

Maintenance Manual

And

Instruction Book

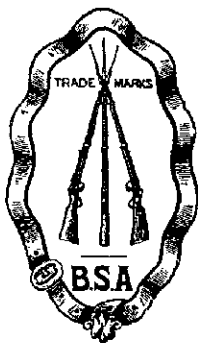
For

MOTOR CYCLE (SOLO)

500 c.c. s.v.



Model M20



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USEFUL DATA

Engine bore	82 mm
Engine stroke M20	94 mm
Engine stroke M21	112 mm
Engine Capacity	496cc
Petrol tank capacity	3 gallons
Oil tank capacity	5 pints
Gearbox capacity	1 pint
Inlet tappet clearance (cold)	.010"
Exhaust tappet (cold)	.012"
Compression M20	4,9:1
Compression M21	5:1
Tyres	3.25/3.50-19
Tyre Pressure	22psi
Piston ring gap	.008 - .012"
Piston clearance Bottom of skirt	.0035 - .0055"
Piston Ring side clearance	.002" - .004"
Ignition timing	7/16" BTDC
Magneto point gap	.012"
Spark plug gap	.012 - .018"
Carburetter- Jet	170
Carburetter- Needle	2nd notch
Engine Sprocket	19 teeth
Clutch sprocket	43 teeth
Gearbox Sprocket	18 teeth
Rear Wheel Sprocket	42 teeth
Primary Chain	95 links
Gear Ratio- Top	5.3
Gear Ratio- 3rd	7.0
Gear Ratio- 2nd	10.9
Gear Ratio- 1st	15.8

THE LUBRICATION SYSTEM

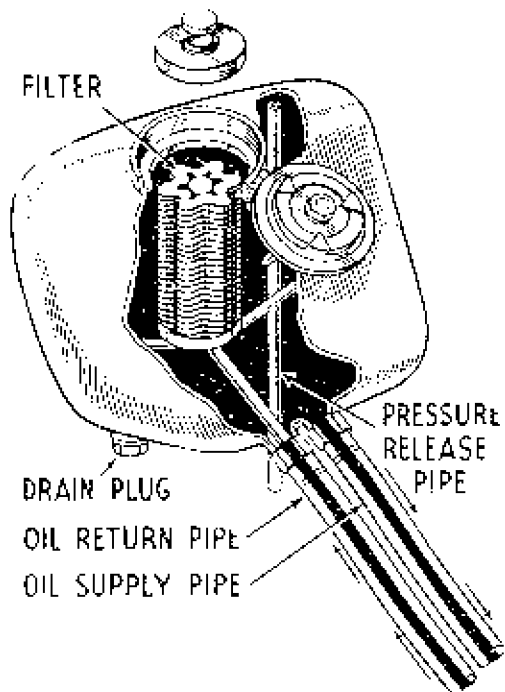


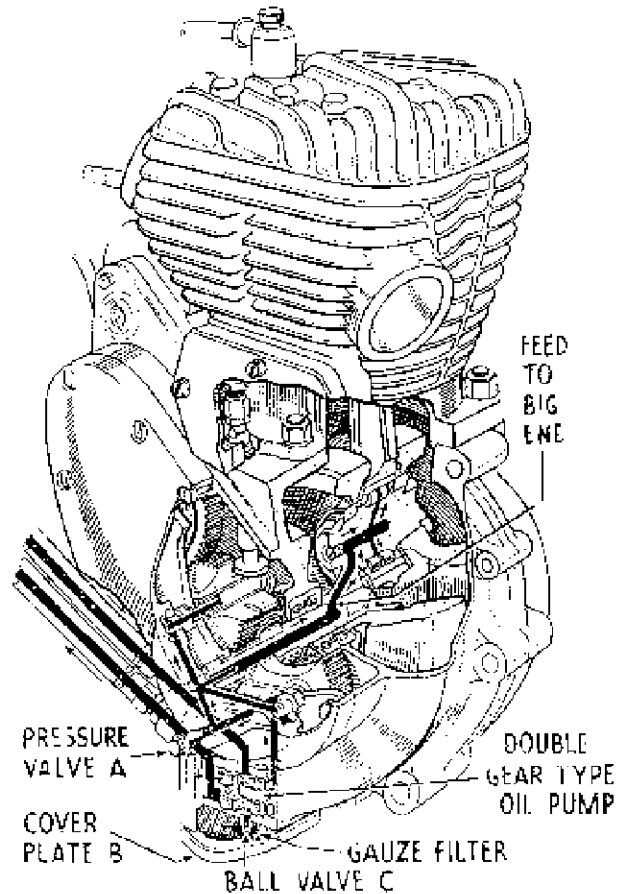
Fig. 1. Lubrication System

The engine lubrication system is of the dry sump type operated by a double gear pump, situated in the bottom of the crankcase on the right-hand side. All oilways are internal except for the supply and return pipes from the tank. The oil flows from the tank to the supply pump (the top pair of gears) and thence past the pressure valve (A) to the two oilways feeding the cam spindles, and along the hollow mainshaft to the big end bearing. After lubricating the big end and circulating through the engine in the form of a mist, the oil drains down through a filter in the bottom of the crankcase, from which it is drawn by the return pump (lower pair of gears) past ball valve (C), and delivered up the return pipe to the tank, where it passes through a fine mesh filter into the tank itself.

Incorrect seating of the ball valve (A), will allow oil to transfer from the tank to the engine, whilst the machine is stationary. If the ball valve (C) should get stuck in its seating, there will be no return of oil to the tank. To check the oil circulation open the tank filler cap and remove filter cap whilst the engine is running. Oil should be seen issuing from the return pipe from the crankcase. The tank and crankcase should be drained every 2,000 miles and replenished

with clean oil.

Any restriction in the pressure release pipe in the tank will cause an increase in pressure inside the oil tank, and will result in leakage of oil at the filler cap. This can be put right by inserting a length of flexible wire into the pipe at its lower end (just in front of the rear mudguard) and pushing the wire right up the pipe, thus clearing any obstruction.



To remove the oil tank filter for cleaning, release the tank filler cap, release the filter tap thus exposed, and lift filter out. The filter should be placed in a can large enough to cover it with petrol, and thoroughly washed. Before replacing make sure that it is quite dry of petrol.

The pump filter can be withdrawn after removing the cover plate (B) and should be thoroughly washed with petrol, dried and replaced.

NOTE. It is not advisable to remove the oil pump unless the pump is definitely faulty.

