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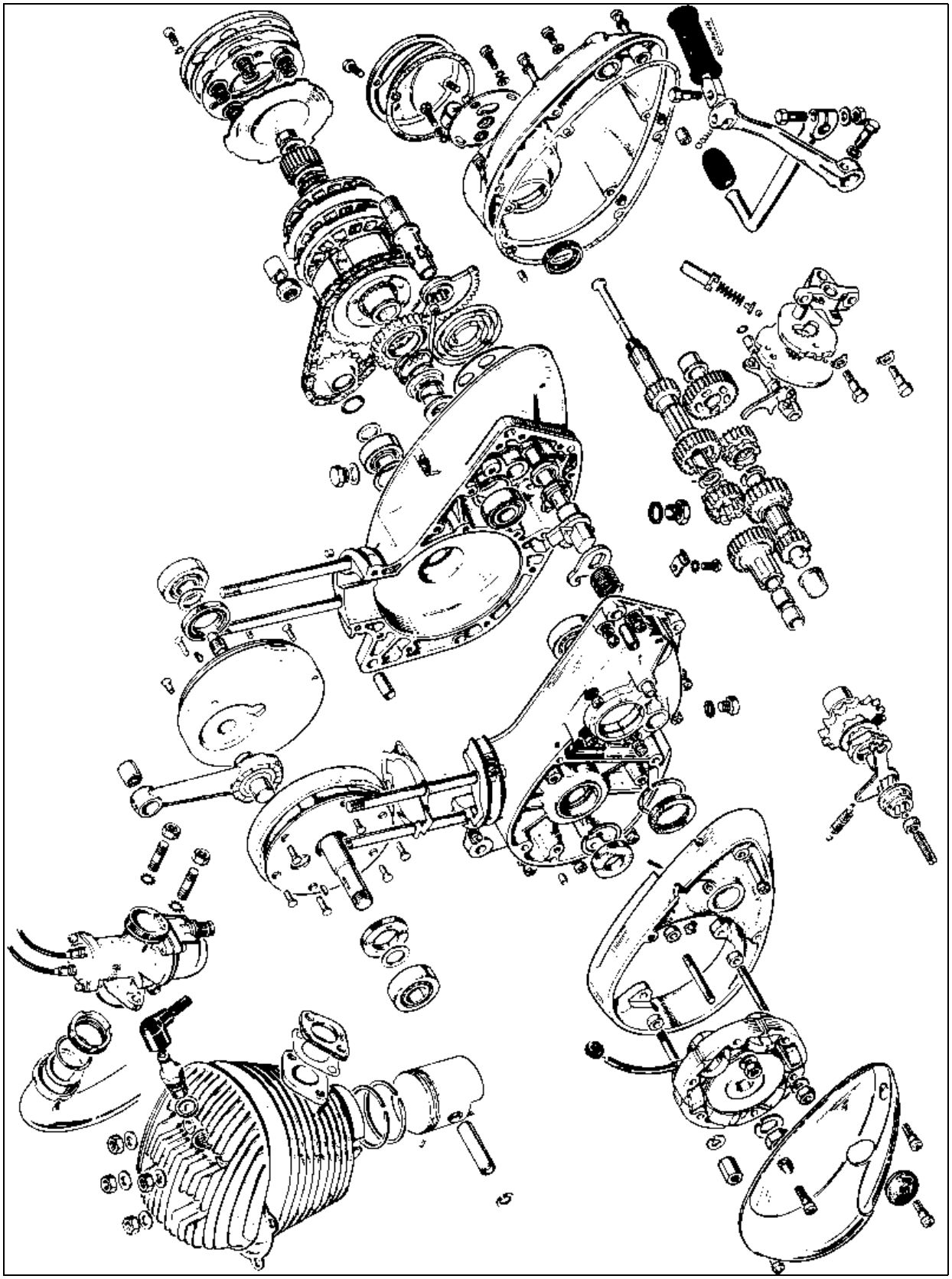

FIG. B1. *Engine exploded.*

OPERATION OF THE TWO-STROKE ENGINE

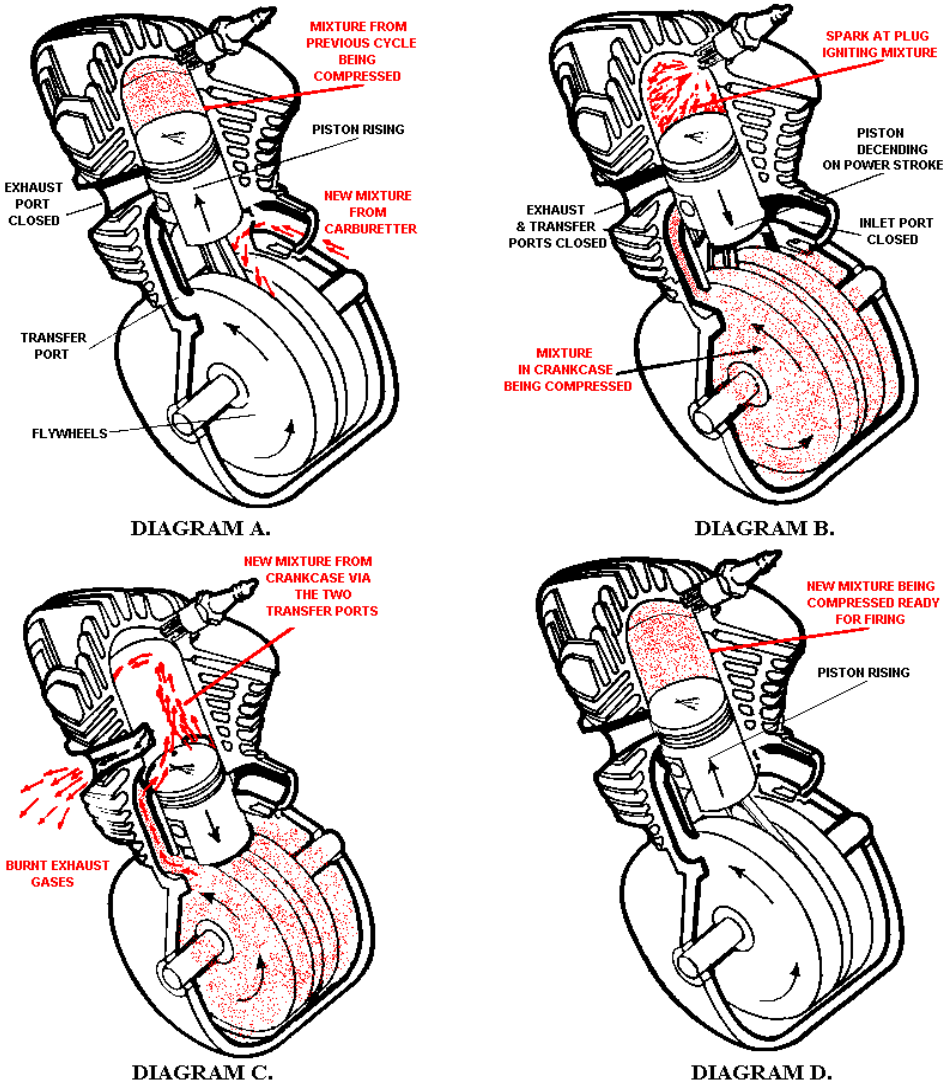

FIG. B2.

Diagram A. Shows the piston nearing the top of its stroke, compressing a charge of mixture from the previous cycle, ready for firing. The inlet port is uncovered and a fresh mixture of petroil/air is induced through the carburetter into the crankcase, filling the vacuum caused by the ascending piston.

Diagram B. The compressed charge has just been ignited by the sparking plug and as the burnt gases begin to expand, the piston is rapidly forced downward on what is know as the firing stroke. The fresh charge of mixture is compressed by the piston as it descends.

Diagram C. Shows the piston at the end of its downward stroke, leaving the exhaust port completely uncovered to enable the burnt gases in the cylinder to escape through the exhaust system. The transfer ports are also open, allowing the compressed mixture in the crankcase to force its way into the cylinder. Each transfer port (only one is shown in the diagram) is so arranged that the stream of incoming mixture is directed to the rear of the combustion chamber. As they sweep upwards under the cylinder head, they assist in forcing out any remaining burnt gases through the exhaust port. This particular stage of events is known as "scavenging."

