,

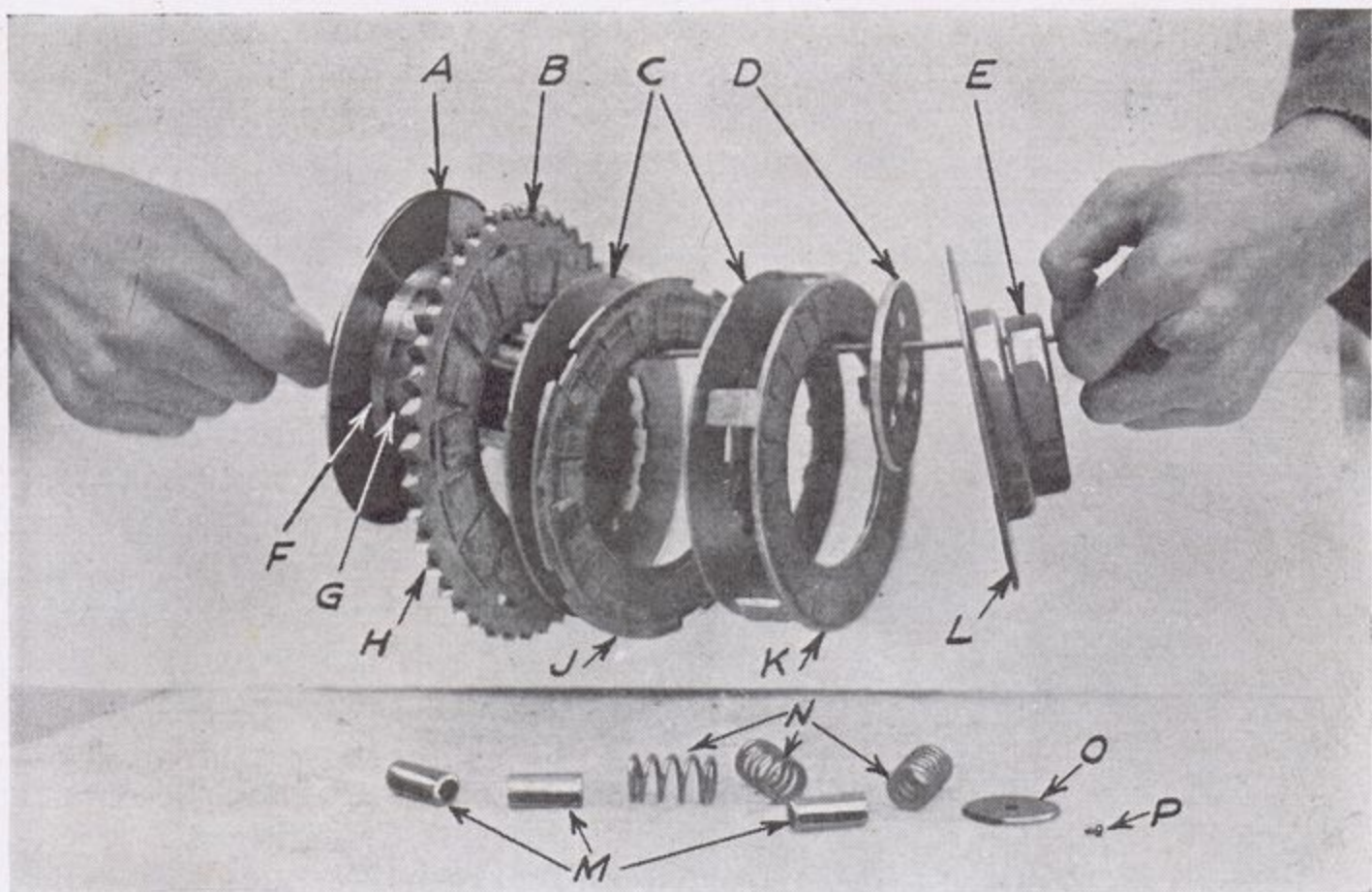


Fig. 40.—CLUTCH PARTS SHOWING ORDER OF ASSEMBLY.

- | | | |
|-------------------------------|------------------------------------|----------------------|
| A. Back plate. | F. Ball ring. | L. Front plate. |
| B. Clutch studs. | G. Drum containing shock absorber. | M. Distance tubes. |
| C. Steel intermediate plates. | H. Sprocket. | N. Springs. |
| D. Rubber retaining washer. | J. Grooved cork plate. | O. Clutch cap plate. |
| E. Clutch cap. | K. Tongued cork plate. | P. Centre screw. |

the coils touch one another sooner than the other, it means that its temper has gone somewhat; this indicates that the others are probably in the same state, and they should be replaced (see Fig. 39).

REASSEMBLY

The Order of Reassembly

Before commencing to assemble wash everything thoroughly in clean paraffin, and allow it to drain off, as paraffin is not a lubricant. The first operation is to fit the inside operator, take the operator anchor pins and screw them into the box until the nose is just

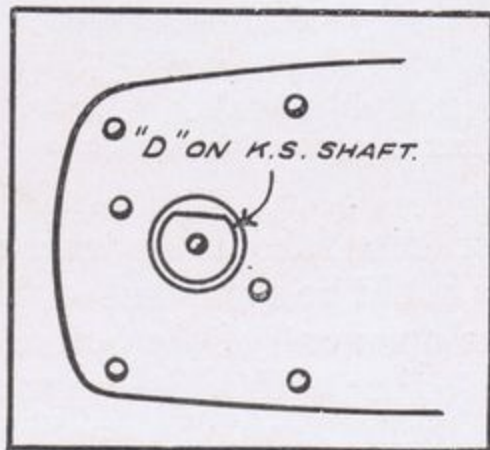


Fig. 41.—SHOWING THE FLAT ON THE KICK-STARTER SHAFT.

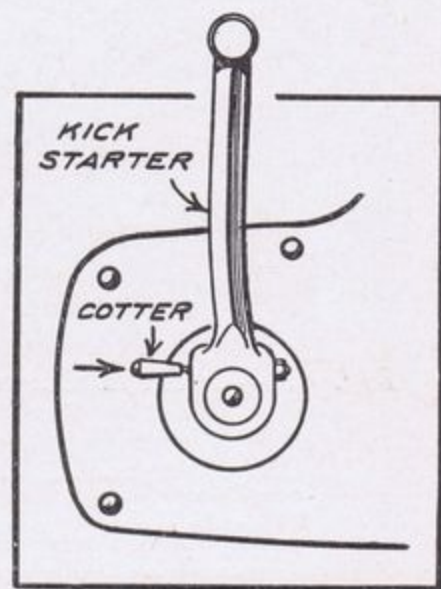


Fig. 42.—NOTE THAT THE COTTER PIN HOLDING THE KICK-STARTER CRANK MUST BE INSERTED FROM THE LEFT.

showing through, then slide the operator in and screw the pins home tightly, giving the aluminium surrounding them a tap with the chisel to drive some of it into the screwdriver slot; this will prevent the screws from turning. Next mount the large mainshaft pinion on to the mainshaft sleeve and thread it through the ball bearing, slip on the final drive sprocket, not forgetting to insert a small packing washer,

if there was one; tap it up the splines, place on the keyed washer and screw on the lock ring. Wrap the odd length of chain round the sprocket to prevent it from turning, secure the end and then lock up the lock ring deadtight.