LUBRICATION

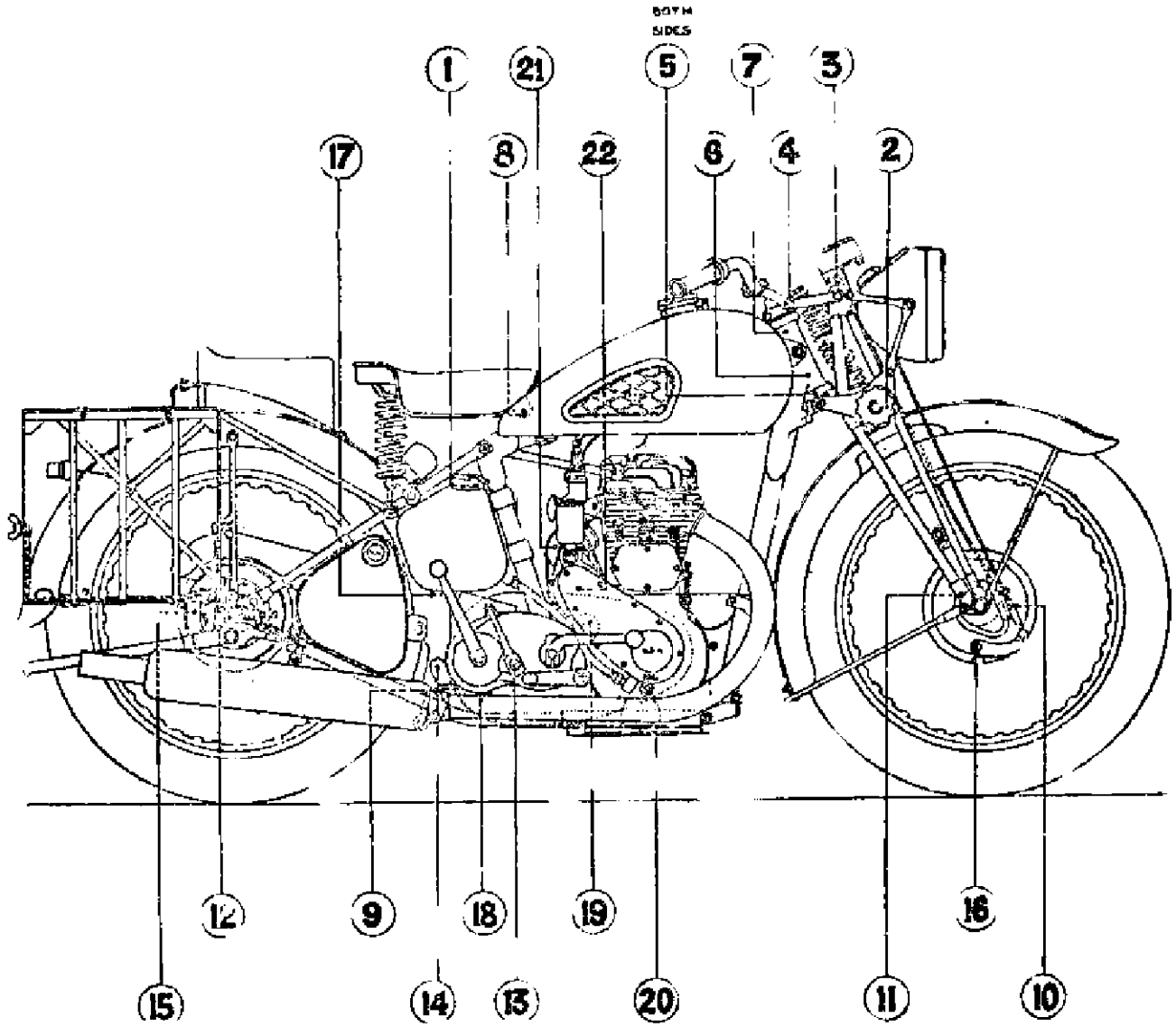


Fig 2. - Lubrication Chart

4 LUBRICATION CHART

No	PART	Lubricant	Type of Lubrication	Daily	250 Miles (Inclusive)	General
FRAME GROUP						
3	Front fork (top)	CG-1 (AL)	1 nipple		Grease Gun	
2	Front fork (centre)	CG-1 (AL)	1 nipple		Grease Gun	
4	Steering Stem (top)	CG-1 (AL)	1 nipple		Grease Gun	
5	Steering Stem (bottom)	CG-1 (AL)	2 nipple		Grease Gun	
7	Steering Head (top)	CG-1 (AL)	1 nipple		Grease Gun	
6	Steering Head (bottom)	CG-1 (AL)	1 nipple		Grease Gun	
8	Saddle nose pivot	CG-1 (AL)	1 nipple		Grease Gun	
11	Front wheel hub	CG-1 (AL)	Re pack		-	Re pack w shops every 5000 miles
12	Rear wheel hub	CG-1 (AL)	Re pack		-	Re pack w shops every 5000 miles
BRAKE GROUP						
9	Brake pedal	CG-1 (AL)	1 nipple		Grease Gun	
16	Brake cam (front)	CG-1 (AL)	1 nipple		Grease Gun	
15	Brake cam (rear)	CG-1 (AL)	1 nipple		Grease Gun	
	Bowden control wire	OE-30	Oil Can		Few Drops	
	Foot brake linkage	OE-30	Oil Can		Few Drops	
ENGINE GROUP						
1	Engine oil tank	OE50	5 pints	Replenish	Replenish	Drain & refill at 1000 miles (AO17)
19	Primary chain case	OE50	Reservoir	Replenish	Replenish	Drain & refill at 1000 miles (AO17)
1/20	Oil Filters	OE50				Wash in petrol every 2000 miles
IGNITION GROUP						
	Advance Retard Cable etc	OE30	Oil Can		Few drops	
	Contact breaker tappet	OE30	Oil Can		One drop	
22	Contact breaker cam	CG-1 (AL)	Hand smear		Slight smear	
	Generator (drive end)	WB-2	Re pack			Re pack w shops
21	Generator (commutator end)	OE30	Oil Can		Few drops	
FUEL GROUP						
	Air cleaner		N/A			
	Carburettor control cables	OE30	Oil Can		Few drops	
	Throttle handle bar grip	OE30	Oil Can		Few drops	
TRANSMISSION GROUP						
10	Speedometer drive	CG-1 (AL)	1 nipple		Grease Gun	
	Speedometer cable	OE30	Oil can		Few drops	
14	Gear box	GO-90	1 pint		Replenish	Drain & refill each 6000 miles No 18
12	Clutch push rod	OE-50	Oil can		Few drops	
	Clutch bowden control wire	OE30	Oil can		Few drops	
	Clutch handle bar grip	OE30	Oil can		Few drops	
	Rear chain	OE30	Oil can		Few drops	Wash in paraffin and soak in oil OE-50 every 2000 miles. Workshops

THE ENGINE – EXPLODED VIEW

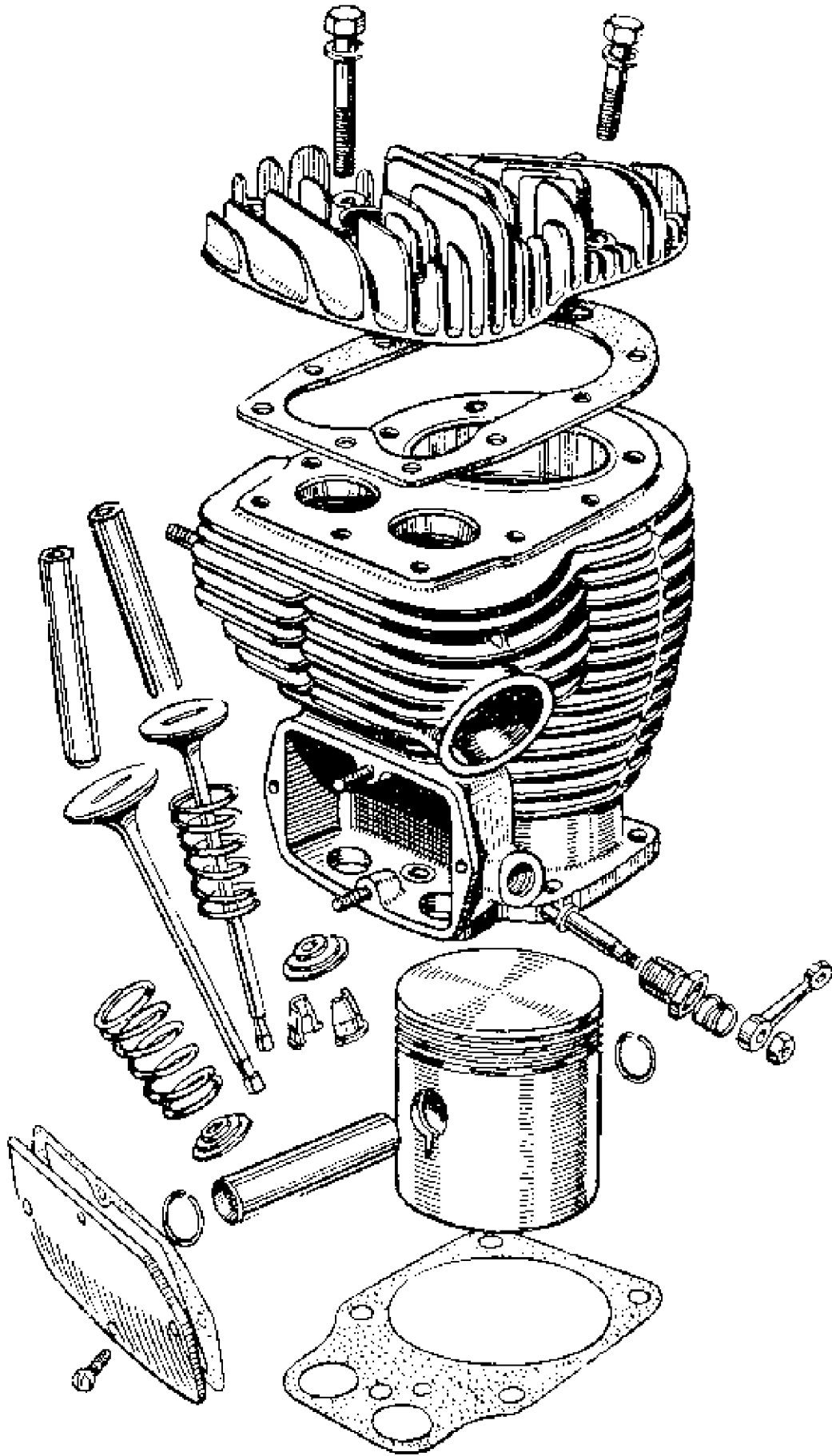


Fig. 3. Top half of engine (exploded view)

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THE ENGINE – EXPLODED VIEW

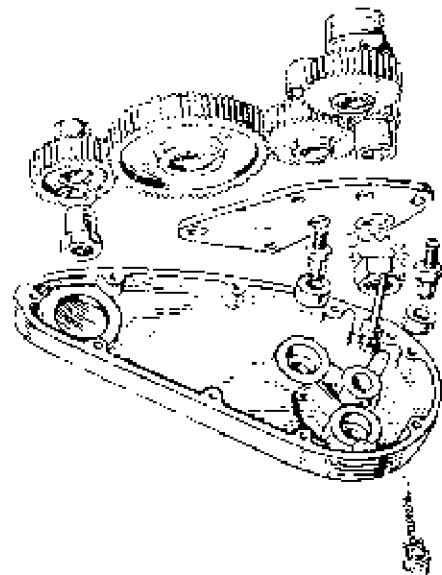
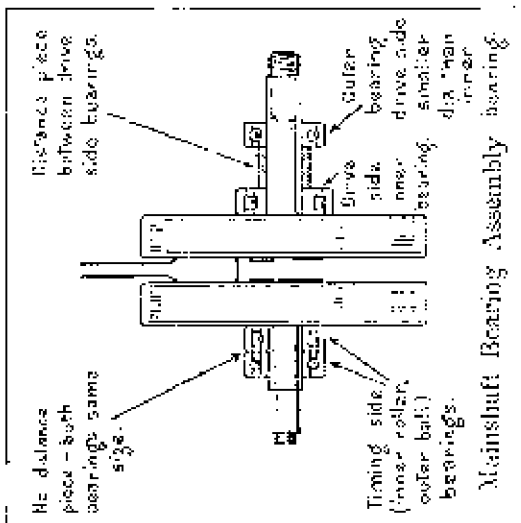
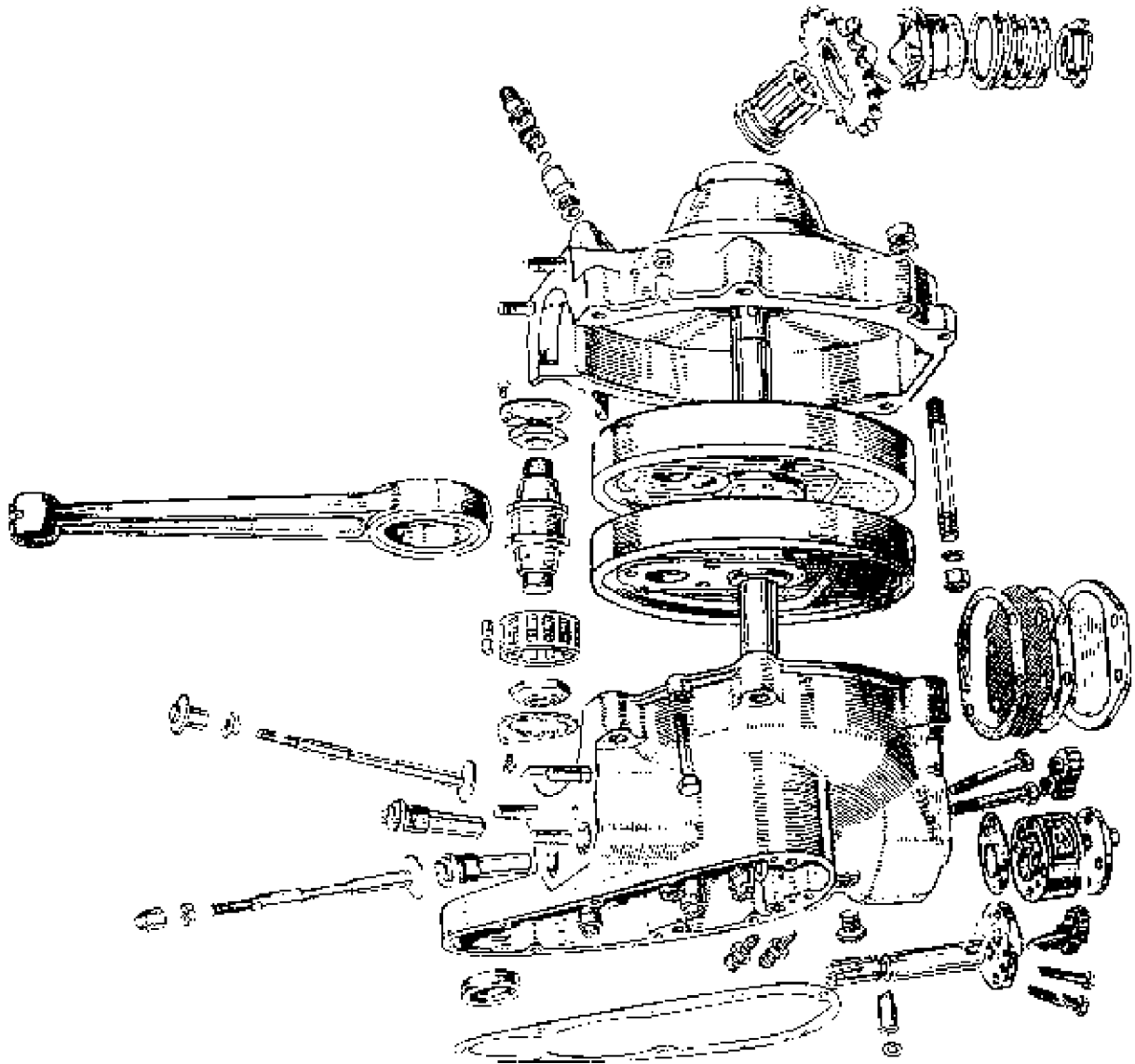


Fig.4. Crankcase half of engine (exploded view)

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ENGINE ADJUSTMENTS

Which can be carried out without dismantling

OIL PRESSURE VALVES

As described under the heading "How the Lubrication System Works" on page 3 there are two ball valves incorporated in the lubrication system to prevent the transfer of oil from the tank to the crankcase.