Diagram D. Shows the piston rising, so compressing the charge of mixture ready for firing. The upward movement of the piston in the cylinder is also creating a partial vacuum in the gas-tight crankcase which will draw in a fresh mix of petroil/air from the carburetter when the inlet port is uncovered.

The two-stroke is so called because a firing stroke occurs on one out of every two strokes of the piston, unlike the four stroke engine which fires once every four strokes of the piston. Induction and exhaust ports in the cylinder wall replace the valves, springs, cams and tappets normally used in a four-stroke engine. The upper portion of the cylinder is linked to the crankcase by two transfer ports, the purpose of which is detailed on page B3.

These notes, when read in conjunction with the corresponding diagrams, should acquaint the inexperienced mechanic with the basic principles of the two-stroke engine.

DESCRIPTION

The 175 c.c. two-stroke engine is of unit construction and has a single cylinder barrel of close grained cast-iron mounted on an airtight, two-piece crankcase. The domed "Lo-ex" aluminium piston is "pegged" to prevent the compression rings from revolving in the bore and is carried on an oval section connecting rod, employing a needle roller small-end. Housed between the two disc-faced flywheels is the big-end bearing, consisting of eighteen plain rollers.

The generator rotor is secured to the keyed shaft of the left-hand flywheel and is protected by a circular cover containing a six-coil stator unit. Mounted on the right-hand shaft is the engine sprocket and contact breaker unit, which, because the engine operates on the two-stroke principal, revolves at engine speed.

From the engine sprocket the drive is taken, via the primary chain, to the clutch assembly. Here the transmission is controlled by a series of spring-loaded friction plates before passing through the four-speed constant-mesh gearbox to the gearbox sprocket.

DECARBONISING

Internal combustion of the petroil mixture in the engine produces normal carbon deposits on the piston crown, rings, cylinder head and ports.

These deposits are not harmful providing they are not allowed to become too heavy and cause pre-ignition and other defects which would impair the performance of the engine.

The usual symptoms indicating an excessive build-up of carbon, are an increased tendency for the engine to "pink" (metallic knocking sound) when under load, erratic running and a tendency for the engine to run much hotter than usual. A general decrease in power will also be apparent, this usually being caused by heavy carbon deposits in the exhaust port restricting the natural flow of exhaust gases. This interferes with the scavenging which takes place in the combustion chamber, making it impossible for an efficient transfer of combustible mixture from the crankcase.

Decarbonising is quite a simple task, so, to ensure constant efficiency from the engine, it is advised that the operation be carried out every 2,000 to 4,000 miles.

SILENCER

It should be noted that the exhaust system contributes a great deal to the efficiency of a two-stroke engine. When decarbonising the engine therefore, do not omit to clean the silencer baffles and exhaust pipe bore.

The baffles in the rear of the D14 silencer are detachable. Access is gained by removing the silencer end cap, retained by two nuts and a spring washer.

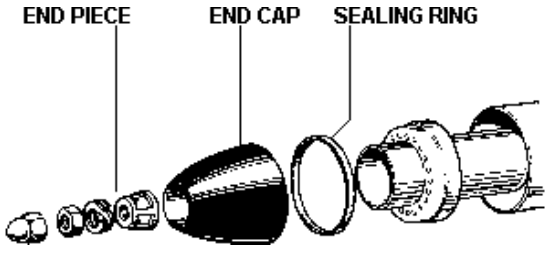

FIG. B3.

Remove these parts, then with a pair of pliers pull the baffles from inside the silencer and soak in caustic soda solution to dissolve the carbon. Take care not to splash your eyes or clothing with the solution which is very corrosive. Reassembly is in the reverse manner. Ensure when reassembling, that the sealing ring is correctly located before replacing the end cap.

Before starting work on the engine ensure you have a clean bench or area in which to work, and somewhere to place the parts as they are removed.

REMOVAL OF CYLINDER

First turn off the fuel supply and disconnect the fuel pipe union at the float chamber. Do not attempt to pull the pipe off the union unless it is in need of replacement. Disconnect the air cleaner, undo the two nuts securing the carburetter to the cylinder flange studs and tie the carburetter out of the way.

Using a suitable "C"-spanner, release the exhaust pipe union nut at the front of the barrel. If any difficulty is encountered in unscrewing the nut, apply a few drops of penetrating oil to the threaded portion and allow to soak before attempting to unscrew it any further. Disconnect the high-tension lead and remove the sparking plug.

Take off the four large fixing nuts from the top of the cylinder head and lift the head clear. Note that on early D14 models two cylinder head gaskets of 0·025" thickness were fitted. Later these were replaced by a single gasket of 0·050" thickness. Always check the gasket thickness when fitting, as two must be fitted if of the thinner type. Before attempting to remove the cylinder barrel, first unscrew the two petrol tank front fixing bolts, loosen the rear fixing bolt and raise the tank slightly to provide sufficient clearance. The petrol tank on the Bushman models must be removed completely. Care must be taken, when sliding the barrel off the studs, to support the piston as it emerges from the end of the bore, otherwise it may be damaged as it falls clear.

Should the barrel be found difficult to remove, it may help if the two crankcase joint screws below the bottom fin of the barrel are slackened.

PISTON

After placing the cylinder head and barrel safely to one side, the piston can now be examined. Unless the piston or small end bearing is to be removed, the piston need not be disturbed. Should it be necessary to remove the piston, first prize out one of the gudgeon pin circlips with a suitably pointed instrument.

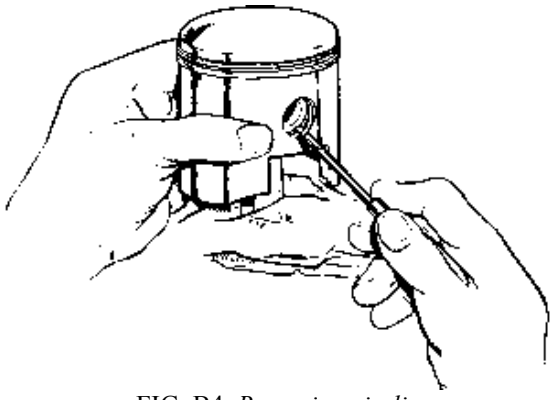

FIG. B4. *Removing circlip*

Before withdrawing the gudgeon pin it is advisable to first warm the piston by wrapping it in a rag that has been soaked in hot water. Application of this rag will cause the aluminium alloy piston to expand more than the steel gudgeon pin, allowing the pin to be extracted more easily. Care must be taken not to damage the small-end needle rollers in the connecting rod when removing the gudgeon pin.

Scrape off any carbon which has accumulated on the piston crown, being careful not to damage the surface of the metal. A stick of tinsmiths solder, flattened at one end, makes an ideal scraper tool and will not score the piston. After removing the carbon, wipe the piston clean with an oily rag.

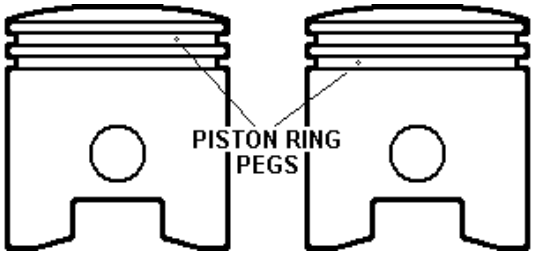

FIG. B5.

PISTON RINGS

Examine the piston rings and note that they are prevented from turning in their grooves by means of pegs which locate in the piston ring grooves.

The outside face of each piston ring should posses a smooth metallic surface and any signs of heat discolouration indicates that the rings are in need of replacement. The rings should also retain a certain amount of "springiness" so that when released, the free gap is considerably greater than the gap measured when the ring is in the bore.

Each ring should be free in its groove but with minimum side clearance. If the rings tend to stick in the grooves, remove them and clean out all the carbon from the groove and the inside face of the ring. A broken piece of piston ring, ground as a chisel, will provide a useful tool for removing carbon deposits from the ring grooves. Care is necessary to permit only a minimum amount of movement when removing the rings as they are very brittle and can be broken easily.