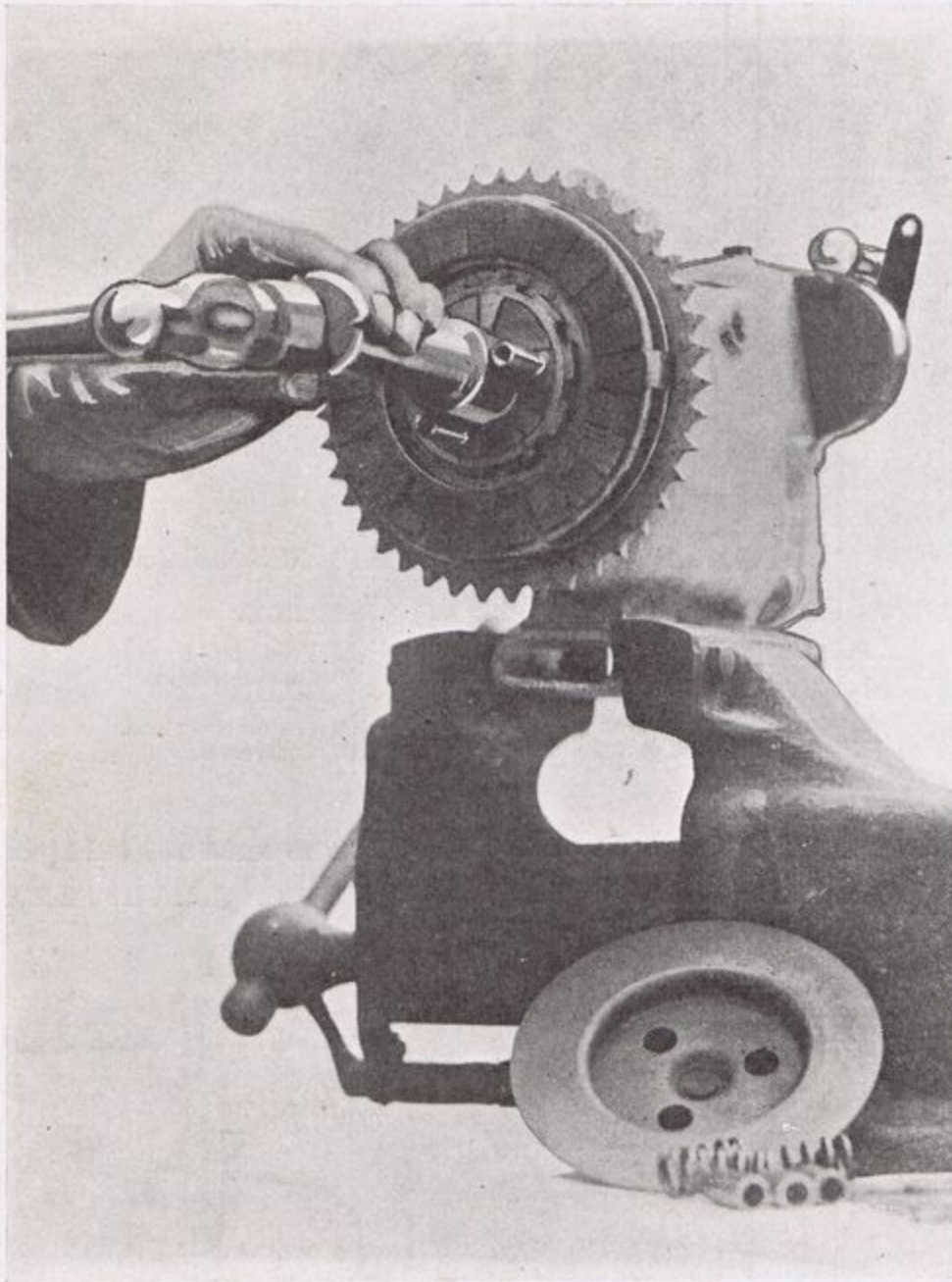


Fig. 43.—DRIVING CLUTCH CENTRE ON TO MAINSHAFT.

An Important Precaution

As a further precaution a small chisel should be driven under the washer between the slots of the lock ring to drive some of the metal into the slots. Oil should now be run in to the layshaft bearing in the box, and the complete layshaft, together with the operating fork and the

mainshaft sliding gear in position, should be inserted as a block into the box. The inside operator should be swivelled so that the slots in the end of the arms face as near the open end of the box as possible and the pegs on the fork inserted in them; then with a little manœuvring the mainshaft slider will drop on the mainshaft sleeve, the smaller gear of the two being towards the open end of the box and the end of the layshaft will be introduced into its bush. It will probably be necessary to rotate the

layshaft a little in order to allow the teeth on the small gear to mesh with the corresponding teeth on the large pinion on the mainshaft sleeve.

Oil Preferred to Grease

More oil should now be poured in, taking care that the shafts and gears are well covered. We do not advise grease for this box, as it chokes the oilways and leads to seizures; a little *very light* grease may be used to have a retarding effect on the gears when the clutch is released. The mainshaft should now be well covered with oil and inserted in the sleeve, the teeth of the pinion mounted on it meshing with the kick-starter wheel on the layshaft. This is followed by the oil thrower and packing shim, if any.

Assembling the Cover

Leaving the box for awhile, the cover is to be assembled. Place the operator lever in position, and fix the cover by means of the two securing pins; the kick-starter shaft should now be inserted in its bush and turned in a clockwise direction (looking at the outside of the cover) until the stop

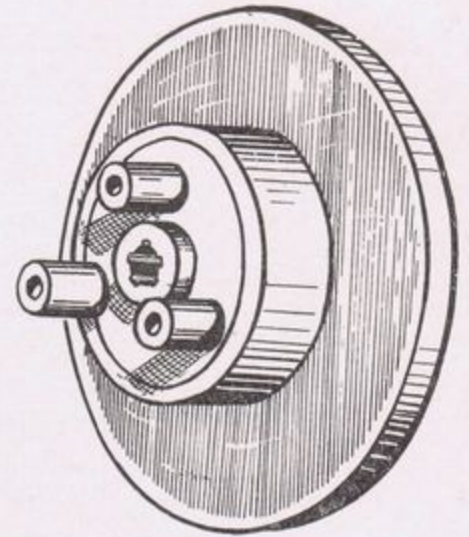


Fig. 44.—SOLID TYPE OF BACK PLATE.

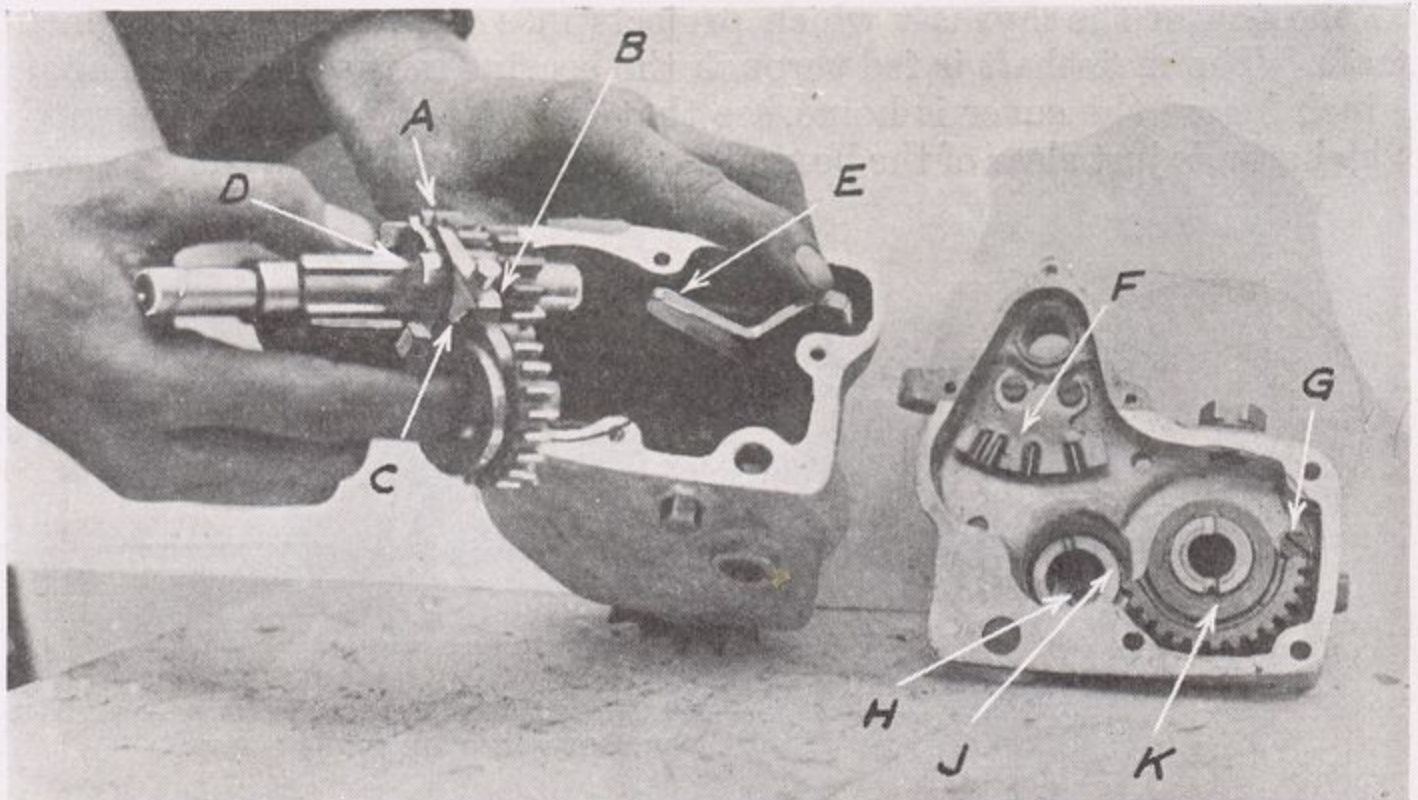


Fig. 45.—DISMANTLING THE THREE-SPEED MODEL.

Fig. 46.—THE COVER OF THE THREE-SPEED GEARBOX.

- A. Layshaft slider.
- B. Wide flat on fork faces mainshaft.
- C. Bosses on fork.
- D. Layshaft splines.
- E. Note how this lever is being depressed

- F. Locating plate.
- G. Kick-starter stop pin.
- H. Mainshaft adjusting nut.
- J. Mainshaft adjusting bush.
- K. Kick-starter segment.



Fig. 47.—EXAMINING THE HIGH-GEAR PINION FOR WEAR ON DOGS.