The spring loaded valve is located in the delivery passage between the pump and the big-end, and lies behind the hexagon plug at the lowest point of the timing cover (see Fig. 5).

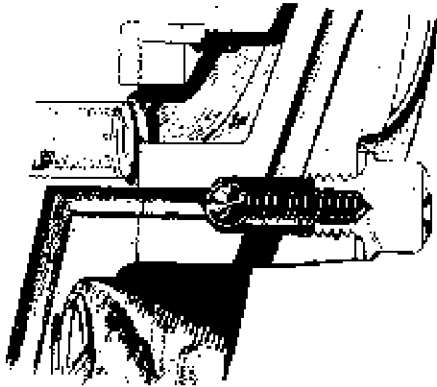


Fig. 5. Pressure valve in timing cover.

Should any foreign matter lodge between the ball and its seating oil will gradually transfer from the tank when the machine is left standing, and when the engine is started up there will be a heavy discharge of blue smoke from the exhaust.

To rectify, remove the plug, spring and ball. The simplest way of removing the ball is to hold the hand close to the orifice and gently turn the engine over, when the ball will be forced out.

Clean the ball and the seating, and if on replacing there is still doubt as to whether the ball is seating properly, insert a small punch against the ball and deal it a sharp tap with a light hammer. Finally replace the spring and plug.

The other ball valve is located between the return pump (Fig. 6), and apparent failure of the return pump may be due to this ball having stuck in its seating.

To rectify, remove the pump cover plate, insert a piece of wire into the valve orifice and lift the ball off its seating. Should the trouble keep recurring it may be necessary to fit a new base plate to the pump.

On no account remove the oil pump unless it is absolutely necessary.

EXHAUST VALVE LIFTER

The peg on the exhaust valve lifter inside the tappet chest must always be well clear of the collar on the exhaust tappet (see Fig. 7), otherwise the engine will be noisy and the tappet clearances seriously affected. Failure to check that there is clearance at

this point may result in a badly burnt exhaust valve.

Adjustment is carried out by means of the cable adjuster at the side of the tappet chest.

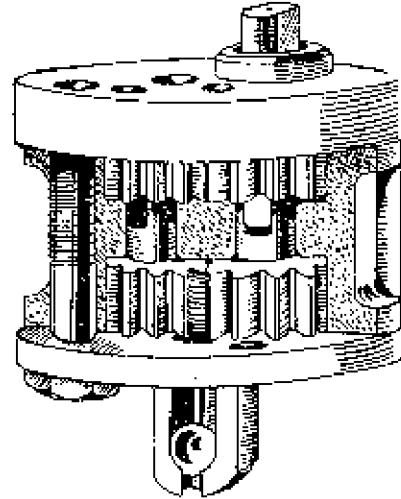


Fig. 6. Ball valve below return pump.

TAPPET ADJUSTMENT

Before any attempt is made to adjust tappet clearances, check that the exhaust valve lifter is correctly adjusted as explained in the previous paragraph.

To check and adjust tappet clearances, it is most essential, owing to the special design of the cam form (see Fig. 8), that the following procedure be adhered to.

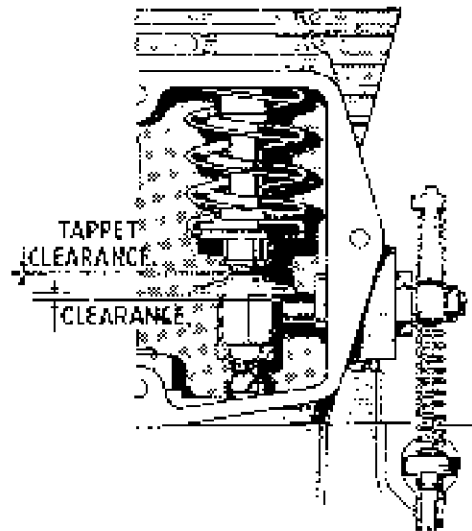


Fig. 7. Tappet and exhaust valve lifter.

Rotate engine forward until the inlet valve has just closed (until tappet is just free to rotate).

Now adjust the exhaust tappet clearance to .012".

Turn engine forward again until the exhaust tappet

clearance is just taken up (but before valve actually starts to lift).

Now adjust inlet tappet clearance to .010"

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known to be at fault.

It is however advisable to check over the timing after carrying out any adjustment to the magneto contact points, as a slight variation of the points tends to advance or retard the timing. (Opening the points advances timing, closing them retards timing).

If the timing requires re-setting, first remove the timing cover, and in so doing take care not to damage the small nozzle in the timing cover which feeds oil to the hollow crankshaft.

With the cover removed, take off the nut locking the magneto pinion on its shaft, and with the aid of a magneto pinion extractor (Fig. 10) release the pinion on its taper. (Note that the pinion is held on its shaft by a plain taper only, and can only be released with safety by using the proper extractor.)

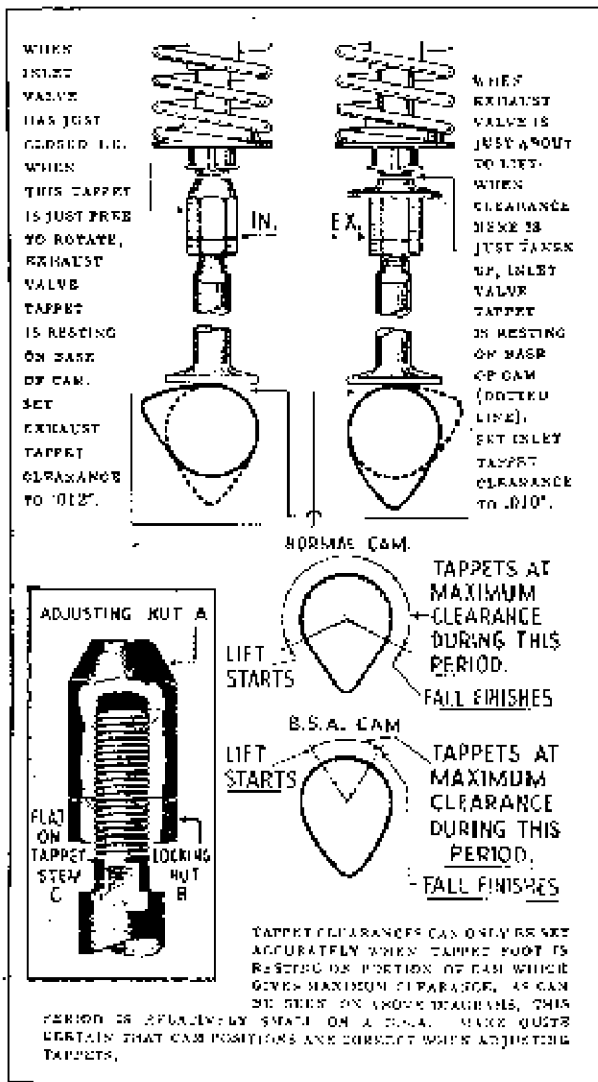


Fig. 8. Instructions for setting tappets

The actual adjustment is carried out by releasing the locknut (B) (Fig. 8), holding the tappet with a spanner on the flat (C), and screwing the tappet head (A) either up or down. When correct clearance is obtained, the locknut must be tightened against the tappet head. It is advisable, after locking up, to check clearance again, to make sure that the adjustment has not been affected.

Tappet adjustment should always be carried out with the engine dead cold, and the clearances recommended above regarded as a minimum, especially in the case of the exhaust valve.

IGNITION TIMING

It is a rare occurrence for the magneto pinion to slacken off and disturb the ignition setting, and it is not advisable to interfere with the setting unless it is

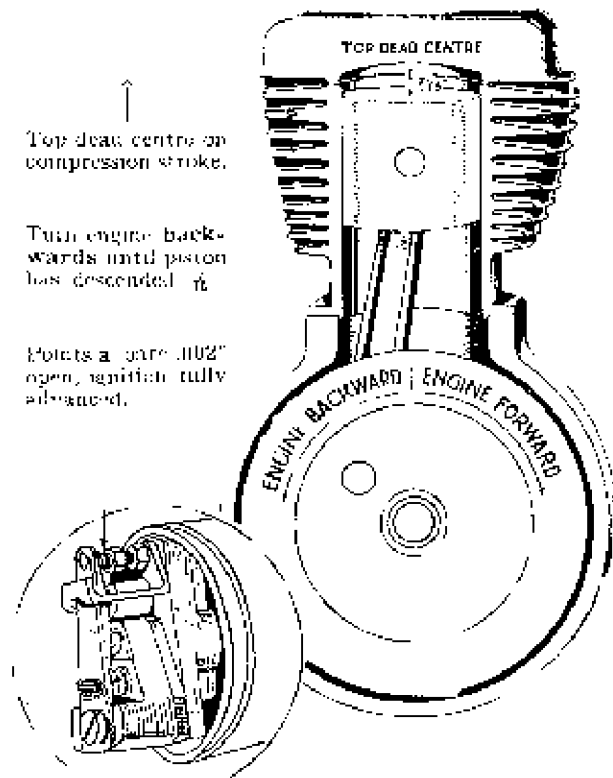


Fig. 9. Ignition timing,

Check that the fully open gap is correct to gauge (not exceeding .012").

To re-set timing, turn engine forward until piston reaches top dead centre on the compression stroke (see Fig. 9). Now turn engine until piston has descended 7/16". With ignition control at full advance turn contact breaker in its direction of rotation until the points are just about to open (not more than .002" open). Lightly tighten the magneto pinion nut and carefully check figures and positions. Then tighten

nut properly and re-check.

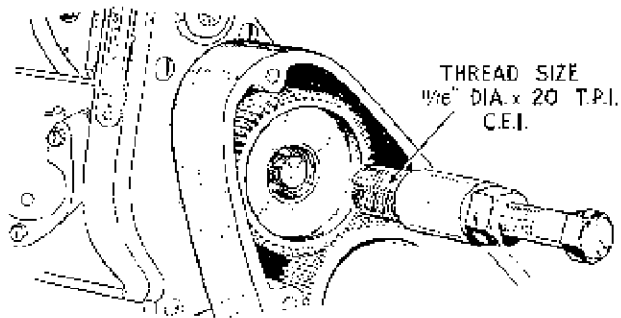


Fig. 10. Magneto pinion extractor.

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CARBURETTOR

To maintain the efficiency of the carburettor it should be cleaned periodically by entirely dismantling it and washing each part in clean petrol.

Renew any worn parts, particularly in the needle valve if the head has a distinct ridge at the point of seating, throttle valve if excessive side play is present or taper needle and clip, if it is possible to rotate the needle freely in the clip. When re-assembling, make sure that the taper needle is refitted into the correct groove, is securely locked by the clip, and that it enters the central hole in the top of the jet block. Also verify that the needle valve enters the top of the float chamber easily, the mixing chamber flange joint is airtight, and the needle valve clip registers correctly in its groove. It will, of course, be necessary to reset pilot adjusting screw.