To check the piston ring gaps, place each ring in the least worn part of the cylinder bore (usually at the bottom) and locate it with the top of the piston to ensure it is square in the bore. Measure the gap between the ends of the ring with a feeler gauge. The correct gap should be between ·009" (·2286 mm.) and ·013" (·3302 mm.) and although an increase of a few thousandths of an inch is permissible, any large increase to, say, ·025" indicates the need for replacement rings.

See also that there is sufficient clearance between the inner portion of the gap and the locating peg in the groove. This can be checked by closing the ring in the groove until the gap closes, proving that there is clearance at the peg below. If the gap cannot be closed, indicating that the steps are binding on the peg, use a smooth file to ease the steps down.

It is advisable to check the gap of a new ring before fitting, and if the gap is found to be less than 0·07" (1778 mm.) the ends of the ring must be carefully filed to the correct limit.

Protect the crankcase mouth with a piece of clean rag and proceed to decarbonise the cylinder head and barrel.

CYLINDER HEAD AND BARREL

Remove all carbon deposits from the cylinder head, again bearing in mind that the aluminium is soft and can easily be damaged if the decarbonising tool is carelessly applied, and carefully wipe away all loose particles.

As explained at the beginning of this section, most of the carbon deposit likely to have accumulated in the cylinder will be in the exhaust port and it is most important that this is removed. Carefully scrape out the carbon, taking care not to let the tool slip out of the port and damage the surface of the bore. Examine the transfer and inlet ports for the presence of carbon, although this is unlikely to be excessive, and finally wipe the ports and cylinder bore absolutely clean.

SMALL-END BEARING

The needle roller small-end bearing, because of its obvious advantages over a plain bush, should not be subjected to a great deal of wear. However, should it be necessary to change the bearing, the old bearing can be pushed out whilst at the same time, the new bearing is pressed in with service tool No. 61-3791. Check that the diameter of the gudgeon pin is as quoted in General Data. If appreciable wear is detected, the gudgeon pin will have to be renewed.

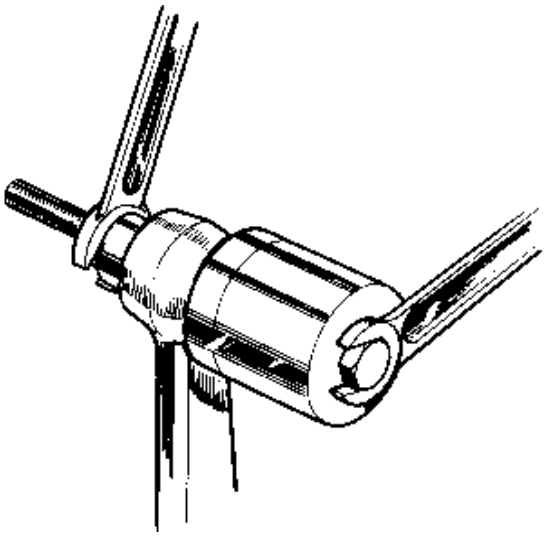

FIG. B6. *Using service tool No.* 61-3791.

BIG-END BEARING

While the cylinder is off, opportunity should be taken to test the big-end bearing for wear. This can be achieved by taking hold of the connecting rod and pulling it upwards until the crank is at top dead centre. Whilst holding it in this position, try gently but firmly to push and pull the connecting rod in the direction of its travel, in order to detect any play. If the big-end is in good condition there should be no free movement in this direction, although it may be possible to move the rod sideways, *i.e.,* at right angles to the axis of the machine. Should vertical play in the big-end be detected and you do not feel qualified to assess whether the amount in evidence is permissible or not, then you should seek expert advice. This point is not likely to give much trouble however, providing that the engine has been carefully used and adequately lubricated, for the big-end bearing is of ample dimensions for the work it has to do. If the big-end has deteriorated as the result of neglect or abuse, it should be replaced as detailed on page B12, though unless you have the necessary experience and facilities for this type of work it is preferable to hand the job over to an expert repairer.

REASSEMBLY AFTER DECARBONISING

If the piston was removed from the connecting rod, replace it in its original position, (*i.e.,* with the piston ring gaps at the front). Before fitting the gudgeon pin, smear it with oil and do not forget to replace the circlips. Remember that if the circlips should come adrift or if one is omitted, the cylinder barrel may be seriously damaged.

Before attempting to replace the cylinder barrel over the piston, smear the piston sides generously with clean engine oil. Fit a new gasket and place the barrel over the piston carefully manipulating the rings into the base of the bore and seeing that they enter freely without the application of force. When the barrel is correctly fitted, replace the cylinder head and gasket. Note that on early D14 models two cylinder head gaskets of 0·025" thickness were fitted. Later these were replaced by a single gasket of 0·050" thickness. Always check the gasket thickness when fitting as two must be fitted if of the thinner type. Fit the washers and nuts on to the fixing studs and tighten the nuts in diagonal order so as to avoid distortion.

Examine the sparking plug and refit if sound. Check that the rubber sealing ring on the carburetter flange is undamaged and finally reconnect the exhaust pipe, carburetter, petrol pipe and re-fix the petrol tank.

REMOVAL OF ENGINE

Turn off the fuel supply and disconnect the fuel pipe union at the carburetter float chamber. Do not attempt to pull the pipe off the union unless it is going to be renewed. The air cleaner hose should now be disconnected from the carburetter. Undo the two nuts securing the carburetter to the cylinder flange studs and tie the unit out of the way.

Using a suitable "C"-spanner, release the exhaust pipe union nut from the cylinder barrel.

If any difficulty is encountered in unscrewing the nut, apply a few drops of penetrating oil to the threaded portion and allow to soak before attempting to unscrew it any further.

Disconnect the contact breaker lead at the snap connecter under the primary chaincase. The gearbox should now be drained by removing the filler and drain plugs and allowing the oil to drain into a suitable receptacle.

Detach the sparking plug lead, and disconnect the generator leads at their snap connectors. The clutch cable should now be disconnected as detailed in D12.

Remove the chainguard as detailed on page D9, and take off the rear chain, noting the correct fitting of the spring link, *i.e.,* closed end pointing forwards on top run of chain.

Unscrew the two bolts fixing the petrol tank at the front and loosen the rear fixing bolt. The tank can now be raised slightly to provide sufficient clearance of the engine.

The engine is held in the frame by two nuts and bolts and the front and two at the rear. One of the rear fixing bolts is situated beneath the engine.

Remove the four fixing bolts and carefully lift the engine out of the frame.

When a prop stand has been fitted as an optional extra (not applicable to Bushman models), it will be released on removal of the front fixing bolts. On Bushman models, the front fixing bolts also retain the crankcase shield.

The kickstart and gearchange pedals can now be taken off in preparation for engine dismantling, described below.

ENGINE DISMANTLING

Perfect cleanliness is essential to ensure the success of any service task, so before starting work make sure you have a clean bench or working area in which to operate, and somewhere to place the parts as they are removed.

Before starting work on a complete strip-down of the engine unit it is advisable to have the following tools and replacements available.

(1 off)	00-3311	Gasket set
(3 off)	90-0749	Oil seal
(1 off)	90-0147	Oil seal
(2 off)	57-3621	Main bearing
(1 off)	90-0010	Main bearing
(2 off)	90-1386	Gudgeon pin circlip

The following service tools are also needed.

61-3191	Clutch spring compressor
61-3786	Engine sprocket extractor

The following notes give in detail the correct procedure for dismantling the engine/gearbox unit.

It will be assumed that the engine unit has been drained of oil, removed from the frame, and dismantled for decarbonising as described in the previous pages.

The primary cover is held in place by five Phillips-head screws, each of which is fitted with a fibre washer. It is not necessary the oil level screw, painted red. Place a suitable tray under the joint to catch any oil, and gently tap the cover with a hide-mallet to break the joint.

The primary cover can now be lifted away complete with the contact breaker cover which is held in place by two screws. Mark the position of the contact breaker plate in relation to the case with a scriber to assist assembly. Remove the plate fixing screws, and contact breaker mounting plate.

Carefully unscrew the contact breaker cam screw on the end of the drive shaft. Before the screw reaches the end of its thread the head will bear against the circlip and further rotation of the screw should release the cam from its taper. It may, however be necessary to lightly tap the cam to free it from the taper.