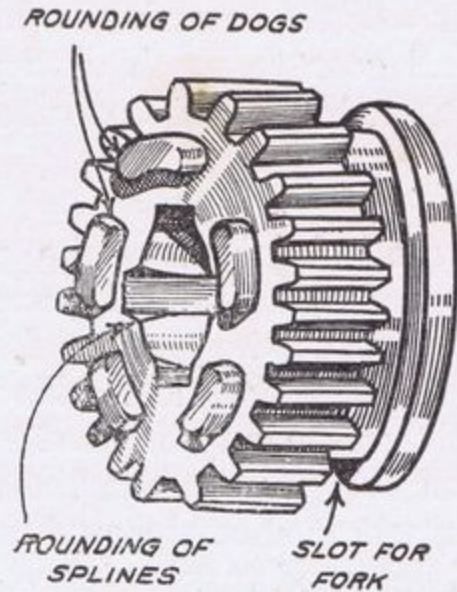


Fig. 48.—EXAMINING THE SLIDING PINION FOR ROUNDING OF DOGS AND SPLINES.

on the segment shaft engages against the stop on the plate, when it can be turned no farther. It will be seen that the pawl has now been depressed through contact with the other end of the stop plate, which forms a trip (see Fig. 14).

Fitting the Cover

The gearbox cover is now ready for fitting to the box. Pour some oil on the end of the layshaft which projects into the bush in the segment shaft. The mainshaft is fed through the bearing in the cover, and about $\frac{1}{2}$ inch before the cover is home, see that the ball on the inside operator, which stands just clear of the box, enters the spoon portion of the operating

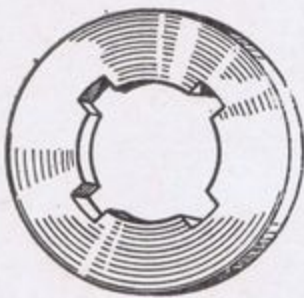


Fig. 49.—PRESSURE WASHER.

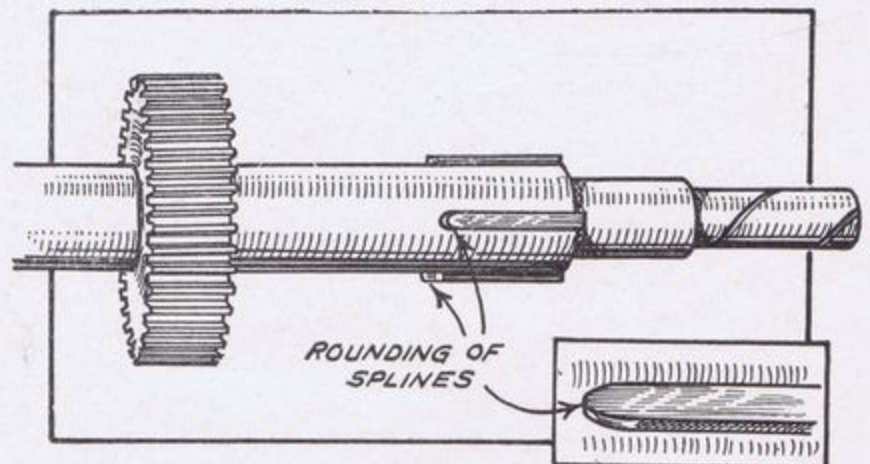


Fig. 50.—EXAMINING THE MAINSHAFT AND LAYSHAFT FOR ROUNDING OF THE SPLINES.

lever; tap the cover gently down and insert the cover screws, one of which takes the loop on the kick-starter return spring (see Fig. 6). On the pivot type this is the one next below the plunger spring box, and on the top or bottom fixing types it is the one on the left-hand bottom corner, so this one should be left until last.

The Kick-starter Spring

Take the kick-starter spring and the cover and place it on the kick-starter shaft so that the flat of the "D" hole rests on the flat milled on the shaft (see Fig. 41). Holding this in position, thread the cover bolt which takes the loop through it, and bolt it in its correct hole. Now the kick-starter crank is to be placed on and the cotter pin inserted. The cotter pin is to be inserted from the left, so that when the crank is depressed the nut is on top (see Fig. 42). If placed in the reverse way the cotter pin will not stand much kick-starting; drive the pin in hard and lock the nut tight.

The Mainshaft Nut is a Left-hand Thread

The mainshaft nut should now be screwed on, remembering that it is left hand and is screwed on in an anticlockwise direction. The mainshaft can be stopped from turning by depressing the kick-starter and holding it rigidly (see Fig. 7). When the nut is tight, tap the thread over a little to stop any chance of the nut unlocking.

How to fit the Gear Locating Plunger

Now take the plunger, spring and plunger box, insert the plunger spring and plunger in the box, and see that they slide easily; then proceed to screw it in. As soon as resistance is felt the plunger box should be rotated backwards and forwards a few times, and at the same time the gear moved; this will ensure that the nose of the plunger fits square into the "Vee" of the register of the inside operator. Oil the bearing, and the bearing cap may be placed in position and the two holding screws screwed home.

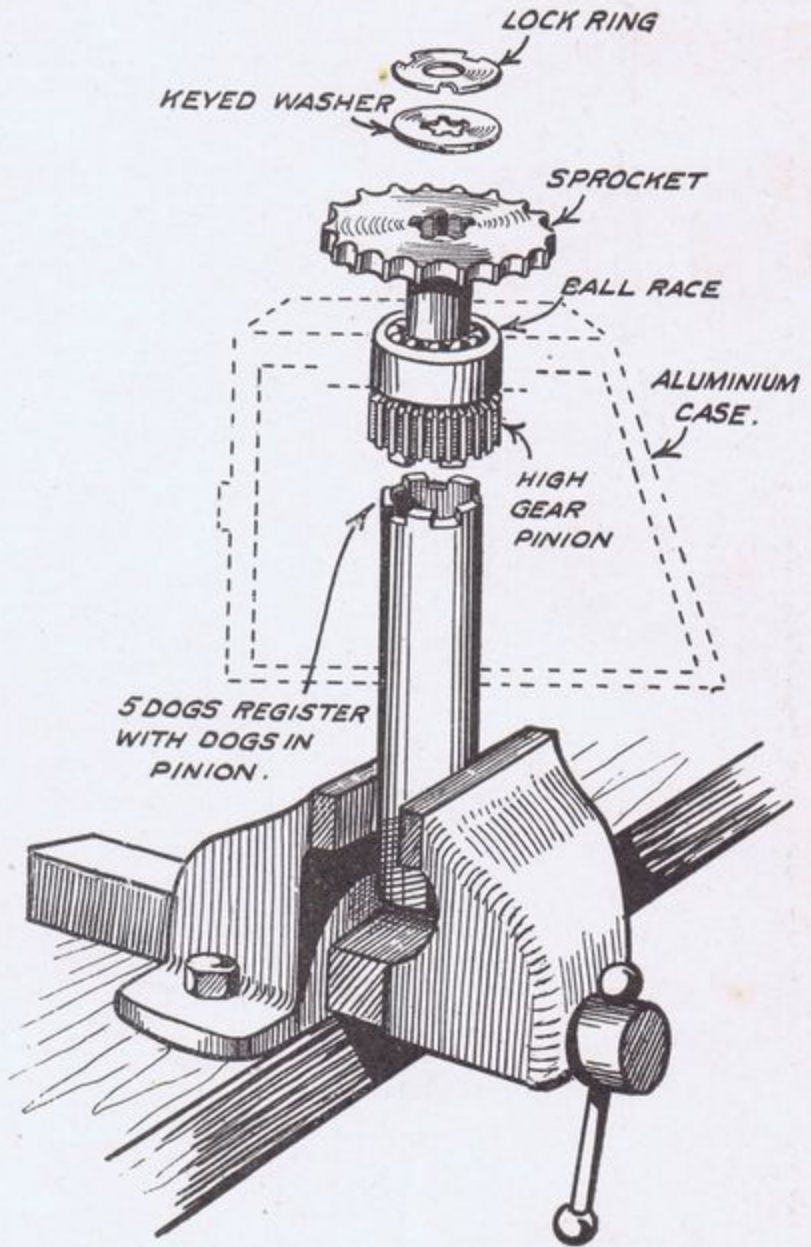


Fig. 51.—USING A DOGGED TOOL FOR HOLDING THE HIGH-GEAR PINION DURING REASSEMBLY.