NEEDLE POSITION . Needle positions are counted from the top of the needle and the groove nearest the top is No. 1.

THROTTLE STOP . The position of the throttle valve is set by means of the throttle stop screw (See Fig 4), the throttle control being closed during this adjustment. Alternatively, if the screw is adjusted clear of the throttle valve, the engine will be shut off in the normal way by the control.

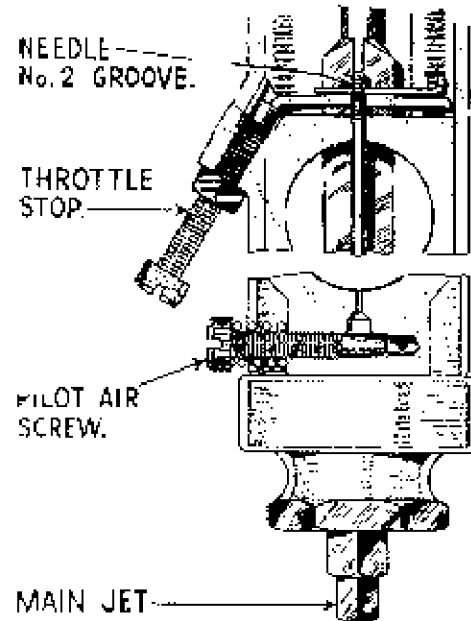


Fig. 11. Carburettor adjustments.

PILOT ADJUSTMENT . To weaken the slow running mixture, screw the pilot air adjuster outwards and to enrich the slow running mixture, screw the adjuster inwards.

Screw the air adjuster home in a clockwise direction. Warm up the engine, close the air lever and set the throttle about 1/8th open. Gently close the throttle when the mixture will prove too rich unless air leaks are present. Gradually unscrew the pilot air adjuster, when the engine speed will increase and must be again reduced by gently closing the throttle, until by a combination of throttle positions and air adjustment, the desired idling is secured.

MIXTURE STRENGTHS . Weak mixture is indicated by difficult starting, a tendency for the engine to spit back through the carburettor (indicated by blue fumes from the air intake). The engine knocks, and runs hot with loss of power. The spark plug electrode shows indications of intense heat, and the mica insulation becomes white. If spitting back occurs, raise the needle in the throttle valve. Test by lowering the air valve gently. Engine revs will rise when the air valve is lowered slightly below the throttle valve.

Rich mixture indications are heavy "thumpy" running with emission of black smoke from the exhaust pipe. As the throttle is opened heavy blowback of fuel is observed from the carburettor air intake. If the engine speed does not increase progressively as the throttle is raised, lower the needle in the throttle valve.

The normal needle setting is with the clip in No. 2 groove.

SPARKING PLUG

The machine is supplied with a K.L.G. type F70 sparking plug, and is of a three-piece construction. After dismantling, the lower (taper) portion should be scraped clean of all carbon deposit.

Note: Earlier models are fitted with type L777 plug – a three-point plug with mica insulation. Where mica insulation is used, the mica must on no account be scraped, but cleaned with petrol and a rag. The inside of the body should be well scraped, and the

earth point cleaned.

When re-assembling, verify that the internal washer is in place before inserting the electrode. Having tightened the gland nut, set the earth point to give a gap of 0.015" to 0.018". This may mean bending the earth point towards the centre electrode, or if the gap is too narrow, prising it outwards. The centre electrode must not be levered towards the earth point. The external washer should be replaced if it is broken or has been completely flattened.

SYMPTOMS OF MINOR PLUG TROUBLES.

Misfiring especially at high speeds and under heavy pulling at lower speeds, invariably indicates that the gap setting of the plus is too wide, whilst erratic slow running can be accounted for by too narrow a gap setting. An over rich mixture will result in trouble in the form of an excess deposit of soot on the internal insulation of the plus with consequent "shorting" inside the plug. A faulty high tension cable, or the magneto contact points being out of adjustment will also account for the plug misfiring.

ENGINE DISMANTLING for DECARBONISING

When decarbonising, it is not necessary or desirable to dismantle the cylinder barrel, unless it is suspected that the valves, pistons or its rings are the cause of some trouble. It is sufficient to remove the cylinder head and gasket thus exposing the piston and valves.

REMOVING CYLINDER HEAD

To detach cylinder head, disconnect sparking plug lead, remove steady strap and the 10 cylinder head bolts. Head can then be lifted off.

Rotate the engine until the piston is at the top of its stroke and scrape it with an old penknife, taking great care not to damage the piston crown. Then clean the cylinder head and replace, tightening the bolts in the order shown in Fig. 24.

If the valve seats are suspected of gas leakage, due to insufficient tappet clearances or other causes these should be remedied. It is possible to grind in the valves in position, but it is preferable to remove the barrel from the crankcase so that the work may be carried out on the bench, and at the same time the piston and rings inspected.

REMOVING CYLINDER BARREL

To remove cylinder barrel, first turn off petrol taps and detach carburetter. This can be tied to frame out of the way. Next, the exhaust pipe and silencer should be removed complete. The exhaust valve lifter should be unscrewed from the tappet chest until the eccentric peg on the lifter is clear of the tappet head. Uncouple the exhaust valve lifter by removing

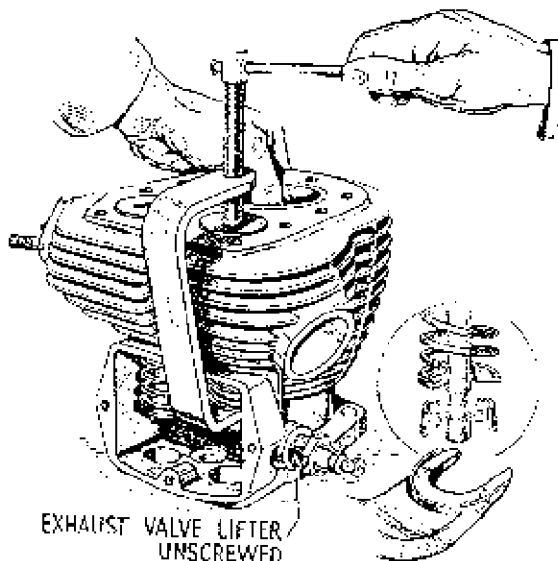


Fig. 12. B.S.A. Valve removing tool.

the pin at the lever end. Now remove the five cylinder base nuts (four outside and one inside tappet chest), and cylinder barrel can be lifted off.

When removing the cylinder barrel, the simplest way is to lift it up and tilt it forwards into the front angle of the frame. The piston should be steadied as it emerges from the barrel to prevent possible damage. Cover the crankcase mouth with rag to prevent dust and grit falling in.

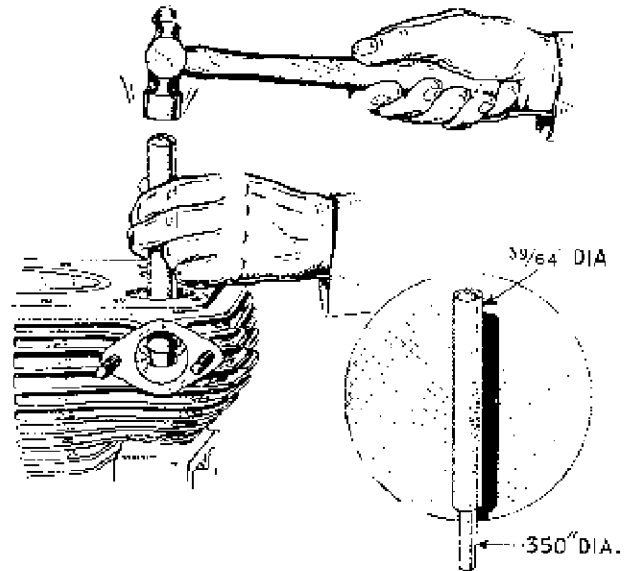


Fig. 13. Inserting valve guides

REMOVING THE VALVES

To remove the valves an extractor as shown in Fig. 12 may be used. If the proper extractor is not available, the valves may be removed by laying the cylinder barrel on a bench (valve heads downwards) and compressing the valve springs with the aid of a piece of tube (suitably slotted), while an assistant removes the cotters. Clean all carbon from the ports and check valve guides for wear.

FITTING NEW VALVE GUIDES

If new guides are to be fitted, the old ones may be extracted (from below) by means of a simple punch (consisting of a bar of steel of not more than 5/8" diameter – Fig. 13). The new guides can be driven in from the top with the same punch and it is important that the dimensions from the top of the guide to the cylinder head joint (as shown in Fig. 14) should be carefully observed. After the new guides have been inserted, the valve seats should be re-cut with a pilot cutter to ensure concentricity of seats and stems (see Fig. 14). Note that the exhaust valve guide only has its upper end counterbored.

GRINDING IN VALVES

If the old valves are to be retained, they should only be ground in if the seating shows slight pitting. If badly pitted, they should be refaced, otherwise excessive grinding

will wear away the seat in the cylinder barrel and cause the valve to become pocketed. Take great

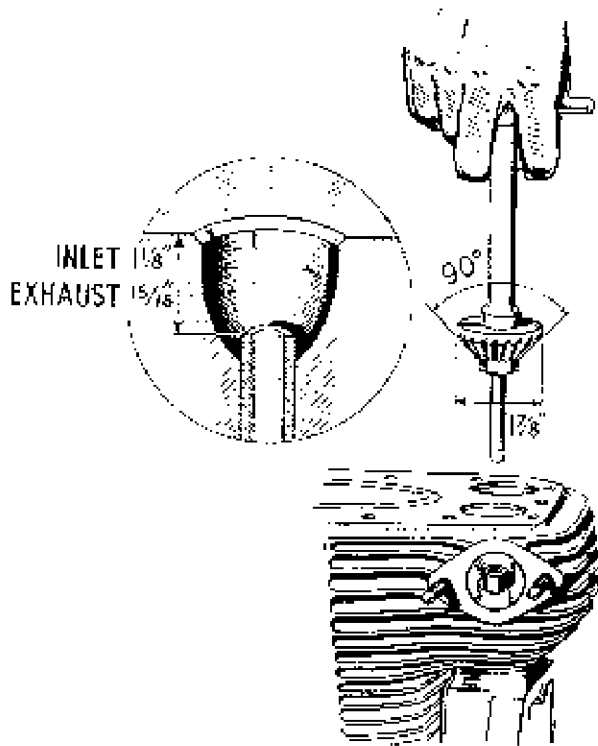


Fig. 14. Valve seating cutter and depth of guide.

care to remove all traces of grinding compound afterwards. A light spring, inserted under the valve head, considerably simplifies valve grinding, which should be continued until the valve face shows a

smooth surface all the way round. If the machine has covered a considerable mileage, the valve springs may need replacing. Refit the valves, springs and cotters with the aid of the tool shown in Fig. 12 after valve stems have been lubricated.

PISTON AND RINGS. The gudgeon pin is located by means of wire circlips which must be removed by means of a tang of a file or similar tool. Withdraw the gudgeon pin, thus freeing the piston and immediately after its removal mark the inside of the piston so that it can be re-assembled in its original position. If inspection of the piston rings shows that they are stuck, prise them out very carefully, and clean them. Remove any carbon from the grooves and rings, but before replacing them, check the gap with a ring in the cylinder. If the gap is excessive, new rings must be fitted having gaps of between .008" and .012" when in position.