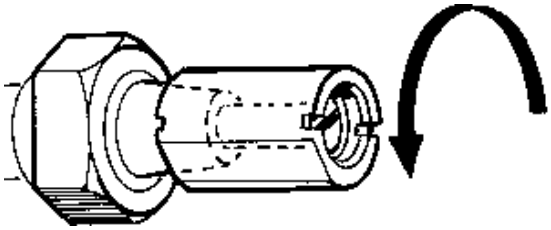

FIG. B7.

Now take out the four small Phillips-head screws securing the generator cover, and remove the cover.

To remove the inner cover, first take out the one Phillips-head screw at the back, then unscrew the three generator cover stator nuts. Tap the cover gently around its edges to release, and withdraw the cover complete with stator. Take care not to loose the three small spacers that are located on the fixing studs between the stator and inner cover. The inner cover carries the clutch actuating lever and adjuster. If this mechanism requires attention, unclip the return spring, unscrew the adjuster locknut and press the lever out of its bush. The push rod ball is loosely located in the lever boss. Withdraw the push rod and rubber sleeve.

The gearbox sprocket is held to thee sleeve pinion by one large left-hand threaded nut, and a tab-washer. Flatten the washer, and locking the sprocket with a length of chain, unscrew the nut.

Pass a length of bar through the small-end bearing, and, taking care not to damage the crankcase top joint face, turn the engine until it is locked solid.

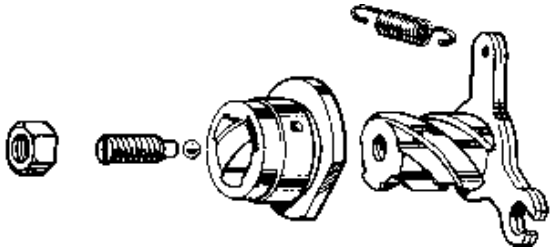

FIG. B8.

The generator rotor is secured to the keyed engine shaft by one large nut and spring washer. Undo this, pull off the rotor and extract the Woodruff key from the shaft.

Using the same method remove the self-locking nut securing the engine sprocket. Remove the chain by releasing the spring link and threading it out.

CLUTCH PLATE DISMANTLING

Take off the clutch cover plate, retained by three small screws with spring washers. Now, using service tool No. 61-319 (as shown in B9) compress the clutch springs to allow the large plate retaining circlip to be removed.

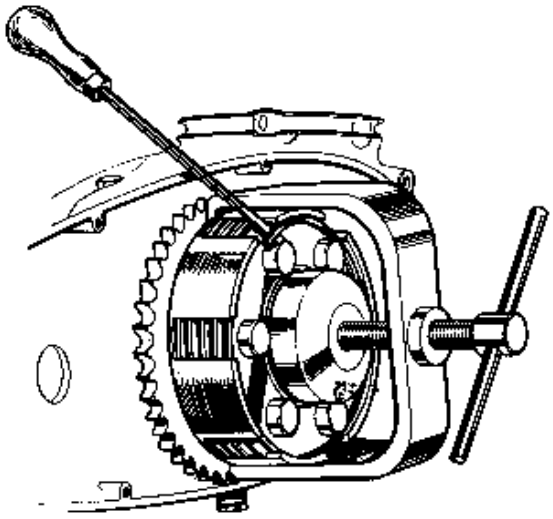

FIG. B9.

Remove the tool, and lift off, and lift off the retaining plate complete with springs and cups. The pressure plate, and friction plates can now be taken out for inspection. Take care not to loose the mushroom-headed push rod which fits in the end of the mainshaft. If the clutch plates or springs are the only items requiring attention the clutch not be dismantled any further.

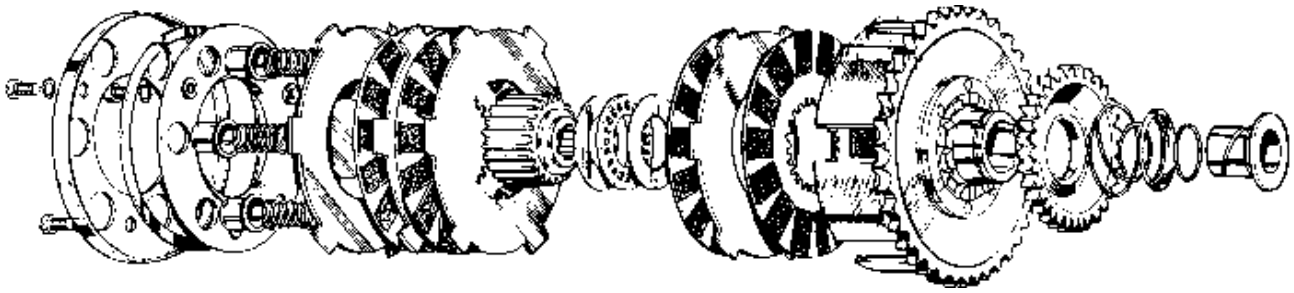

FIG. B10.

New clutch springs have a free length of 1-9/64" (29 mm.) and if this length has reduced by more than 1/32" (0·8 mm.) it is recommended that a new set be fitted.

The four driving plates have segments of a special friction material securely bonded to the metal.

All these segments should be complete and unbroken. Even if there appears to be no damage to the plates or segments, the overall thickness of each segment should be measured. The thickness of a new driving plate is ⅛" (3·2 mm.) and if the wear is excessive the plates should be renewed.

The tags on the outer edges of the plates should be a reasonable fit in the housing slots. If there are any burrs on the tags, renew the complete plate.

The three plain driven plates should be free from score marks, and must be perfectly flat. To check the latter lay the plate on a piece of plate-glass, or other known flat surface: if it can be rocked it is obviously buckled and must be replaced with a new one.

Service tool No. 61-3796 must now be used to pull the engine sprocket off the tapered shaft, but do not forget to first screw in the protector bolt, as the end of the shaft is easily damaged. After removing the sprocket, tap out the small Woodruff key, and take off the rubber oil seal and steel collar.

The crankcases are now about ready for splitting. First take out the twelve Phillips-head screws from around the outer edge of the case on the generator side, two of which are to be found below the cylinder barrel flange, and then remove the four screws from around the gearbox sprocket.

Tap out the two hollow dowels from each end of the case, through the upper engine bolt holes, using a suitable drift.

The crankcase halves can now be parted by gently tapping with a hide-mallet. Under no circumstances should any attempt be made to lever the crankcase halves apart as this will cause irreparable damage to the joint face.

When the crankcases have been separated the sleeve pinion can be tapped out of the bearing in the left-hand crankcase. Check for any shims stuck to the main bearing.

The flywheels can now be removed from the right-hand half, by tapping the crankcase with a hide-mallet taking care not to damage the joint faces. Take careful note of the number and positions of any shims on either of the flywheel shafts.

GEARBOX DISMANTLING

First take off the loose fitting light coil spring, and lift the selector plate off the gearchange spindle. Withdraw the spindle, complete with return spring from the case.

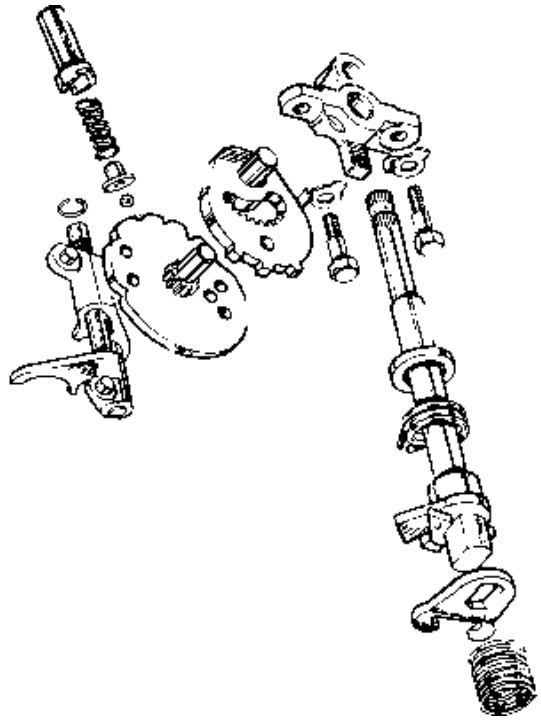

FIG. B11.