Reassembling the Clutch

Put a little grease on the balls in the clutch sprocket, and then assemble the back clutch plate, sprocket, steel friction plate, grooved cork plate, steel friction plate and tanged cork plate in that order, making

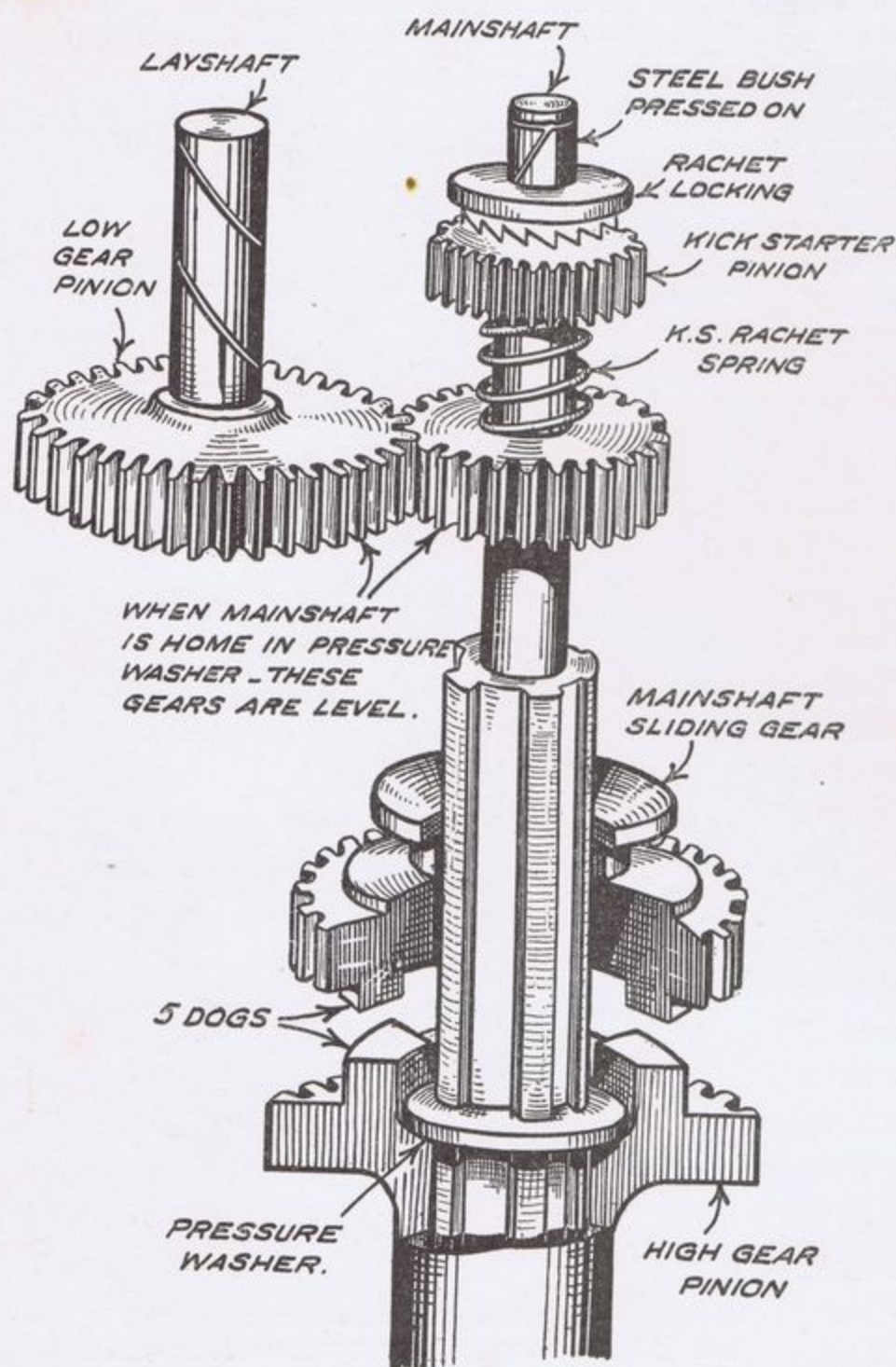


Fig. 52.—ASSEMBLING THE THREE-SPEED GEARBOX.

When the mainshaft is properly assembled, the low-gear pinion should be in line with the small pinion on the mainshaft as shown above.

c.c., Model "J" for 350 c.c., and Model "E" up to 300 c.c. Many parts in the three-speed models are similar to parts in the four-speed, and the reader is recommended to read about the four-speed first, so that he will understand the reference "the same as in the four-speed." The three

certain that the tangs on the cork plate pass through the grooves in the grooved plate and then through the slots in the sprocket (see Fig. 40). Place the body on the shaft, and tap it right home by means of a piece of tube in the recess of the clutch centre (see Fig. 43). Lock up the nut holding the body on to the mainshaft. Then place into position the rubber retaining plate, front clutch plate, distance tubes, clutch springs and cap, insert the three screws and screw them home tightly. Put on the small round disk, turning the hexagon heads of the pins slightly until it fits, and screw in the small centre pin.

THREE-SPEED MODELS

The range of three-speed boxes consist of Model "G" for 500

three-speed models are alike in construction, with the exception of the clutch, and also in operation, so that the description of one will suffice for the whole range. The difference in clutches lies in the number of plates and the size: the "G" model and some "J" models have three plate clutches, some of the "J's" and some of the "E's" have two plate clutches, and the remaining "E's" have single plate clutches, and are used chiefly on the 175- and 196-c.c. engines.

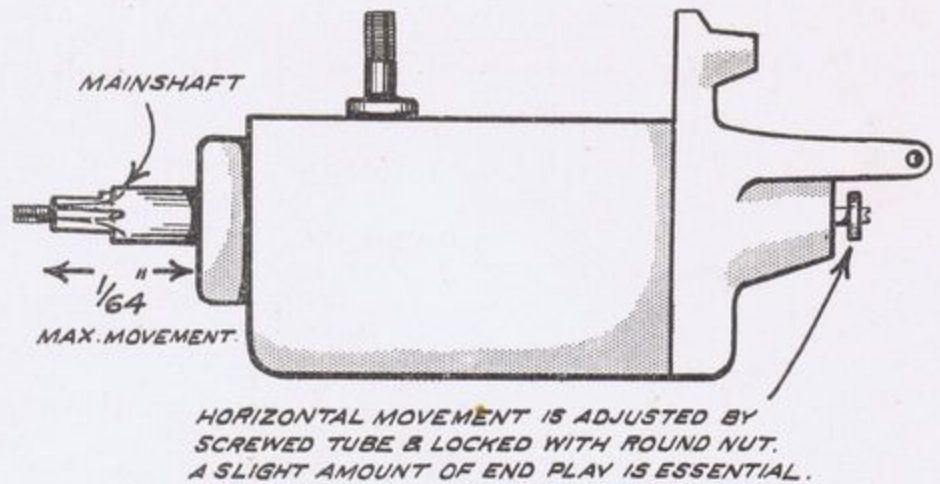


Fig. 53.—TAKING UP ENDPLAY ON THE MAINSHAFT. The above adjustment should be made to bring the endplay down to $\frac{1}{64}$ inch.

The Difference between Shock Absorber and Solid Type

The clutch may be a shock absorber or solid type (see Fig. 44). If it is the shock-absorber type, then the same procedure follows in dismantling as on the four-speed, with the exception of course of the number of plates; the principle, however, is the same. With the solid type, dismantling is begun in the same way, but the difference is that there are no rubbers, no distance tubes and no drum; a solid centre with the studs riveted to the back plate takes the place of the drum, centre and rubbers.

Similar Methods used

The solid centre is drawn off the shaft in the same manner as the shock-absorber centre. The method used for removing the lock-ring, key washer and final-drive sprocket is the same as that used with the four-speed. Turning to the kick-starter end of the box, remove the plunger box complete with plunger and spring, then the cover bolts and lift off the cover.

Do not damage the Joint

We must emphasise the necessity for avoiding the use of a screwdriver or similar tool to prise off the cover. Tap on the back of the kick-starter crank, and this will free the cover, which may be stripped down in the following manner: remove the crank by withdrawing the cotter pin, take off the return spring and cover, and tap the shaft out of the cover. Inside the cover

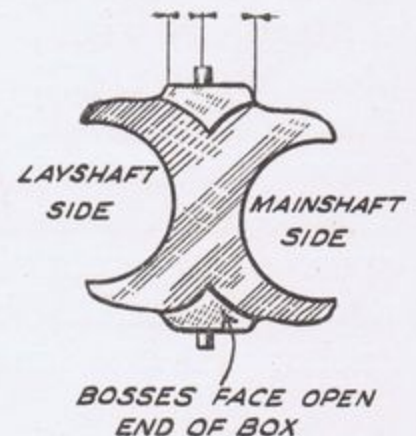


Fig. 54.—SPECIAL FORK FOR "E" AND "J" MODELS.