At this stage it is advisable to check the big end bearing for wear. Turn engine until piston is at top of stroke, and resting both hands on sides of crankcase mouth, hold connecting rod between fingers and thumbs and feel for up and down play. It should be remembered that, even though there may be a little play present, it will not necessarily mean sudden failure of the bearing, though it will inevitably become worse. Where play seems excessive, and apparent big end noise has been noticed when engine is running, the engine should be completely dismantled, and a new big end assembly fitted.

Dismantling for decarbonising and piston inspection as described so far is carried out without removing the engine from the frame. Assembly from this point is described on Page 18.

REMOVING ENGINE FROM THE FRAME AND COMPLETE DISMANTLING

The procedure for the removal of the engine from the frame and dismantling will be described from the point reached in the previous section when the cylinder head and barrel have been removed. The oil pipes must next be disconnected, but first the oil tank should be drained. Alternatively the pipes can be disconnected and suitably plugged. Detach the leads to the dynamo (both of which are held by a small plate and one screw), and then the earth wire adjacent to the contact breaker housing. Follow these with the sparking plug lead. The magneto control cable can be readily detached from the handlebar lever.

REMOVING CHAINCASE

The oil bath chaincase follows next. Take off the footrest and then undo all the screws round the rim of the chaincase. The nuts of these screws are welded to the other half of the case and so cannot be lost. When the outer chaincase cover is taken off, careful note should be made of the positioning of the cork washers and distance pieces, to facilitate replacement. Before removing the chain loosen clutch as described in next paragraph, and then dismantle engine shaft cush drive. Tap the lock washer clear of the slot in the cush drive retaining nut

and

unscrew the latter. Then withdraw the spring and cam sleeve, leaving the sprocket and chain in position. Next, take off the clutch.

REMOVING CLUTCH.

cover, the actuating cap and the central sleeve nut. The extractor screws into the thread provided inside the clutch centre. Now uncouple the chain, the spring link being of the usual "hairpin" type. Take off the clutch as a unit and then the cush drive. There now remains the inner half of the chaincase, which is held

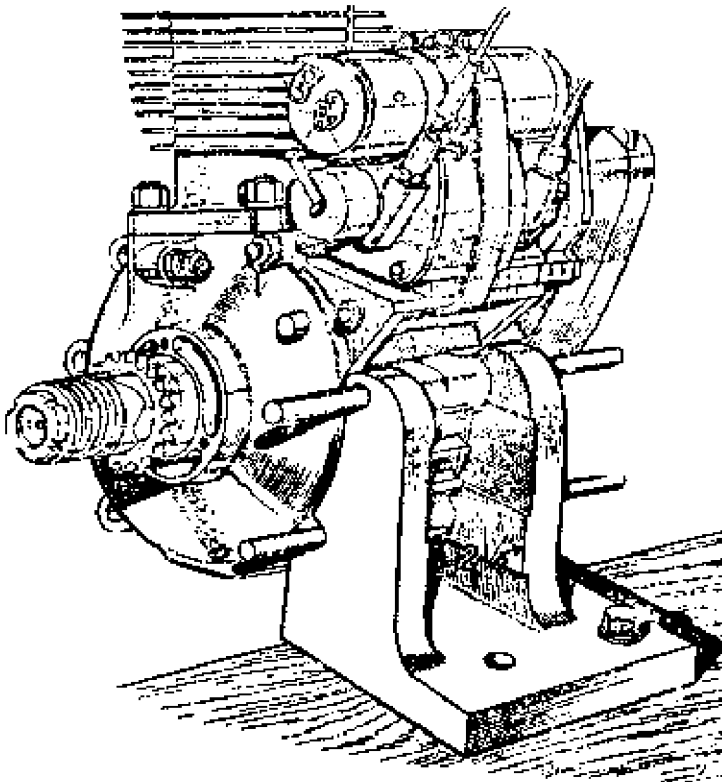


Fig. 15. Angle bracket for mounting engine.

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This can be accomplished with the aid of an extractor (shown in Fig. 30) after removal of the clutch outer

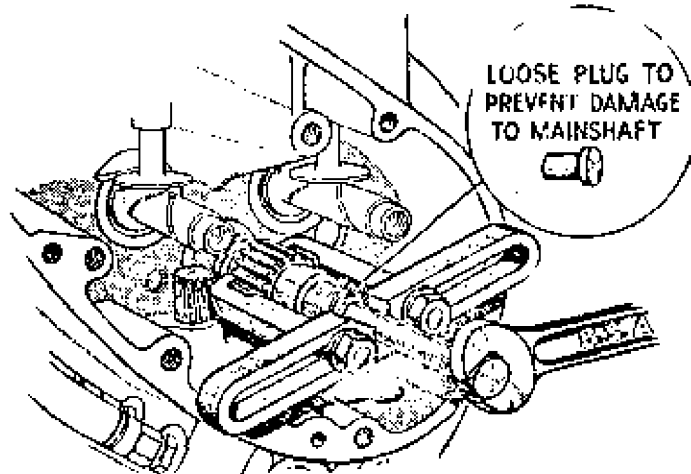


Fig. 16 Engine Shaft pinion extractor

to the crankcase by three bolts, wired together for locking purposes, and by a nut attaching the rear chainguard to the case. The nut can be released easily after the chaincase is pulled off the crankcase register.

The bolts holding the crankcase to the front and rear engine plates can now be removed and it is advisable to release the gearbox bolts in the case of the rear plates, since the latter clamp both gearbox and crankcase lugs between them. The frame bolt at the bottom of the front engine plates should be slackened off so that the plates may be swung forward, greatly facilitating removal of the engine.

DISMANTLING THE ENGINE

It is advisable before commencing to dismantle the engine to construct a simple fixture such as that shown in Fig. 15 on which the engine can be mounted.

Alternatively, a lug on the crankcase may be clamped in a vice and the crankcase itself supported on the bench.

Attention may next be given to the crankcase portion of the engine. Take off the timing cover, and if any difficulty is experienced in releasing the screws, it will facilitate matters if a long screwdriver is used, and the head given a sharp tap with a mallet. On some models an oil tell-tale is fitted on the timing cover and this must also be taken off. It is possible that the jointing compound on the case between the cover

and crankcase will not allow the cover to be removed easily and in this event, the lugs on the end of the cover should be used to tap it off. Take care not to damage the small nozzle in the timing cover which feeds oil to the hollow crankshaft; if it should be refitted in a bent condition it will foul the mainshaft, and break off eventually, thus starving the big end and piston of oil.

REMOVING MAGDYNO PINION

Next, the magdyno pinion should be removed. Since the pinion fits on to a taper shaft difficulty may be

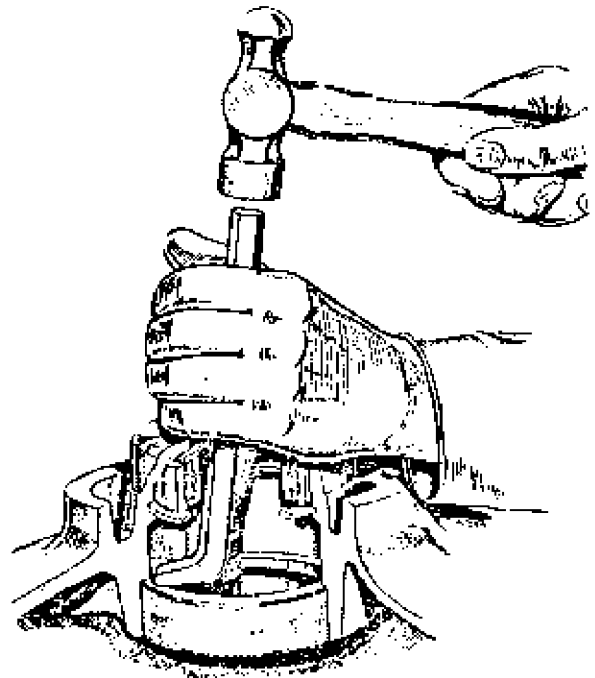
experienced in removing it. It is not advisable to attempt to prise the pinion off with levers, as there is a grave risk of breaking the timing case, but it will come off quite simply provided an extractor to that shewn in Fig. 10 is used. Note that there is a special oil seal fitted in the timing case, behind the magneto pinion. It is only necessary to release the magdyno strap bolt, when the straps can be swung on one side, and the magdyno lifted off. The latter is located by dowels only, and if any shims were fitted below the magdyno they should be carefully preserved.

The engine shaft nut should be removed and the plate holding the timing gears in position is detached by removal of the six fixing bolts, three of which screw into the crankcase casting and have coarse threads, while the remaining three screw into the pinion spindles and have fine threads. All the pinions can now be withdrawn with the exception of the engine shaft pinion which may require an extractor. The latter is shown in Fig. 16, and in order to prevent damage to the engine mainshaft, a flat headed pin of suitable dimensions should be inserted in the oil hole, in the manner illustrated. If the pinions are re-bushed they should be reamed out to $.6255"/.6250"$ for the cams and $.7505"/.7495"$ for the idler pinion. The correct size for the outrigger bearing in the timing gear plate is $.815"/.814"$.

Before the oil pump spindle is released it is first necessary to remove the locking plunger which is exposed after removal of the timing cover (Fig. 17). Take care not to lose the loose washer covering the plunger. If the latter cannot easily be removed with the fingers, a timing cover screw should be screwed into the plunger, when it can easily be withdrawn. If it is necessary to remove the pump take off the sump

cover plate, together with the filter and joint washers, and remove the two bolts holding the pump in position, thus releasing the pump. These two bolts are the ones with spring washers under the heads; the other two bolts hold the pump parts together and should not be disturbed unless it is strongly suspected that the pump is giving trouble.

The crankcase is now ready for "splitting". Release all the bolts around the crankcase joint face (the magneto strap hinge pins also act as bolts and the nut on these must be removed) and draw each half of the crankcase off the engine mainshaft. Where single lipped roller bearings have been used in the engine, the outer race will remain in the crankcase and if necessary can be pressed out later. It should be remembered that the outside bearing on the drive side has its outer race retained in the crankcase by means of a spring ring which must be removed before extracting the race.



Ball bearings will usually be left on the shafts after removal of the crankcase halves, but should they remain in the crankcase, they may be pressed out of the gearside in an arbor press as shown in Fig. 19. On the drive side the inner bearing must first be tapped out with a punch, projecting through the outer bearing and, working all round the

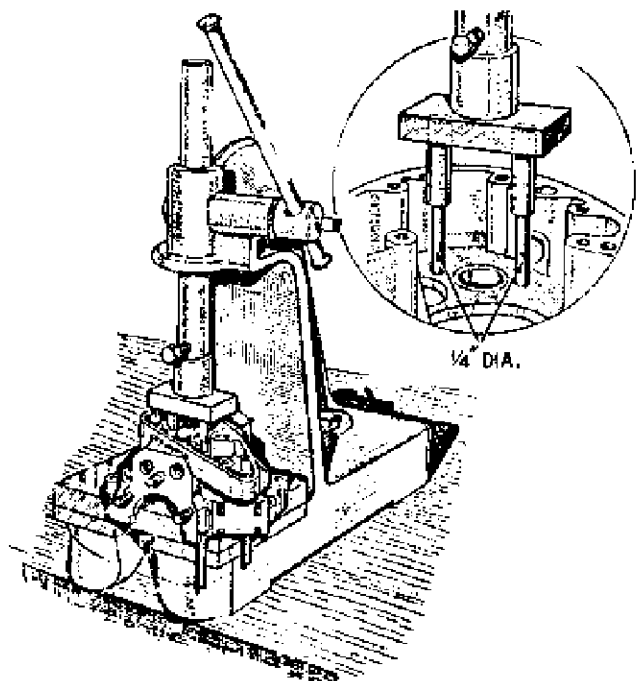


Fig. 19. Ballrace extraction (gearside)



Bearing to give even extraction (Fig. 18). These operations will be considerably helped if the crankcase is first warmed, the most suitable method being by dipping in boiling water.