The kickstart mechanism can now be removed from behind the clutch, by releasing the clock-type spring and lifting the quadrant clear.

Gently withdraw the layshaft with its fixed top and second gear, and lift out the remaining layshaft second and bottom gear.

To enable the mainshaft gears to be removed it will be necessary to take off the cam plate mounting bracket. Bend back the tab washers and take out the two fixing bolts. Carefully lift out the cam plate, mainshaft sliding gear and selector forks, taking care not to lose the two loose fitting rollers which locate the selector forks in the cam track.

The cam plate plunger spring, seating and ball are a loose fit in their socket at the back of the case, and should be removed now to prevent any loss of parts.

Hold the crankcase assembly firmly in a soft-jawed vice gripping the gearbox mainshaft.

REMOVAL OF CLUTCH HUB

With the gearbox mainshaft held firmly in a soft-jawed vice, remove the clutch centre nut and washer, which will release the clutch centre pinion, thrust bearing and two washers and the clutch chainwheel.

The kickstarter ratchet pinion is held on to the chainwheel by a circlip which, when removed, releases the pinion, spring and retainer.

The gearbox mainshaft complete with its fixed first gear, and third gear, can now be withdrawn.

GEARBOX INSPECTION

The mainshaft third gear is held against the mainshaft first gear by a circlip. This gear should spin freely on the shaft without excess play.

The layshaft second gear is held against the layshaft fixed gear by a similar circlip, and this gear should also spin freely without excess play.

All dogs and teeth should be free from signs of excess wear and pitting, and the sliding gears should be a good sliding fit on their splines. The diameters of the shaft that run in bushes should be smooth and polished, free from signs of seizure and picking up.

The selector forks should be lightly polished on their forks, and should run freely in their sliding gears.

The selector fork rod should be a good fit in the right-hand crankcase and should be straight. The selector forks should slide up and down the shaft, if it is suspected that the shaft is bent it can be checked by rolling on a surface plate or a piece of plate-glass.

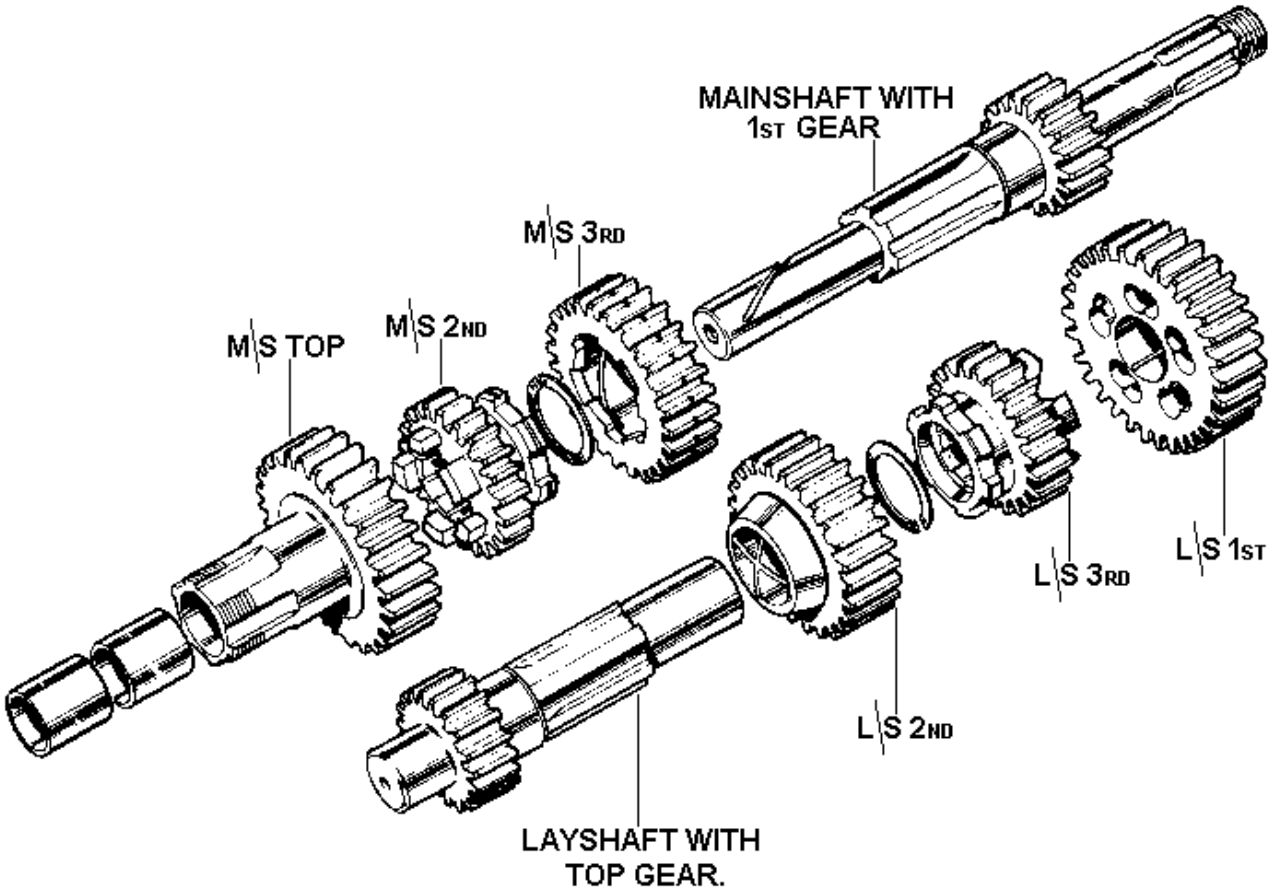

FIG. B12.

The pegs in the cam plate and quadrant should be secure and the dogs on the quadrant and the corresponding claws on the selector plate should be in good condition.

ATTENTION TO FLYWHEELS

Whilst at this stage it is advisable to check the big-end for signs of wear. Hold the connecting rod at its highest point of travel and try gently but firmly to push and pull the rod in the direction of travel. If the big-end is sound there should be no play in this direction though it may be possible to rock the rod sideways. The sideways play is permissible provided the connecting rod does not catch on the flywheels at any point, but if any vertical play is detected it must be decided if the amount is permissible or not.

The bearing is of ample dimensions for the work it has to do and, provided that the engine has been carefully used and adequately lubricated, the bearing is unlikely to need replacement.

If the bearing has noticeably deteriorated as the result of neglect or abuse, the flywheels must be parted to gain access to the bearing.

The flywheels are a press-fit on to the ends of the crankpin and no attempt should be made to part them unless the services of an expert mechanic and a fully equipped workshop are available.

To part the flywheels first place the assembly in the bolster and position the stripping bars as shown in Fig. B13. Using the punch, drive out the crankpin and take off the uppermost flywheel. Reverse the assembly in the bolster and again drive out the crankpin, releasing the other flywheel.

To reassemble the flywheels, place the left-hand flywheel into the bolster and, using a suitable hand press, insert one end of the new crankpin.

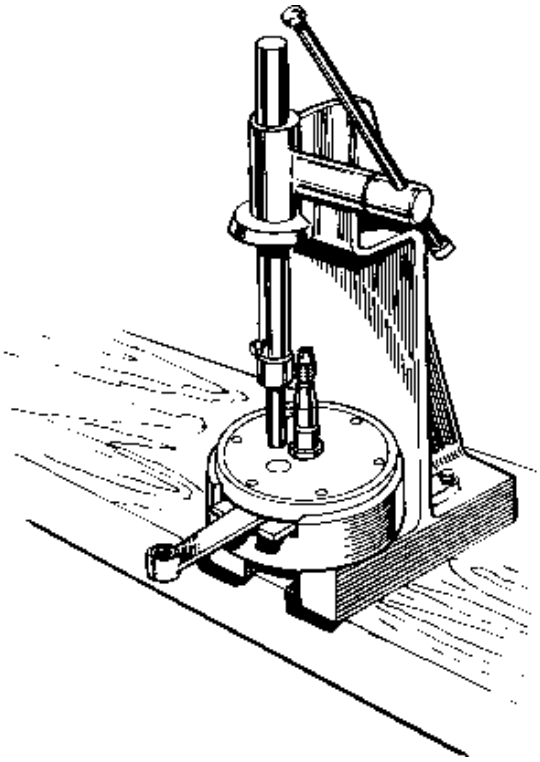

FIG. B13. *Parting the flywheels.*

Position the second flywheel over the crankpin and, using one of the stripping bars as shown in Fig. B14, press the flywheel on to the crankpin.