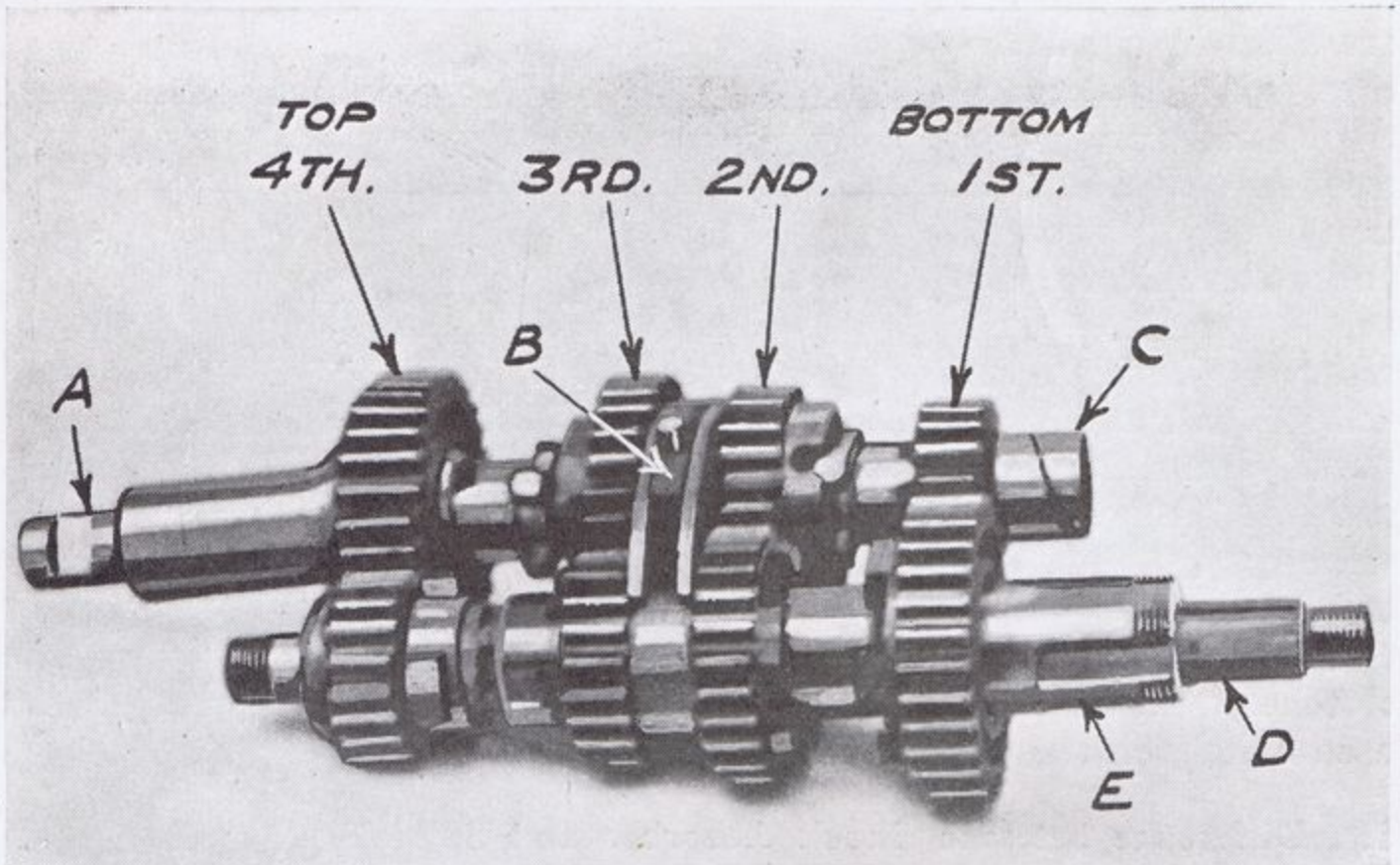


Fig. 55A.—ALBION FOUR-SPEED GEARS.

- | | |
|--|----------------|
| A. Kick-starter shaft. | C. Steel Bush. |
| B. Long Flat on Fork, towards Mainshaft. | D. Mainshaft. |
| E. Mainshaft Sleeve. | |

is a round-headed screw, against which the return spring forces the kick-starter segment; this is the kick-starter stop pin, and is a plain screw into the cover locked on the outside with a nut. Next remove the three pins holding the steel operator cover on the back of the operator box (see Fig. 46) and withdraw operator.

Withdrawing the Gears, etc.

Remove the mainshaft complete with pinion, kick-starter ratchet and spring, then take out the large gear pinion on the layshaft. Press the ball of the inside operator to the right as in the four-speed, and withdraw the layshaft with sliding pinion, fork and mainshaft sliding pinion as a block (see Fig. 45). The high-gear pinion may now be taken out, noting that in a recess slightly larger than the hole through which the spindle passes is a washer in which is a hole shaped to fit the splines (see Fig. 49). This leaves the inside operator and bearings in the shell. The inside operator is removed in the same manner as the four-speed, which it strongly resembles, by chipping out the aluminium from the slots in the anchor pins and unscrewing them.

Careful Examination Needed

Everything should be carefully washed in paraffin before examination. All phosphor-bronze bearings which are worn should be returned to the

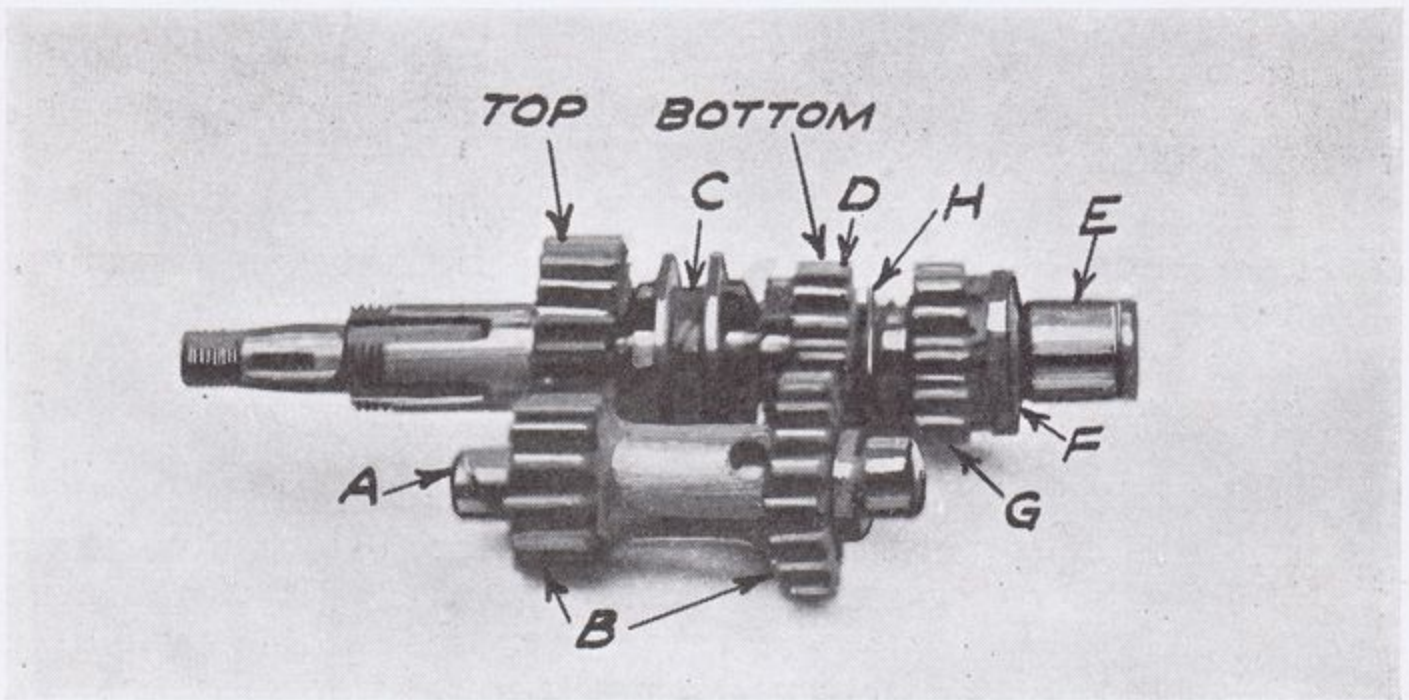


Fig. 55B.—ALBION TWO-SPEED GEARS.

- | | |
|---------------------|---------------------------------|
| A. Layshaft. | E. Steel bush. |
| B. Layshaft gears. | F. Kick-starter lock nut. |
| C. Dog clutch. | G. Kick-starter ratchet pinion. |
| D. Low-gear pinion. | H. Spring washer. |

works for renewal, owing to the fact that they must be reamed to size and in correct line. The high-gear pinion should be examined for wear on the dogs (see Fig. 47), or wear in the bore; this may be tested by using a feeler gauge in conjunction with the insertion on the spindle. The clearance here should not exceed $\cdot 010$ to $\cdot 012$ inch.

Cause of Gear jumping out

The sliding pinion should be inspected for rounding of the dogs and the hole for rounding of the splines (see Fig. 48). If the middle gear has been jumping out this will probably be found to be the cause. The dogs on the large pinion on the layshaft should be inspected for wear. The layshaft has a small top-gear pinion splined on, and this is followed by a steel bush also pressed on splines. If any renewals are required the shaft should be returned to the works in order that the parts may be pressed on correctly and the diameter of the bush made true with the shaft. The foregoing remarks apply also to the mainshaft, which has a small pinion pressed on, followed by the kick-starter pinion, which is free to slide against the spring, followed by a steel bush.

Check Ratchets

The condition of the ratchet on both pinions of the mainshaft should be noted,

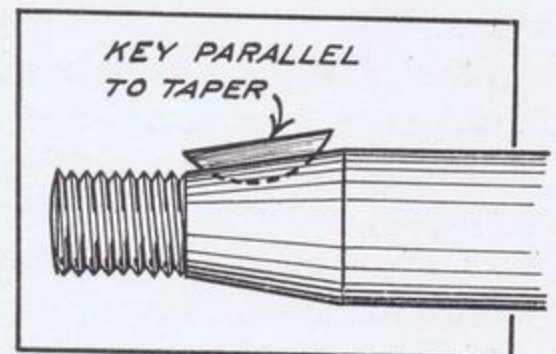


Fig. 56.—ILLUSTRATING THE METHOD OF SECURING THE CLUTCH CENTRE ON TWO-SPEED MODELS.

and if either set of ratchets is badly chipped it would be well to renew the part.