If it is desired to remove the cam pinion spindles, they can easily be taken out by means of an extractor (Fig. 20). **Do not remove these spindles unless absolutely necessary.** If the tappets require renewal, then the cam spindles and tappet guides must be withdrawn so that the tappets can be drawn out downwards into the timing case. The exhaust tappet requires special treatment, and should not be replaced by an inlet tappet. The tappet guides unscrew upwards out of the crankcase.

The final item is the flywheel assembly. Remove the locking plates holding the crankpin nuts and take off the latter. They will require an unusually large leverage and it may be necessary to add a piece of tubing of suitable size to the spanner before sufficient purchase can be obtained.

The crankpin is a taper fit on the flywheels and can be released by a sharp blow with a mallet. It is now only necessary to decide which parts require renewal, and the following points may be of assistance in making these decisions.

In the event of big-end wear, we do not advise the fitting of oversize rollers; the whole big end assembly (consisting of crankpin, rollers and connecting rod), should be changed. All these components are carefully matched by the B.S.A. Co., and supplied in complete sets ready for fitting.

The bore of a cylinder when new is between 3.2295" and 3.2280" (82mm) and when the bore (measured at right angles to the gudgeon pin) shows wear to the extent of .010" or more, the liner should then be rebored to ½ mm. oversize (3.2487" – 3.2477") and a ½ mm oversize piston fitted. Subsequently, the liner may again be rebored, to 1 mm. oversize (3.2684" – 3.2674") and a 1 mm. oversize piston fitted.

When wear develops after the second rebore, it is necessary to fit a new cylinder liner. A suitable screw or hydraulic press giving a pressure of between 5 and 7 tons is necessary – first to press out the old liner (which must be pressed out from the base of the cylinder) and then to insert the new liner, which is pressed in from the top of the cylinder. Owing to the possibility of the liner "closing-in" during the fitting process, it must be ground to a finished diameter of 3.229" – 3.228" when in position.

It is also necessary to grind two scoops at the skirt of the liner at right angles to the gudgeon pin to provide clearance for the connecting rod (see illustration

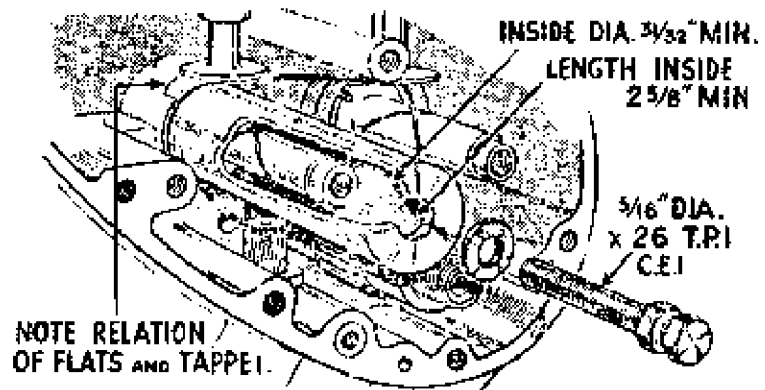
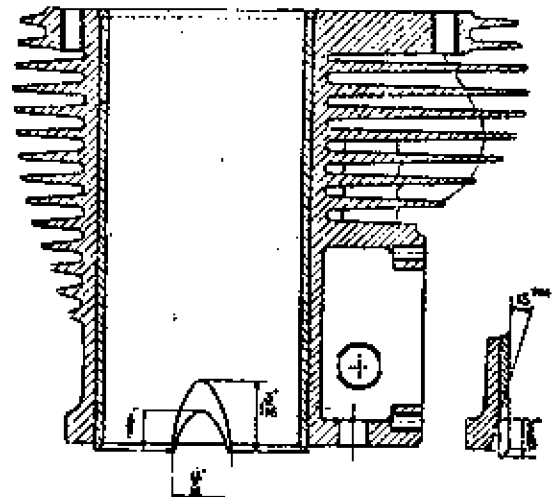


Fig. 20 Cam pinion spindle extractor.

below).

A standard piston and rings must of course be fitted when a new liner is used. The piston should be selected so that the clearances between the skirt and the liner fall within the prescribed limits given in Technical Data (page 2).

Wear in the mainshaft bearings will be readily apparent and bearings showing signs of damaged balls, rollers or tracks should be replaced. Special internal clearances are specified for mainshaft bearings used on B.S.A. motor cycles, and these are "000 clearance" for roller bearings and "00 clearance" for ball bearings. It is not advisable to fit bearings with any other clearance.



Two scoops diametrically opposite, ground after liner is pressed in.

RE-ASSEMBLING THE ENGINE

The need for extreme cleanliness cannot be over-emphasised.

Parts should be thoroughly cleaned and all trace of any antirust preparations with which new parts may be coated must be removed.

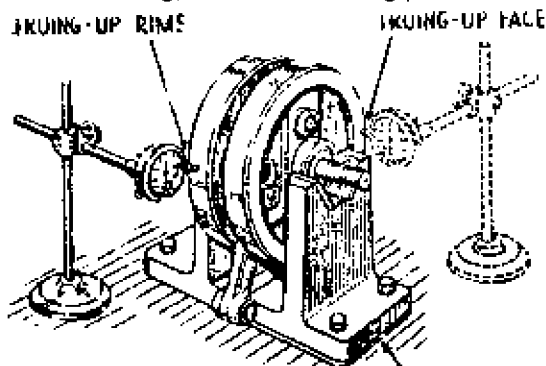
All bearing surfaces should be liberally smeared with engine oil when assembling.

FLYWHEELS

If the big end assembly is to be renewed it is as well to check the weight of the new components against those which have been removed. A slight variation in the weights is inevitable, but provided that the discrepancy does not exceed 1 ½ oz no further action need be taken. This tolerance should not be exceeded since in the first instance the flywheels have been balanced to suit the original parts, and the balance may be adversely affected if the weight of the new components varies considerably from that of the original ones.

The driving side flywheel should now be fitted to the crankpin (this is the side with the keyway) and the nut tightened up by hand. Fit the timing side flywheel and again tighten the crankpin nut by hand.

In order properly to tighten the crankpin nuts, the whole flywheel assembly must be held rigidly. For this purpose, it should be mounted in a large vice (fitted with lead clamps) with the driving side flywheel uppermost. If a large enough vice is not readily available an alternative method is to fix rigidly to the bench in a vertical position, two 1 1/16" diameter posts, the distance between their centres being 3 7/8". Midway between the posts a hole of 1" diameter should be bored in the bench to receive the mainshaft. The flywheel assembly is mounted on these posts so that they pass through the holes bored in the flywheels and the driving side flywheel should be uppermost. Tighten the crankpin nut **very firmly**, using a tubular extension to the spanner as when dismantling, and fit the locking plate and screw.

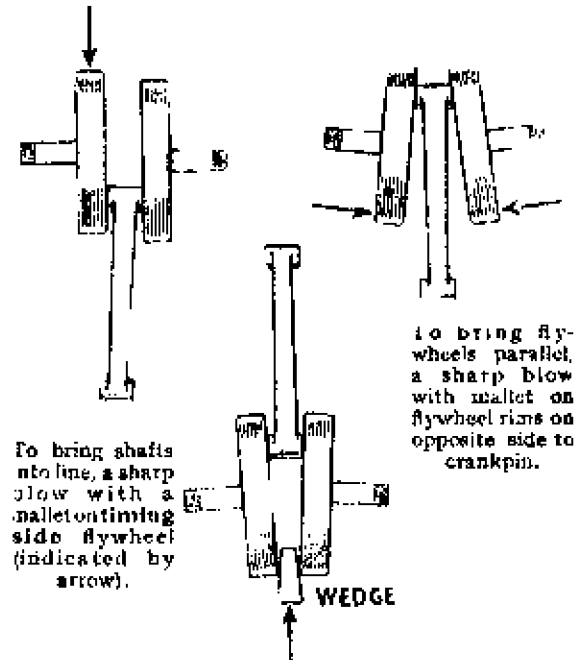


Suitable packing under timing side "vee" block to compensate for smaller diameter bearing.

Fig. 21. Checking flywheel alignment.

Now turn the assembly over, so that the gearside flywheel is on top and tighten the crankpin nut lightly.

The grub screw in the end of the crankpin must be



To bring flywheels parallel when sides opposite Crankpin are converging insert wedges as shown and deal sharp blow with mallet.

Fig. 22. Method of correcting flywheels out of alignment. Note that above illustrations are greatly exaggerated.

riveted over or centre-punched to prevent its unscrewing. If it unscrews serious damage may result to the engine. Check that the side clearance of the connecting rod in the flywheels does not exceed .012" and is not less than .010".

The flywheels will now be aligned only very approximately and further steps must be taken to ensure that the wheels are aligned as true as possible. Two of the actual (or similar) bearings to be used in the engine should be fitted to the mainshafts and the latter mounted on vee-blocks. The flywheels must be trued up, both on faces and rims, for which purpose a dial micrometer is necessary (Fig. 21), and after the wheels are trued to within at least .005" tighten the timing side crankpin nut fully. A mallet or lead hammer applied to the flywheels will provide a sufficiently heavy blow for final truing, and will not harm the flywheels (Fig. 22). The shafts must not be struck. The shafts should be finally trued to within .002" maximum.

CRANKCASE

Withdraw the bearings from the shaft and press them into their appropriate positions in the crankcase halves. A new washer will be required behind small drive bearing and a new retaining ring must be fitted. In the case of single lipped roller bearings only the outer race can be so fitted. Do not omit the retaining ring which holds the driving side bearing in position, and check the ends of the spacing sleeve between the bearings are parallel to within .002". In order that the inner bearing and the sleeve will stay in position it is advisable to lay the crankcase half on a bench with the outer bearing lowest.

Fit the oil flinger washer to the driving side mainshaft and note that this washer is bent over in one place to prevent accidental movement when fitting. If a new washer is being used it should be bent in a similar manner to the one which has been removed. Insert the driving shaft carefully into the crankcase, taking care not to disturb the flinger washer. The shaft should fit into the bearing without the use of unnecessary force and although the shaft must be a fairly tight fit in the bearings, it should be possible to assemble it by hand. If necessary ease the shaft with emery cloth, **carefully cleaning off any trace of emery afterwards.**

It is advisable to attend to the timing side of the crankcase before continuing further. Replace the oil pump driving spindle together with its locating pin (see Fig. 17) and then fit the oil pump in position. The fibre washer between the pump and crankcase should be smeared with jointing compound, **but an excessive amount must not be used, since any surplus will be squeezed out and may find its way into the oil passages.** The pins securing the oil pump must not be screwed up too tightly. Check that the pump spindle can be rotated between finger and thumb.