The flywheel assembly must now be aligned within the necessary limits. Two of the actual or similar bearings used in the engine should be fitted to the shafts and the assembly mounted in vee-blocks as shown in Fig. B15. Using a dial micrometer, measure the accuracy of the assembly. Any necessary should be made by the careful use of a mallet or lead hammer. The wheels should be brought within the limit of ·004" on the rims, ·006" on the inner faces and a maximum of ·002" on the shafts.

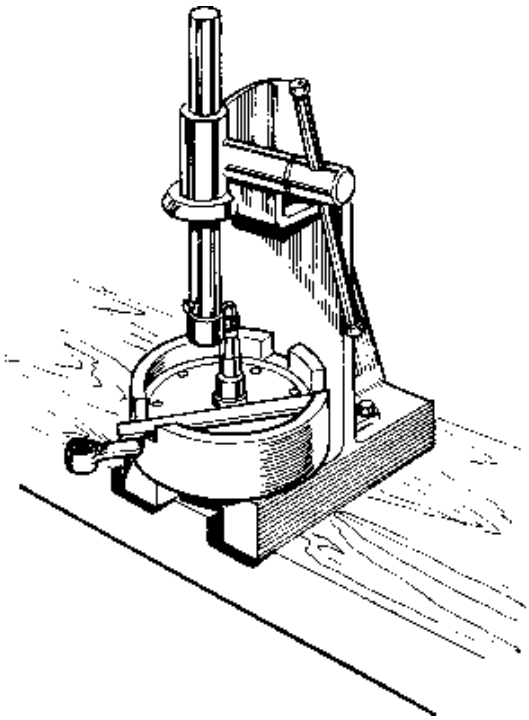

FIG. B14. *Reassembling the flywheels.*

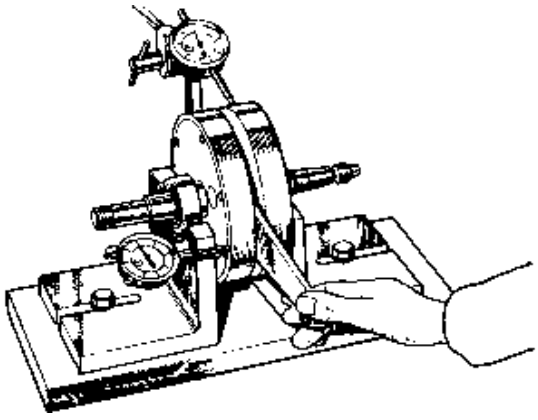

FIG. B15.
Checking the flywheel assembly.

Having checked the flywheels for concentricity, it will now be necessary to check the end float of the shafts. Place a ·010" shim on the right-hand spindle and insert it through the main bearings and oil seal in the case. Fit the left-hand oil seal, bearing and case, and temporarily screw the case halves together. Measure the amount of end float on the flywheel shafts, which should be between ·004" and ·006". Remove the left-hand crankcase and fit the required shims to the shaft, next to the flywheel. The shims are available in the following sizes: ·001" (90-0152), ·004" (90-0153), ·005" (90-0154), and ·010" (90-0155). Part numbers are shown in brackets.

If, during dismantling, the flywheel assembly was not disturbed, the standard ·010" shims can be replaced in their original positions.

BEFORE ASSSEMBLY

Before assembly all components should be thoroughly cleaned and checked for signs of wear. All joint faces should be cleaned of all old jointing compound, and if possible the crankcase halves should be lightly lapped together to check for distortion. Carefully examine all threads, bushes and bearings.

The flywheel assembly runs on three ball bearings, two on the drive-side and one on the generator side. Before trying to remove these bearings it is advisable to warm the crankcase halves. The bearing on generator side, and the outer bearing on the drive-side are both retained by circlips, and can therefore only be knocked out from one side.

Whenever the engine is stripped it is advisable to replace all oil seals.

ENGINE ASSSEMBLY

Fit the gearbox mainshaft through its bearing in the right-hand crankcase, and grip the mainshaft in a soft-jawed vice.

Assemble the clutch drum and kickstart ratchet pinion, having first checked the ratchet teeth for signs of wear.

The kickstarter ratchet engages on the clutch drum and is followed by a spring, a retainer, and the circlip. Check that the ratchet spins freely on the clutch drum.

Slide the hardened steel thrust washer over the mainshaft, followed by the cylindrical mainshaft bush. Replace the clutch drum. Grease the thrust bearing, the two large steel washers and assemble the "sandwich" on to the clutch centre. Slide the assembly carefully on to the mainshaft splines taking care not to trap the needle trust bearing. Fit the steel washer and nut and taking care that the clutch drum spins freely, fully tighten the clutch center nut.

If it was removed, replace the gearchange cam plate plunger socket together with spring, ball, and a little grease.

Place the layshaft first gear in position and prepare to assemble the selector forks. The forks are handed, and when the two flat edges are together the roller pegs should be in line. Lightly grease the rollers, and assemble on the pegs and fit the selector forks on to the selector fork spindle.

Assemble the cam plate, quadrant and mounting bracket, ensuring that the center of the gear lines up with the centre line of the small hole in the quadrant, and the neutral slot.

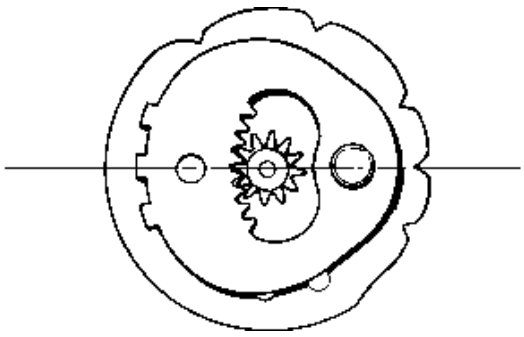

FIG. B16.

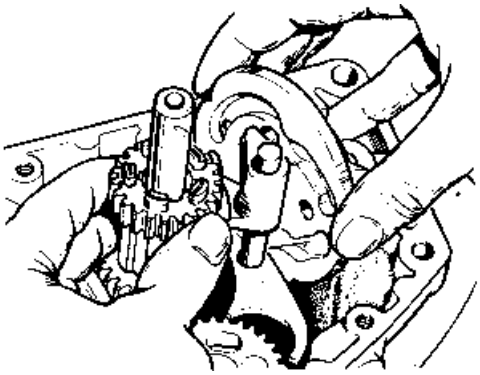

FIG. B17. *Assembling gearbox.*

Loosely assemble the mainshaft sliding gear, identified by saw cuts around the dogs, its selector fork, and the cam plate. Pass the sliding gear over the mainshaft and slide the assembly into position.

Engage the layshaft sliding gear in its selector fork and the selector fork rollers in their tracks, and secure the cam plate in position with two bolts and tab washers. Insert the layshaft complete with the free pinion retained by a circlip, and pass it through the layshaft sliding gear, and first gear, into its bush in the crankcase.

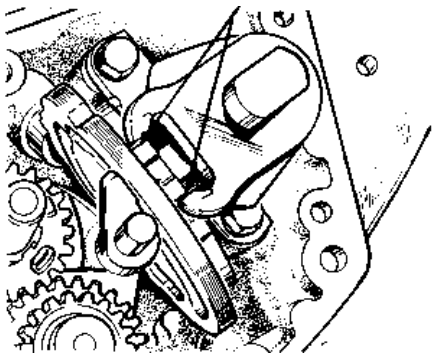

FIG. B18. *Centralising the selector claw.*

Refit the return spring to the gearchange spindle. The ends of the spring locate over a projection on the cam plate mounting bracket, acting as a centralising device for the claw. Place the distance piece below the spring and replace the spindle in the case. Locate the selector claw, if it is not central it must be adjusted by bending the spring.