Also both Shafts

Both mainshaft and layshaft should be examined on the splines for rounding (see Fig. 50), as this, in conjunction with the rounding of the splines in the sliding gears, will cause trouble in holding middle gear.

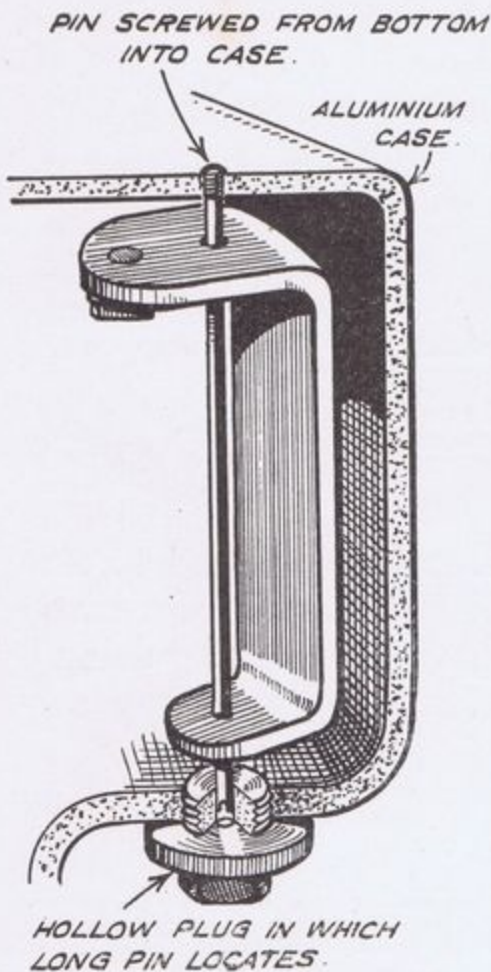


Fig. 57.—DISMANTLING THE TWO-SPEED MODEL.

The inside operator cannot be removed until the hollow plug shown above has been unscrewed.

in the ballrace, and mounting on it the final-drive sprocket, lock ring and keyed washer. The chain may be wrapped round the sprocket to hold it whilst screwing the lock ring tight. Another way of holding the sprocket with this type is to obtain a dogged tool, and to insert it in the dogs of the high-gear pinion and then to screw on the lock ring in its position behind the final-drive sprocket, as shown in Fig. 51. Having locked the sprocket and lock ring in position, place the pressure washer in its recess in the the high-gear pinion. The inside operator should now be placed in the box, and the anchor pins screwed home, aluminium being driven into the slots in the head to prevent their turning.

Special Attention to Kick-starter Segment

The kick-starter segment is pressed on to splines on the kick-starter shaft, and the splines are riveted over at the end to secure the segment in position. If the segment requires renewing, the shaft should be returned complete to the works for renewal.

How to test Bushes

The same remarks apply to the renewing of the phosphor-bronze bush in the shaft as in the four-speed: return it to the works. The bushes in the cover should be tested for play by inserting their respective shafts and rocking. In the end of the bush in which the mainshaft turns is screwed a hardened steel tube which is locked with a small round nut. This is used to provide end clearance correctly for the mainshaft, and should be slacked off before assembly. The examination of the operating lever and the round-nosed screw in the clutch lever concludes the inspection.

REASSEMBLING THREE-SPEED MODELS

The assembly of this pattern commences with the insertion of the high-gear pinion with the insertion of the high-gear pinion in the ballrace, and mounting on it the final-drive sprocket, lock ring and keyed washer. The chain may be wrapped round the sprocket to hold it whilst screwing the lock ring tight. Another way of holding the sprocket with this type is to obtain a dogged tool, and to insert it in the dogs of the high-gear pinion and then to screw on the lock ring in its position behind the final-drive sprocket, as shown in Fig. 51. Having locked the sprocket and lock ring in position, place the pressure washer in its recess in the the high-gear pinion. The inside operator should now be placed in the box, and the anchor pins screwed home, aluminium being driven into the slots in the head to prevent their turning.

Next press the ball on the operator to the right as in the four-speed ; this brings the slots in its arms to the open end of the box ; pour a little oil in the layshaft bush (see Fig. 45).

Insert the Gears together

Then take the layshaft, layshaft sliding gear and mainshaft sliding gear with the fork in between them, and pass them into the box, so that the pegs on the fork enter the slots in the arms of the operator ; pass the gears farther in, and rotate the layshaft a little until the end is introduced into its bush in the box. A little hand pressure may be necessary to force this home, owing to the fact that the oil in the bush will form a buffer. The feel of this is easily distinguished from the feel of something solid, in which case no force should be used. Rotate the shaft backwards and forwards, and the surplus oil will work out, allowing the shaft to go right home. The large pinion should now be oiled in the hole and placed on the layshaft, followed by the mainshaft being passed through the mainshaft slider and high-gear pinion. The mainshaft must be rotated and held lightly against the pressure washer in the high-gear pinion to ensure that the splines on the shaft fit in the grooves in the washer.

Check the Mainshaft

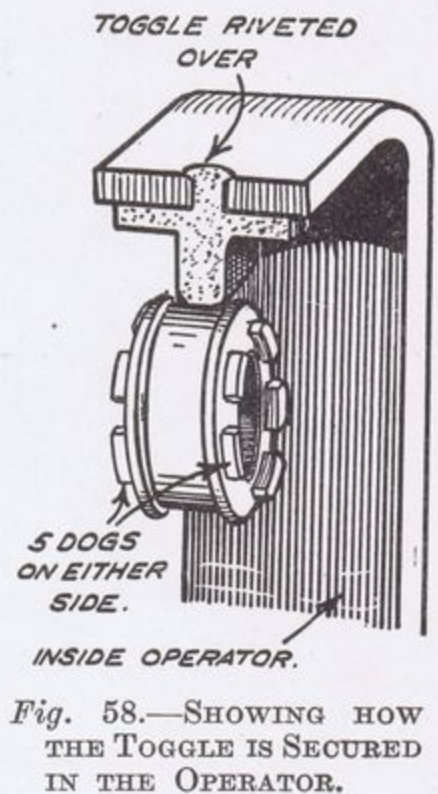
When the mainshaft is right home the teeth on the layshaft low-gear pinion will be in line with the teeth on the small pinion on the mainshaft (see Fig. 52).

Reassembling the Cover

The cover should now be assembled by inserting the operator lever in its bush, in which a little oil has been poured, and securing the triangular steel plate in position on the back of the operator box by means of the three screws. Oil the kick-starter shaft bearing, and push the kick-starter shaft in position ; rotate in anti-clockwise direction, looking from the inside of the cover until the segment makes contact with the segment stop (see Fig. 46).

Fitting the Kick-starter

Now place the kick-starter return spring and the cover in position so that the "D" of the hole rests on the flat which is milled on the shaft, follow this with the kick-starter crank, which is secured by the cotter pin being driven tightly in and locked up with the nut and washer. Oil the



bearing inside the kick-starter shaft, and also the bearing for the mainshaft, the screwed tube in which should have been slacked off. Oil can now be poured in the gearbox, noting that it runs down the shafts, and the cover placed on the box.

Set the Operator Lever

About $\frac{1}{2}$ inch before the cover is finally home see that the operator lever is moved to enclose in its spoon portion the ball of the inside operator. Insert the cover bolts and plunger box and lock down.