Now replace the tappets and guides, the latter being screwed well home, and insert the cam pinion spindles. **These should be pressed home taking great care to keep them dead square, and must be fitted so that the flat on the spindle shoulder is parallel to the tappet foot, for which it provides clearance and consequently its position is most important.**

Assembly of the crankcase will be made easier if the flywheel assembly, together with the driving side portion of the crankcase fitted on as previously explained, is mounted in a vice. Lead clamps must be used and

the splined portion of the shaft held.

The mainshaft bearings may now be pressed into the gearside half of the crankcase and the latter replaced on the mainshaft. Bolt up the crankcase and check that the flywheels, etc., spin easily. Fit sprocket centre, tighten up, and verify also that the connecting rod is centrally disposed in the crankcase mouth. Provided that the connecting rod is not visibly out of centre, there is no necessity for any adjustment to be made. If the connecting rod is out of centre, it will be invariably be towards the driving side of the crankcase. In this event a shim will have to be made and inserted between the driving side flywheel and the oil flinger washer. It may be also that the distance sleeve between the driving side bearings has become a little worn on its end faces, and a new component (one specially chosen so that its length is on the maximum limit) will rectify the connecting rod alignment. The maximum length for the distance sleeve is 1.005" and the minimum is 1.000". When the connecting rod alignment is found correct, remove the gearside half of the crankcase and clean the joint of any compound used previously. Fit the magdyno straps on their hinge pins, smear jointing compound lightly on the crankcase joint face and again bolt up the crankcase. Check that top of the crankcase, where cylinder base flange fits, is dead flat.

TIMING GEARS

Replace the engine shaft pinion, taking special care to note that the worm is engaging properly with the oil pump spindle and that rotation of the flywheels drives the pump.

The cam pinions are interchangeable and consequently the timing marks are duplicated on both pinions. This should not cause any difficulty when timing the valves if it is remembered that the dash mark only is used for the inlet cam and the dot for the exhaust cam. (Fig. 23).

The magdyno can now be fitted to the crankcase and

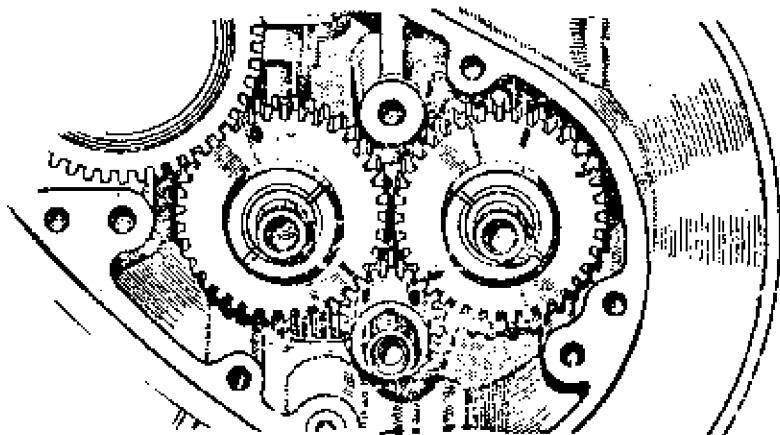


Fig. 23. Valve timing marks.

its straps loosely coupled up. Make sure that the dowels in the base engage properly in their holes in platform and that any packing shims are refitted. Refit the idler pinion between the inlet cam pinion and the magdyno pinion, but do not replace the

pinion retaining plate at this stage.

An oil sealing washer is fitted behind the magdyno pinion and this should be temporarily removed. Replace the magdyno pin on its taper; it need

not be driven on very firmly but just tightly enough to prevent slip. Check the backlash between this pinion and the idler. If excessive, the gears will be noisy; if insufficient, a whining noise will result.

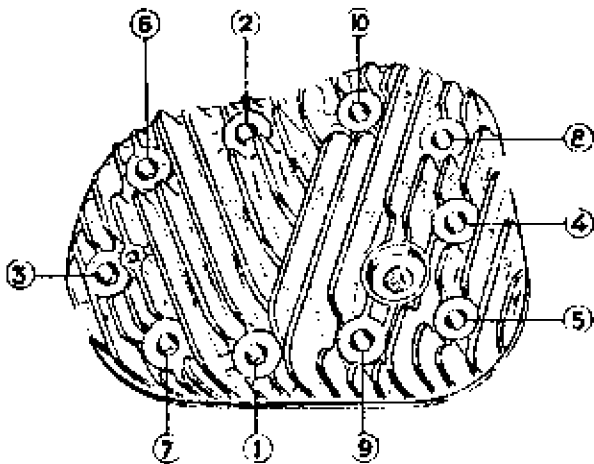


Fig. 24. Cylinder head bolts.

In order to adjust the backlash, shims are fitted under the magdyno if necessary, when the engine is first built. If a different magdyno is being fitted it is essential this backlash be checked carefully, shims of a different thickness being used as required.

Remove the magdyno pinion once more, replace the oil sealing washer and again fit the magdyno pinion **loosely** in position. It is preferable to leave the setting of the ignition until the barrel and piston are in position, and for this reason the magdyno pinion should not be tightened up. The valve timing can now be set. Replace the pinion retaining plate, noting that the coarse threaded bolts screw into the crankcase bosses and then fit the lockwasher and nut on the engine mainshaft. Play between the pinions and the retaining plate should be .002"-.003".

ASSEMBLY FROM THIS POINT WILL BE THE SAME AS AFTER DECARBONISING.

CYLINDER AND PISTON

The gap between the ends of the rings should be checked with the ring in the cylinder. If the gap is excessive new rings should be fitted with gaps of .008"-.012". Replace the piston and gudgeon pin on the connecting rod and if the original piston is used make sure that it is the correct way round (see Page 12). Do not omit the gudgeon pin circlips and verify that they are properly fitted. Set the tappets on their lowest position, fit the paper washer on the cylinder base and replace the cylinder

barrel on the crankcase. The piston rings may be compressed quite easily by hand while the barrel is being replaced.

Tighten the barrel down, not forgetting one nut is inside the tappet chest. The tappet clearances should be set very carefully as described on pages 8 and 9.

Next set the ignition timing as described on Page 9. Note that as the magneto cable is disconnected the cam will be in the "full retard" position and it must be held in the "full advance" position.

The resetting of magneto timing will not apply after decarbonising as there is no necessity to disturb the timing to remove the cylinder head and barrel.

Replace the timing cover after lightly smearing both sides of its paper washer with jointing compound, **taking care that the oil hole (Fig. 17) is not obscured.** (This does not apply after decarbonising). Bolt the cylinder head and gasket in position, but if the latter shows signs of leakage from previous use (indicated by black patches) a new one should be fitted. The cylinder head bolts must be tightened down in the order shown in Fig. 24.

The exhaust valve lifter body may now be screwed into its original position. Before the sparking plug is replaced it should be dismantled and cleaned, or if the machine has covered a large mileage a new plug should be used.

Replace the tappet cover and lightly smear the washer with jointing compound before fitting.

The engine is now ready for bolting into the frame (This does not apply after decarbonising), and after replacement check that the bolts are really tight, and that the gearbox bolts have not been forgotten. Refit right-hand footrest assembly pushing rod fully home.

The near-side footrest sleeve and distance piece (behind chaincase) should now be placed in position.

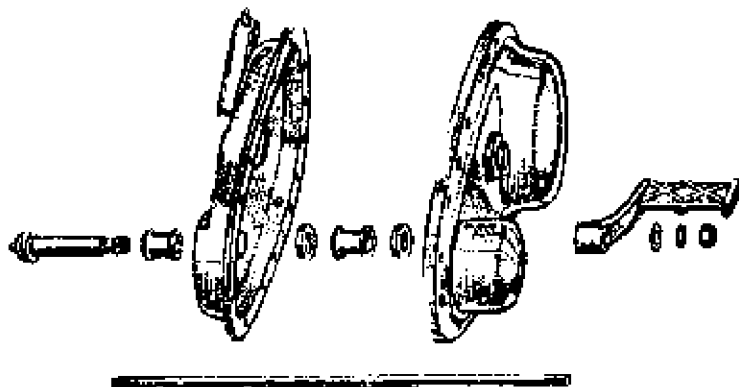


Fig. 25. Assembly of chaincase and footrest.

Then refit the inner half of the chaincase (first checking that oil-seal washer is in good condition) and when the bolts holding it to the crankcase have been finally tightened, wire them together with a fresh piece of wire for locking purposes.

The engine shaft cush drive can be replaced by

hand, without the need for special tools to compress

the spring (this does not apply after decarbonising). Lock the central nut up tight, when the clutch and primary chain are in position.

Fit the clutch on the gearbox mainshaft (this does not apply after decarbonising) – see re-assembly of clutch, page 22 – and replace the chain. On fastening the spring link it is important that it should be fixed so that the closed end is pointing in the direction of the “run” of the chain.

When replacing the chaincase outer cover, make sure that the washers, etc., on the footrest bar are in the correct position (see Fig. 25) and that the jointing washer is properly fitted. The chaincase must be

refilled with engine oil to the level plug, before the machine is used.

If there is any suspicion that the rubber pipes from the oil tank to the crankcase are faulty they should be replaced, otherwise the engine may suffer harm from insufficient oil. Note that in later models, the oil pipes are metal with a short rubber insertion.

All the control cables (i.e., carburettor, magneto and exhaust valve lifter) should be re-coupled next, followed by the dynamo leads and the earth wire.

Finally, replace the petrol pipe and then the exhaust pipe and silencer.

TRANSMISSION

Adjustments which can be carried out without dismantling

CLUTCH ADJUSTMENT

Two adjustments are provided at the clutch control arm on the gearbox outer cover. The adjustment, which is for the clutch push rod will be exposed when the rubber cover at the base of the arm is moved aside and consists of a grub screw and locknut. Between the inner end of the screw and the clutch push rod a steel ball is inserted and the grub screw must be adjusted so that there is just a little clearance between the ball and push rod. The control arm in the declutched position should be as upright as possible.

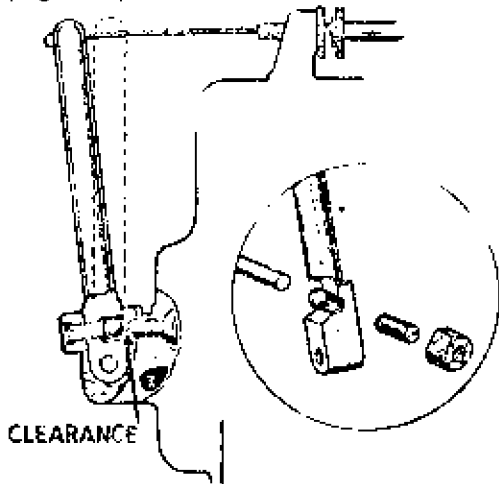


Fig. 26. Clutch control adjustment.

The second adjustment is for the cable itself. If the control arm has been set in a new position, the cable length is altered to suit by means of the thumb nut on the cable stop above the gearbox.

FRONT CHAIN ADJUSTMENT

The front chain is adjusted by moving the gearbox. The latter slides between two plates and cannot, therefore, cause chain misalignment.