The operation of the gearbox should be checked by spinning the gears, and trying to select all four gears and neutral.

Withdraw the gearchange spindle, and turning to the other side of the engine, place the kickstart in position. Fit the clock-type spring on to the kickstarter quadrant shaft, and the circular distance plate between the case and the spring. Give the spring one turn of tension, and push the kickstarter quadrant home in its recess, with the quadrant against its stop below the dowel hole. Replace the dowel to stop the quadrant unwinding the spring. Replace the gear selector shaft from the other side, not forgetting the spacer below the spring.

Fit the sleeve pinion, complete with its two mainshaft bushes, into its bearing in the left-hand crankcase. Lightly grease the distance piece to assist its passage over the oil seal, and replace with chamfer innermost. Fit the sprocket, lockwasher, and nut, then locking the sprocket with a length of chain held in a vice, tighten the nut. Check that the assembly spins freely. Bend the edge of the washer over the flat of the nut to secure.

Apply a liberal coating of oil to the flywheel shafts, and fit the assembly complete with the correct shims, into the right-hand crankcase half.

Paint the joint faces of both crankcase halves with a good sealing compound and fit the cases together. Spin the gearbox as the layshaft enters its bush, to prevent burring. Do not use excess force to fit the cases together. If any difficulty is experienced part the cases and check.

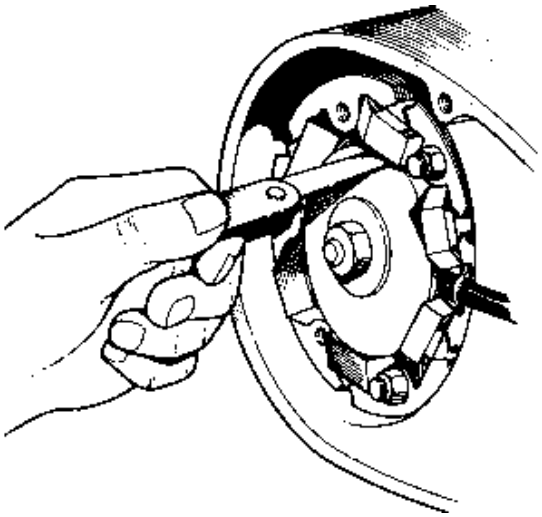

FIG. B19.

Insert the hollow dowels into each end of the case. Replace the twelve short Phillips screws round the crankcase edge on the generator side, the three screws round the gearbox sprocket, and the long screw in the machined face above the gearbox sprocket. Note that spring washers are fitted under the heads of all crankcase fixing screws except the short screw in the upper rear engine mounting lug, and the long screw above the gearbox sprocket set into the inner generator cover joint face.

Before fully tightening the screws it is advisable to check the operation of all gears and ensure that the flywheels rotate freely.

Replace the Woodruff key in its shaft and fit the generator with its marked face outwards. Using a suitable bar through the connecting rod small-end, tighten the fixing nut on to its spring washer.

Check the long clutch push rod to see if it is bent by rolling it along a flat surface. Insert the long push rod with its rubber sleeve, into the hollow gearbox mainshaft. The inner cover, complete with clutch actuating lever, can now be replaced and held in position with one screw at the rear, and a solid dowel at the front.

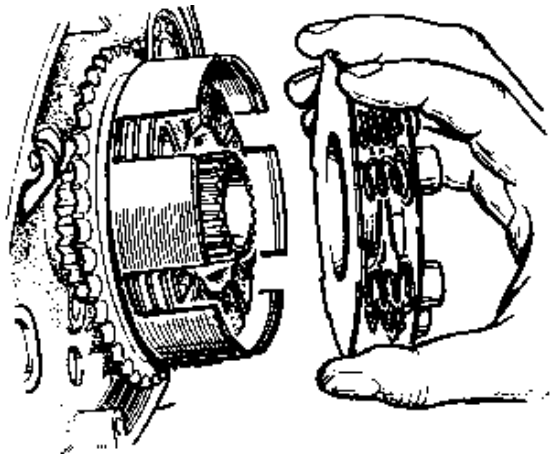

FIG. B20.

Fit the distance pieces over each generator stud, and replace the stator. The stator is correctly fitted when the cable assumes a three-o'clock position and is outward. Replace the fixing nuts with their spring washers noting that the special nut is fitted at the front. It is essential that the air gaps between the rotor and stator are equal, and are a minimum of 0·008" (0·2 mm.). Use a feeler gauge to check the gaps, correcting any discrepancies by slackening the fixing nuts, inserting a feeler in the tight side, and retightening the nuts.

The outer cover need not be replaced until the clutch has been adjusted, as detailed on page B19.

Now turning to the primary drive-side of the engine replace the steel collar, rubber oil seal ring, and key, and then fit the engine sprocket on to its tapered shaft. Fit the self-locking nut, and with engine locked by a bar through the small-end, fully tighten.

Insert the small mushroom-headed push rod into the centre of the mainshaft from the clutch side. Fit the plates, starting with one bonded friction plate, plain plate, and a bonded plate alternately. Assemble the caps and springs in the retaining plate, and the domed pressure plate, and fit on to the clutch hub.

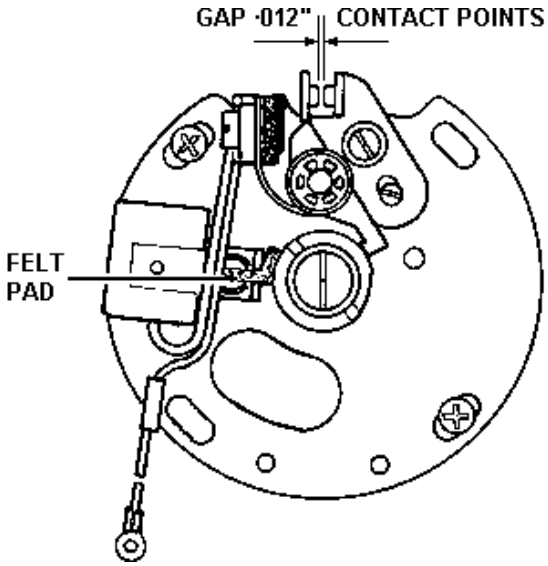

FIG. B21. *The contact breaker.*

Using service tool No. 61-3191 compress the clutch springs and fit the large plate retaining circlip. Replace the cover plate and secure with three screws. Details of adjustment are given on page B19.

Fit the primary chain over the sprockets, and join the ends with a connecting link. Note that the spring link should be fitted with its closed end pointing in the direction of travel. Because the primary chain operates on short fixed centres no provision has been made for adjustment. If an appreciable amount of slack is evident, the chain should be renewed.

Replace the primary cover after fitting a new gasket, and secure with five fixing screws. Ensure that the contact breaker oil seal is not displaced as the cover is fitted.

Replace the contact breaker plate with the points at the top. See that the screws are centrally located in the elongated holes to allow for adjustment either way. Refit the cam on the shaft, but do not fully tighten the screw.

Engine assembly from this point should proceed as detailed in Reassembly, after decarbonising, on page B7.

IGNITION TIMING

Contact Breaker Gap

In order to maintain correct ignition timing the contact points must be set to the specified gap when in the fully open position. Rotate the cam (if free) or the engine, until the heel of the moving contact is at the highest point of the cam, when the points will be fully open. Using a feeler gauge, check the gap is ·012" (·3 mm.). If it is found to be incorrect, loosen the fixed contact screw and turn the eccentric pin until the correct gap is obtained. Finally, tighten the fixing screw and re-check the setting.

It is most important that the contact breaker gap is accurately set and regularly maintained, as any variation in the setting tends to alter the ignition timing. Widening the points gap advances the ignition; closing the gap retards the ignition.