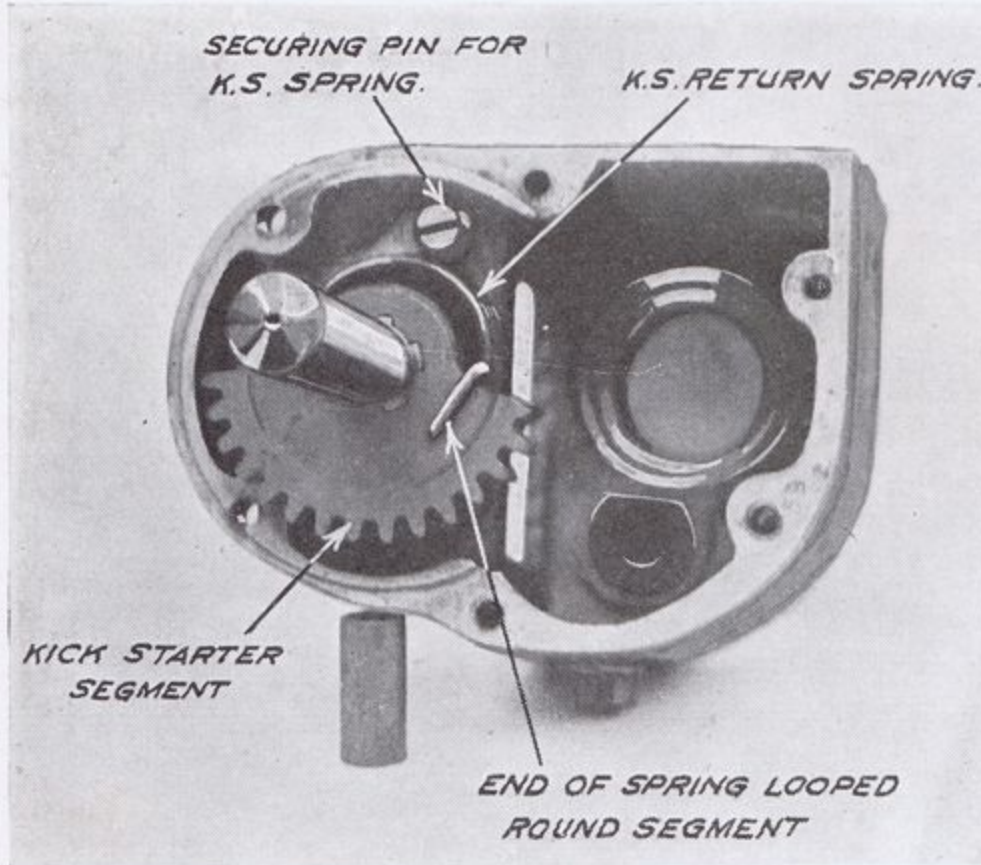


Fig. 59.—REASSEMBLING THE TWO-SPEED GEARBOX.

This shows how the kick-starter spring and segment are assembled.

How to take up End-play on Mainshaft

The mainshaft should now be tested for end-play, of which not more than $\frac{1}{8}$ inch should exist; any more should be taken up by means of the screwed tube in the mainshaft bearing. The tube is screwed in until it makes contact with the end of the mainshaft and is then withdrawn $\frac{1}{8}$ inch and locked down with the round nut so that end-play is just perceptible (see Fig. 53).

Examine Push-rod Screw

The round-nosed screw in the clutch lever should be examined for flats, and any small hollow in the push rod should be ground off; the clutch is built up and secured to the mainshaft in the same manner as in the four-speed.

Special Note for "E" and "J" Models

When assembling an "E" or "J" model, it should be noted that the layshaft is higher than the mainshaft, and that the fork between them, which moves the sliding gears, is made with one radius higher than the other: the high side takes the layshaft; also the flat to one side of the peg is larger than the other: this side goes towards the mainshaft.

Part of the fork has been turned off, leaving a portion immediately below each peg on one face standing out. This side faces the open end of the box (see Fig. 54). When the control is fitted direct on the box a small plate is fitted inside the operator box, in the slots of which the "V" piece on the back of the operating lever fits. This is held by two small screws, and is there to prevent the long gear lever from oscillating (see Fig. 46).

TWO-SPEED MODELS

The two-speed gearbox model "C" is used only on small machines with engines up to 150 c.c. The clutch is of the single plate solid type, as used on some of the "E" models; the only difference is that, instead of the centre being mounted on splines, it is on a taper, in which is a half-moon key (see Fig. 56).

Clutch Dismantling

The same procedure is followed in dismantling the clutch as in other models, and this applies also to the final-drive sprocket.

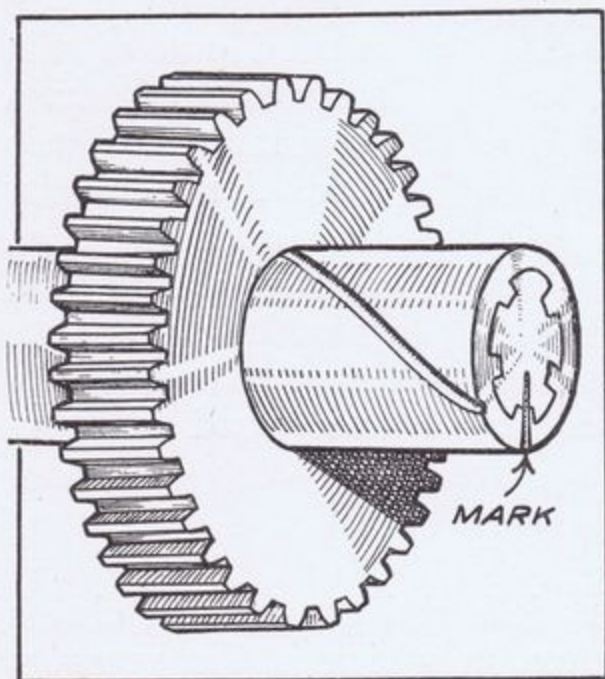


Fig. 61.—SHOWING HOW THE STEEL BUSH AND SHAFT SHOULD BE MARKED BEFORE DISMANTLING TO ENSURE THAT THEY CAN BE RE-ASSEMBLED CORRECTLY.

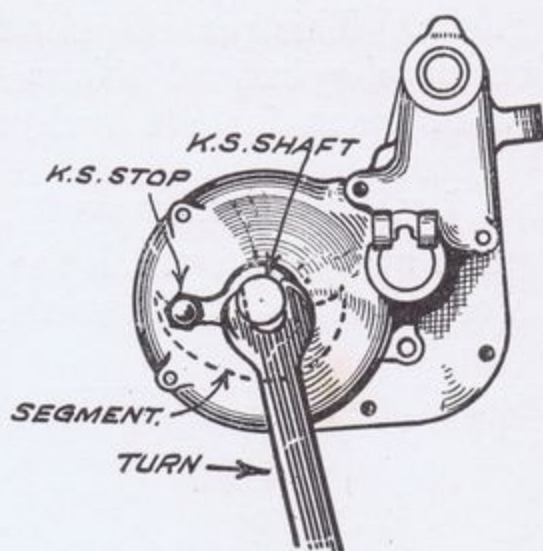


Fig. 60.—ANOTHER STAGE IN ASSEMBLING THE KICK-STARTER.

Turn the kick-starter shaft by means of a spanner as shown to bring the segment clear of the stop.

Remove Kick-starter and Cover

Next remove the kick-starter crank by withdrawing the cotter pin, and examine the shaft to see whether it is swelled or cut up by the cotter pin, and, if so, smooth it round with a file to its original diameter. Remove the cover bolts (there is no plunger or plunger box in this model), and pull off the cover, tapping the end of the kick-starter shaft to leave segment in position in the box. The operator lever should be examined by withdrawing the three screws holding the cover: this lever is the same as on all models. Behind the operator lever is a small spring plate which acts as a register for the gears, and is held in position by two small screws (see

Fig. 45). This plate is the same as the three-speed, except that it has three notches instead of four. The mainshaft adjusting screw (the screwed tube in the mainshaft bush) should be slacked off to ease assembly later.

How Layshaft is Removed

The spindle on which the layshaft gears rotate is screwed tightly into the cover, right-hand thread; to withdraw this it should be held tightly

in a vice, preferably with lead faces to protect the bearing surface, and the cover tapped round with a hide hammer or mallet anticlockwise.