Release the gearbox fixing bolts and move the box by means of the screw adjuster (see Fig. 27) until the chain has about $\frac{1}{2}$ " total play at a point about mid-way between its sprockets. The chaincase filler plug can be used as an inspection cover for this purpose, or

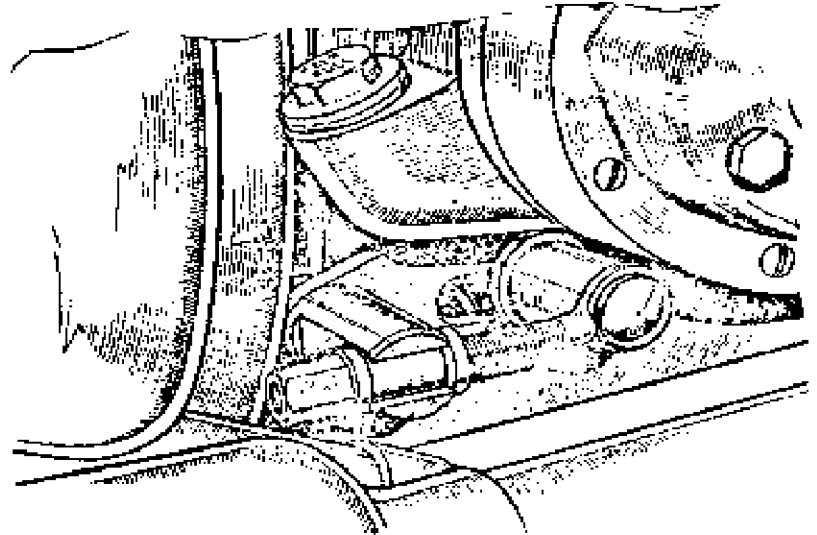


Fig. 27. Front chain adjuster

alternatively, the chaincase outer cover can be taken off. Make sure that the adjustment is correct for all positions of the sprockets and that the gearbox bolts are well tightened.

REAR CHAIN ADJUSTMENT

The rear chain is tensioned by means of a special cam on the nearside of the wheel spindle and by screw adjustment on the offside. First, release the offside spindle nut (see Fig. 28), then the cam locknut on the nearside. The latter nut is the larger of the two nuts on this side. Then, applying a spanner to the smaller nut, turn it in an anti-clockwise direction to tighten the chain, until it has a total amount of play, mid-way between the sprockets, of about $\frac{3}{4}$ ".

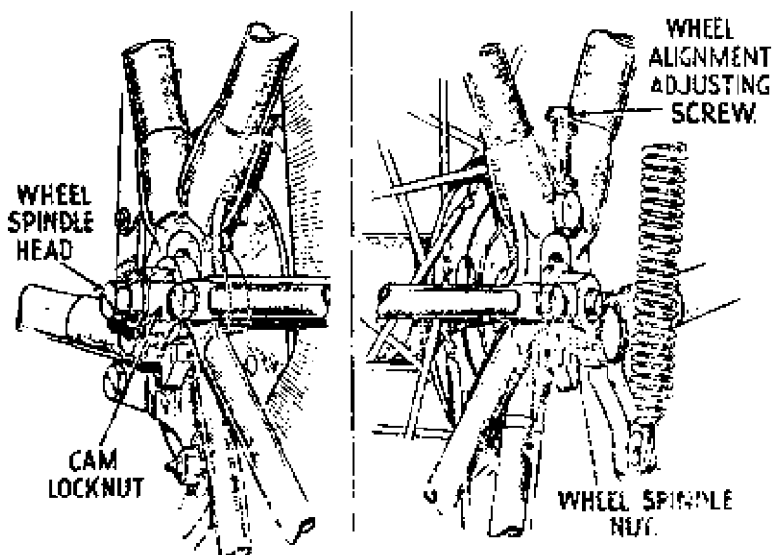


Fig. 28. Rear Chain adjuster.

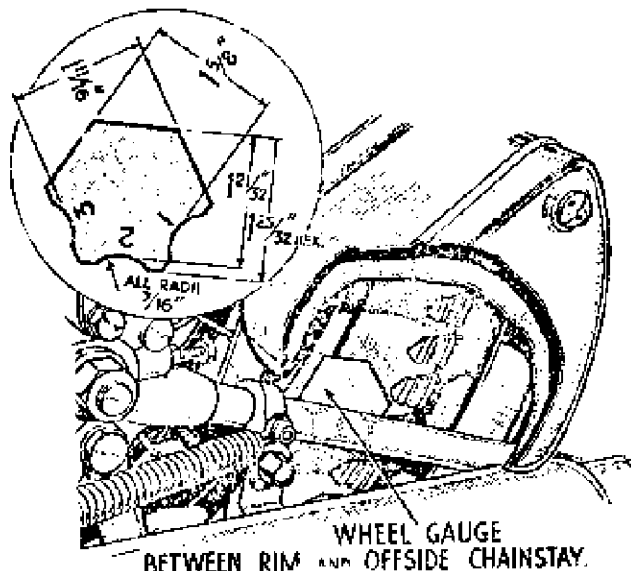


Fig. 29. Wheel alignment gauge.

Now turn to the offside of the machine and screw the adjuster in (if the chain has been tightened) until the wheel is properly aligned in the frame.

A gauge is provided in the tool kit for this purpose, and fits between the offside chainstay and the wheel rim (Fig. 29). (Before the gauge is used it is necessary that the wheel alignment be checked with a straight edge and the see which gauge – 1, 2 or 3 – is the correct fit). If the machine is in the workshops, however, it is much better to use a wooden straight edge, in the normal manner, i.e., it should touch each wheel in two places. Tighten the cam locknut and check the chain setting. If correct, tighten the offside spindle nut and then the offside adjuster locknut.

NOTE: It may be necessary to adjust the rear brake, since this will have been altered by movement of the rear wheel.

DISMANTLING AND RE-ASSEMBLING THE CLUTCH

Take off the left footrest and then undo all the screws around the rim of the chaincase. The nuts of these screws are welded to the other half of the case, and so cannot get lost. As the outer chaincase cover is taken off, careful note should be made of the repositioning of the washers, etc., for replacement purposes (see Fig. 25). The joint washer should be carefully preserved.

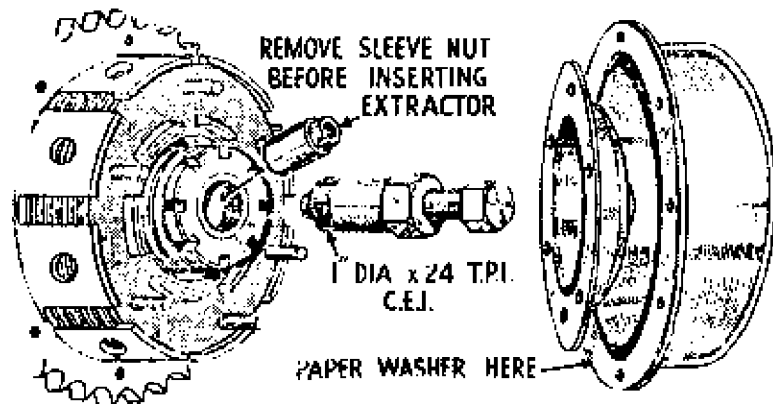


Fig. 30. Clutch extractor tool.

The clutch is next to be removed exposing the clutch

pressure plate, which in turn can be taken off after removal of the six nuts. By unscrewing the central ring nut all the clutch plates, both steel and fabric, will be released. Take care that the spring does not fly off as the nut is removed.

The clutch hub is held to the gearbox mainshaft by means of a sleeve nut through which the clutch push rod will be seen to protrude. Unscrew this nut and apply the extractor as shown in Fig. 30, thus drawing the remainder of the clutch off the mainshaft.

The various parts may now be examined for wear. Special attention should be paid to the slots in which the steel plates slide and if any grooves worn in them are not too deep the sides of the slots can be filed smooth. If the sprocket teeth are worn to a hook shape the sprocket must be replaced, otherwise rapid chain wear will result. The steel plates should be smooth and if they are badly scored should be replaced, while the fabric rings will require a thorough washing in petrol if there is any trace of oil on them.

Finally, examine the rollers and tracks and

verify that the cork washer is intact.

RE-ASSEMBLY OF THE CLUTCH

The clutch is of straight-forward construction and a study of Fig. 32 will show how the parts are

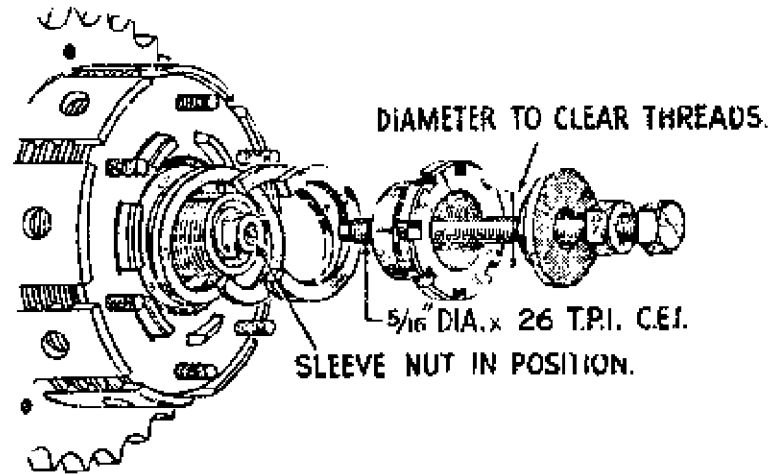


Fig. 31. Clutch assembly tool.

assembled. It is important to note that the cork

washer must not be omitted as this is for the purpose of preventing oil reaching the clutch. The plates must be fitted in their proper order, as follows: Fabric disc, driven plate (tongues on outer diameter), fabric disc, driving late (tongues on inner diameter), etc., stating and finishing with a fabric disc of which there are eight.

Difficulty may be experienced in compressing the spring before the central ring nut can be started on its threads, and a suitable bolt and washer used as illustrated in Fig. 31 will enable the sprig to be compressed sufficiently for the ring nut to be screwed home.

No adjustment is provided for altering the tension of

the ring and the ring must be screwed up tight. After carefully centralising sliding plate (in ear half of chaincase) with gearbox mainshaft, refit clutch assembly to mainshaft after cork washer and key have been placed in position. Screw home and well tighten sleeve nut.

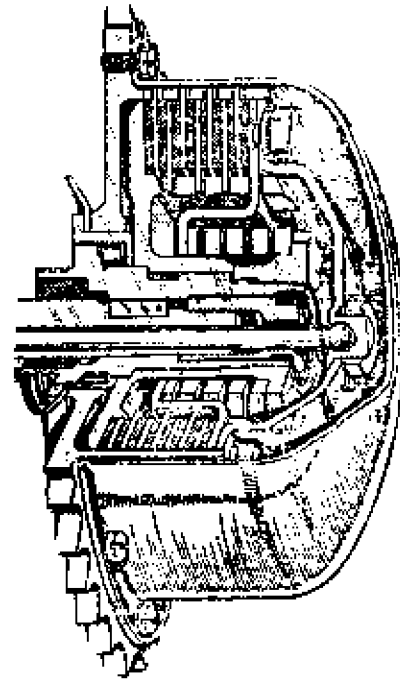


Fig. 32. Section through clutch.

Refit clutch actuating cap (first smearing small quantity of grease on ball in centre) and finally replace clutch cover. When replacing the clutch cover verify that the paper washer is in position and it should be lightly smeared with jointing compound before assembly, to ensure an oil-tight joint.