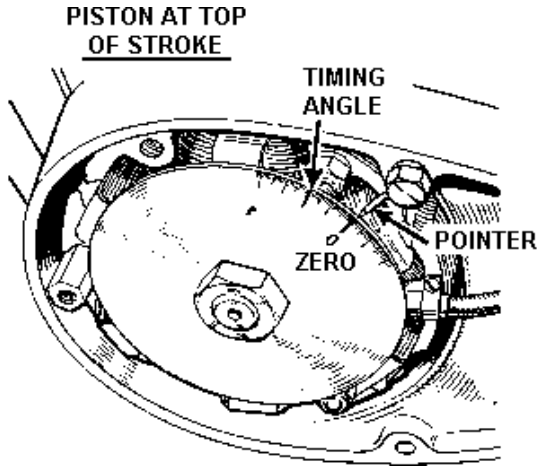

FIG. B22. *Degree plate.*

Piston Position
Before checking the ignition timing, the piston must first be set at the recommended position before top dead centre on its compression stroke. This position can be accurately set with the aid of a degree plate. The outer timing cover should first be removed and the degree plate mounted centrally on the engine shaft, against the rotor. A suitable pointer should then be attached to some convenient part of the engine with the point adjacent to the plate (see Fig. B22). Rotation of the engine through several degrees near the top dead centre position produces very little piston movement, making the actual top dead centre very difficult to find. It is a good point therefore to use a suitable stop (such as a dummy plug with a projection into the cylinder head) so that the piston can be brought gently against it.

Bring the piston slowly up to the stop by rotating the engine as far as it will go, first in a clockwise direction, then in an anti-clockwise direction. Take degree plate readings at each position and calculate the point midway between them. The result will give you an accurate top dead centre of the piston. Loosen the timing disc retaining nut and turn the disk until the zero mark corresponds with the pointer.

From this position, rotate the engine **backwards** to obtain the desired reading of 16½° on the plate.

Setting the Ignition Timing
With the piston at 16½° before top dead centre, the contact points should just be separating.

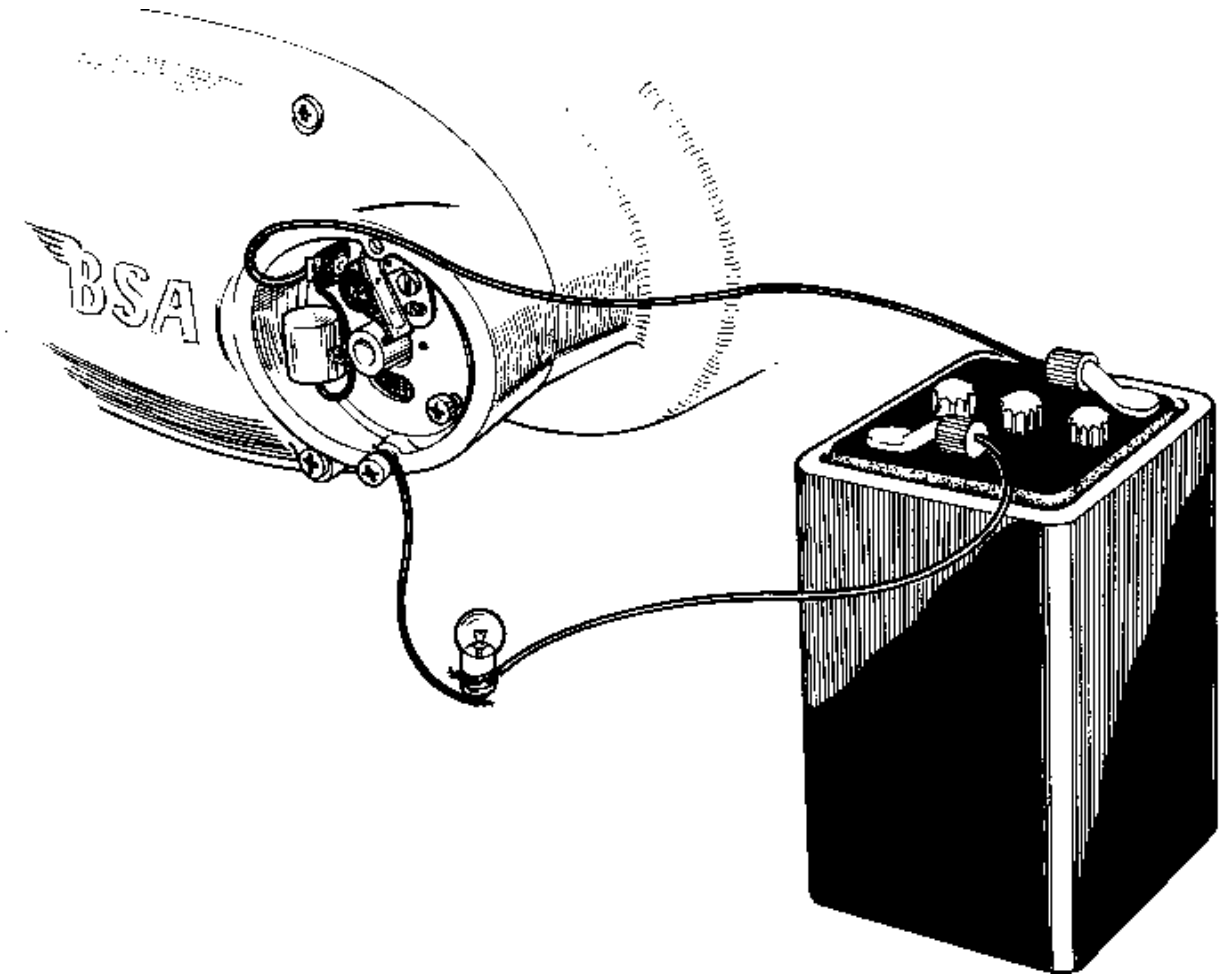

FIG. B23. *Setting the ignition timing.*

An accurate means of checking the opening of points can be made by connecting a battery and bulb in circuit with the points, as shown in Fig. B23. Attach one lead between the moving contact spring and the battery terminal. Take a second lead from the other battery terminal to a bulb, then from the base of the bulb to a good earthing point on the machine. As soon as the contact points open, the circuit will be instantly broken and the light will go out.

With the fixing screw loosened, turn the central cam until the points are just opening, then lock in position by tightening the screw fully.

Re-check the setting and make any finer adjustments by turning the contact plate. Finally tighten all the fixing screws and replace the circular cover with its gasket.

CLUTCH ADJUSTMENT

Provision for clutch adjustment has been made at the sprocket end of the gearbox mainshaft an consists of an adjusting pin, screwed into the actuating lever boss, and a locknut. The adjusting pin presses against a steel ball, located on the end of the clutch push rod which passes through the hollow mainshaft.

Access is gained through the hole in the cover blanked off with a rubber plug.

In order to ensure that the clutch springs exert their full pressure on the friction plates, the operating mechanism must be adjusted so that there is a slight amount of play between the pin, the steel ball and the push rod.

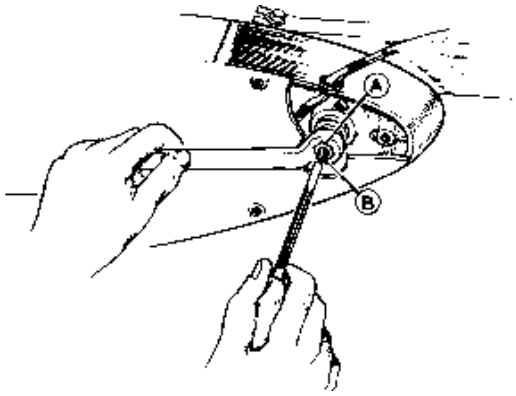

FIG. B24. *Clutch adjustment.*

If there is insufficient play between these items, the clutch will continually tend to slip, owing to lack of spring pressure. This will cause rapid overheating and eventually, serious damage to the clutch. However, if the play is allowed to become excessive, difficulty will be experienced in changing gear, as the clutch may not fully disengage.

To adjust the clutch, release the locknut (*A*) and unscrew the adjusting pin (*B*) one or two turns with a screwdriver. Now, whilst holding the locknut with a spanner, slowly screw in the adjusting pin until it is felt to meet some resistance, then unscrew it half a turn. Holding the pin in this position, retighten the locknut. After correctly making the adjustment in the described manner, a small amount of free movement at the clutch lever will be felt before the spring pressure is taken up during the action of declutching.

Note that a grease nipple is provided in the cover to facilitate regular lubrication of the clutch mechanism at the intervals quoted on page A2.