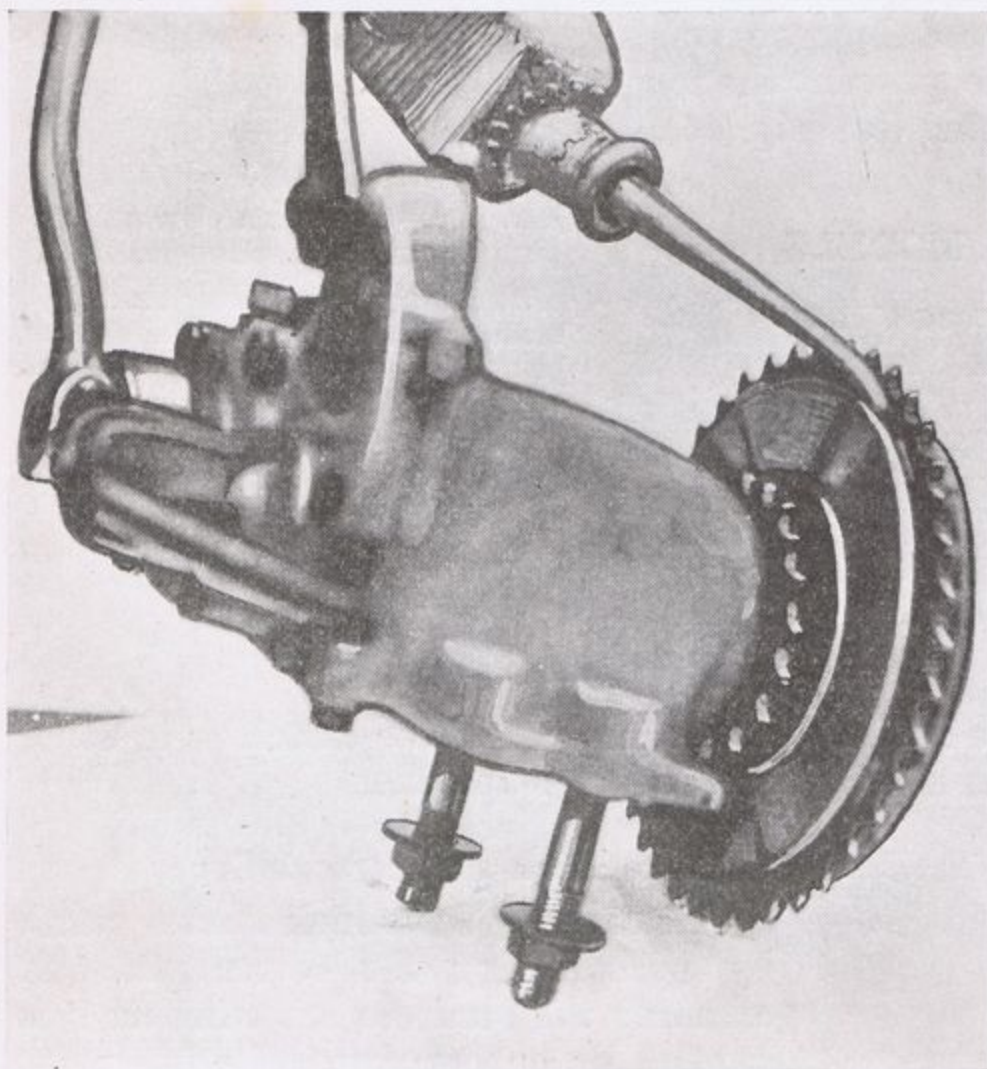


Fig. 62.—OILING THE CLUTCH.

Withdraw the clutch, and run oil down the sprocket between the corks on the dog plate side of the sprocket.

spring in a loop. This has a nut on the back of the kick-starter case, the removal of which allows the retaining pin to be unscrewed and the spring to be freed.

Kick-starter Segment

The kick-starter segment is returned by a spring, one end of which is anchored by a pin to the box while the other end is looped round the segment. The segment should be slipped out of the loop and withdrawn from its bush in the box. A small screw with a slotted head will be seen to hold the other end of the

Extracting Mainshaft and Gears

The mainshaft may now be withdrawn, followed by the dog clutch and the layshaft gears and high-gear pinion, in which is the pressure washer. The inside operator is held in position by a long pin screwed into the top of the box from the bottom, and the bottom of the pin is located in a hollow screwed plug (see Fig. 57). The plug is removed first, right-hand thread, and this discloses the end of the long pin which

has a screwdriver slot, and is unscrewed out, right-hand thread. The inside operator may now be removed.

Fitting Layshaft Bush

The small steel bush in the box into which the layshaft fits is pressed in and dowel pegged. If it is necessary to renew this the dowel peg must be removed, the old bush knocked out, a new one inserted and drilled through the aluminium, tapped, and a new dowel peg inserted. After this it has to be reamed to size, so that unless the garage is well equipped it is a job that is better sent to the works. Any other bushes required must be sent with the part in which they fit, box or cover, to the service depot for replacement for reasons explained earlier.

Inspecting Parts for Wear

The layshaft should be tested in the double gear for wear, and if necessary exchanged; .010 to .012 inch clearance is permissible, but above that wear will take place more rapidly, as the case hardening wears. Dogs on the high-gear pinion dog clutch, and on the low-gear dog-clutch pinion should be examined for rounding. The dog-clutch pinion is free to rotate on the mainshaft, and is held in position by a pen-steel washer, a contracting spring washer and another pen-steel washer, which also acts as a stop for the ratchet spring. The spring holds the kick-starter ratchet pinion in mesh with the ratchet lock ring. A distance bush is placed on the shaft against the outside pen-steel washer, and it is on this bush that the ratchet pinion slides and rotates. The bush is held in position by the ratchet lock ring, which is pressed on splines on the shaft, followed by a steel bush, also pressed on. If any renewals are required on the shaft, it should be returned complete to the works. Test the spindle for wear in the high-gear pinion, not allowing more than about .010 inch. In the inside operator will be found a small swivelling toggle which is riveted in. Should this be worn, it can be renewed by grinding off the riveted head, inserting a new one, and burring the head over (see Fig. 58), making certain that it swivels quite freely; put a little oil on.

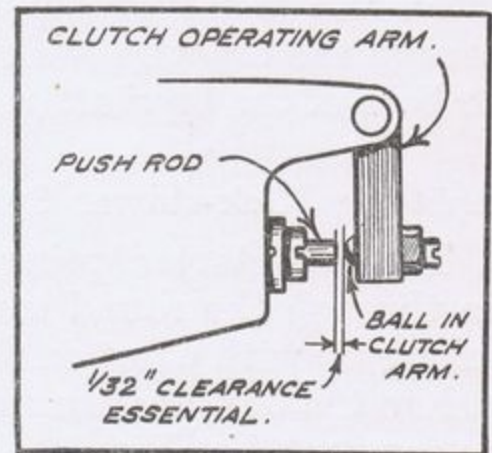


Fig. 63.—ILLUSTRATING THE CORRECT CLEARANCE BETWEEN THE CLUTCH LEVER AND PUSH ROD.

REASSEMBLING THE TWO-SPEED GEARBOX

The Gearbox

The examination is now complete, and the assembly can be commenced. Place the high-gear pinion through the ballrace and fit the

final-drive sprocket, keyed washer and lock ring, using chain to hold the sprocket from turning, as described in the three- and four-speed models, or the dogged tool as described in the three-speed assembly, if available. Next thread the long operator pin through the hole in the bottom side of the case, through the inside operator, screw it into the top of the case and lock tightly. Follow this up with the hollow screwed plug, also locked tightly. Place the pressure washer in the high-gear pinion, and then engage the toggle between the flanges of the dog clutch and place this on the high-gear pinion so that the dogs are in mesh (see Fig. 58). Next insert the layshaft gears, small gear first, to mesh with the teeth of the high-gear pinion. Oil the mainshaft, and pass it through the dog clutch and high-gear pinion, rotating it either way until it drops home through the pressure washer; pour oil into the box, not omitting some in the bore of the layshaft gears.

Replacing Kick-starter Spring

The kick-starter spring can now be replaced by threading the screwed pin through the round loop of the spring, screwing it into the box and locking up with a nut on the back. Place the kick-starter segment in its bush in the box, and turn it to get the loop of the spring round the web of the segment (see Fig. 59). Screw the layshaft into the cover absolutely deadtight, and remove any marks on it caused by holding it when screwing or unscrewing by polishing with a very fine emery cloth. Place the spring plate in position, securing it by the two pins, and follow this up with the operating lever after oiling the bush and the steel cover. Put some oil in the mainshaft and kick-starter shaft bearings, and place on cover.

Adjust Operator Lever and Kick-starter Segment

Just before the cover is home see that the spoon of the operator lever surrounds the ball of the inside operator, then turn the kick-starter shaft anticlockwise for about one quarter turn to bring the segment clear of the stop and the cover will drop into position (see Fig. 60). A little manœuvring may be necessary to get the end of the layshaft into the small steel bush in the box. The cover now may be locked down by the cover screws, and the kick-starter crank fitted with the cotter pin.

Refitting the Clutch

When fitting the clutch make certain that the tapers on the spindle and in the clutch centre are perfectly dry and free from oil or grease: rubbing them with chalk is a good drying medium. The key should be inserted and tapped down, so that the top is parallel with the taper, and the body knocked on tightly, followed by spring washer and nut. Build up the clutch, as has been previously described.

Alterations in Later Models

At the end of 1928 the clutch on the three-speed models was altered to the ball-bearing type from a phosphor-bronze bearing. The stripping down is performed in exactly the same manner, the only difference being that instead of a steel drum, in the shock-absorber type, a phosphor-bronze drum was used, and in the solid type a phosphor-bronze ring on a steel centre was used instead of the hardened centre and balls.

Most Important

If the phosphor-bronze ring or drum is worn and requires renewing, the back plate complete must be returned to the works for refitting. In a well-equipped workshop changes of gears which are pressed on may be made, provided that before stripping down the steel bush is marked to show which spline fitted into its groove, and it must be replaced in *exactly* the same position, otherwise they almost certainly will not run true with the shaft (see Fig. 61).

GENERAL

Lubrication is very important: use engine oil, and pour in about $\frac{1}{4}$ pint every 2,000 miles. Lubricate all joints in controls to prevent wear and loss of gear registration. The clutch cable also should be lubricated occasionally. The sprocket bearing can be lubricated, and this applies particularly to the phosphor-bronze bearing type, which must be kept well lubricated, by declutching and running some oil down the sprocket between the corks on the back plate side of the sprocket (see Fig. 62). Do not strain gears by attempting to change when stationary.

Adjustments

There should be $\frac{1}{32}$ inch between the end of the push rod and the nose of the adjusting pin in the clutch lever (see Fig. 63). If there is any suspicion of clutch slip, look to the adjustment at this point. Unlock the nut and screw or unscrew the small pin to the correct distance and then lock the nut.

Chains

Use the correct size of chain for the sprocket; see that the chains are in line with the corresponding sprockets on the engine or rear wheel, and do not have the chains too tight. When sending for spares the letter and number on gearbox should be quoted, and patterns should be sent wherever possible to preclude the possibility of mistakes.