Instruction Manual

for

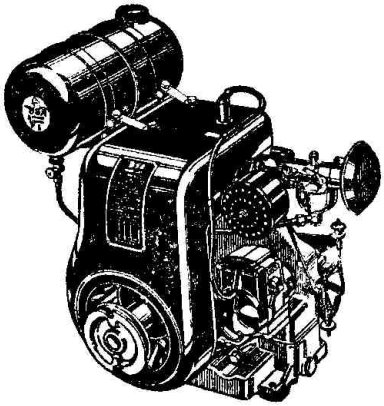
Models

B 98 c.c.

C 120 c.c.

D 220 c.c.

Power Units



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B 98 c.c.
C 120 c.c.
D 220 c.c.
Power Units

B.S.A. POWER UNITS
A DIVISION OF THE BIRMINGHAM SMALL ARMS CO. LTD.,
Studley Road, Redditch, Worcestershire.

Telephones: Redditch 4272
Telegrams and Cables: "BESA", Redditch.

SERVICE SPARES AND REPAIRS DEPARTMENTS
ARMOURY ROAD, SMALL HEATH, BIRMINGHAM 11.

Telephones: Birmingham VICtoria 2381.
Telegrams and Cables: "SELMOTO", Birmingham.

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CONTENTS

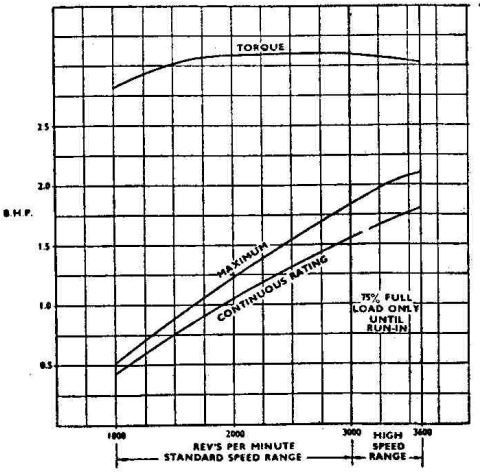
TECHNICAL DATA

	MODEL B 98 c.c.
Petrol tank capacity	4 pints (2.25 litres)
Oil sump capacity	1⅛ pints (639 c.c.)
Bore	2.125 in. (54 mm.)
Stroke	1.750 in. (44.5 mm.)
Compression ratio	5.9
Valve clearances (cold) inlet	.012 in. (.3 mm.)
exhaust	.012 in. (.3 mm.)
Piston ring gap: maximum	.012 in. (.3 mm.)
minimum	.006 in. (.15 mm.)
Sparking plug	Champion N8B
Sparking plug gap	.018—.020 in.
Sparking plug gap for speeds exceeding 2,500 r.p.m.	.025—.030 in.
Contact breaker gap	.018—.020 in.
Valve timing inlet opens b.t.d.c.	1½°
inlet closes a.b.d.c.	44°
exhaust opens b.b.d.c.	45°
exhaust closes a.t.d.c.	1°
Ignition timing	⅛ in. b.t.d.c.
Engine speeds:	
Standard speed range governed up to ...	3,000 r.p.m.
High speed range governed up to ...	3,600 r.p.m.
Power take off shaft diameter	11/16 in.
Power take off (direction of rotation) ...	Anti-clockwise
(with 2 : 1 or 3 : 1 reduction gear unit)	Clockwise
Carburetter type	Zenith 13T
main jet (petrol)	Adjustable
main jet (power paraffin with low compression head) ...	Adjustable
main jet (V.O.)	Adjustable
choke size	9.5 mm.
spray tube (needle jet) ...	—
float	Cylindrical
pilot jet	40 c.c.
Reduction gear units (when fitted) choice of...	2 : 1, 3 : 1, 6 : 1
Centrifugal clutch (when fitted). Free up to 900 r.p.m. fully engaged at about ...	1,050 r.p.m.
Petrol consumption	1 to 1½ pints per hour
Engine weight (approx.)	40½ lb.

PERFORMANCE CHART.

The figures given in the Performance Char show maximum H.P. at full throttle and for continuous running 85% of these ratings are shown.

For operation at higher altitudes, the engine power will decrease by 3% for every 1,000 feet above sea level. There will also be a decrease of 1% in power output for each 10 deg. above 60 deg. F. Power will be reduced approx. 5% when using V.O. or power paraffin.



TECHNICAL DATA

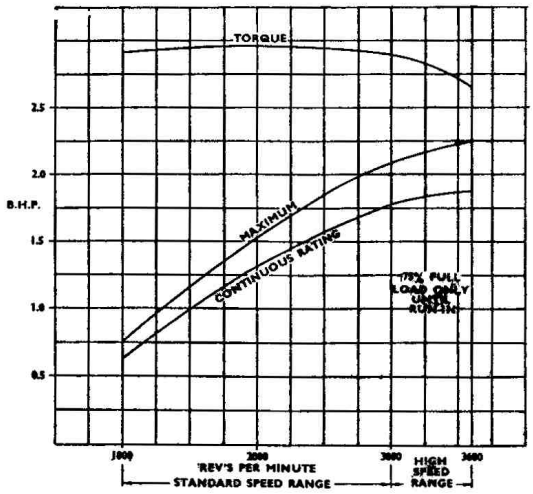
MODEL C 120 c.c.

Petrol tank capacity	4 pints (2.25 litres)
Oil sump capacity	1½ pints (852 c.c.)
Bore	2.204 in. (56 mm.)
Stroke	1.968 in. (50 mm.)
Compression ratio	5.9
Valve clearances (cold) inlet	.012 in. (.3 mm.)
exhaust	.012 in. (.3 mm.)
Piston ring gap: maximum	.012 in. (.3 mm.)
minimum	.006 in. (.15 mm.)
Sparking plug	Champion N8B
Sparking plug gap	.018—.020 in.
Sparking plug gap for speeds exceeding 2,500 r.p.m.	.025—.030 in.
Contact breaker gap	.012 in.
Valve timing: inlet opens b.t.d.c.	1½°
inlet closes a.b.d.c.	44°
exhaust opens b.b.d.c. ...	45°
exhaust closes a.t.d.c. ...	1°
Ignition timing	⅛ in. b.t.d.c.
Engine speeds:	
Standard speed range governed up to ...	3,000 r.p.m.
High speed range governed up to ...	3,600 r.p.m.
Power take off shaft diameter	¾ in.
Power take off (direction of rotation) ...	Anti-clockwise
(with 2 : 1 or 3 : 1 reduction gear unit) ...	Clockwise
Carburetter type	Amal 343/1
main jet (petrol)	70
main jet (power paraffin with low compression head)	70 (4.5–1)
main jet (V.O.)	95
choke size	0.5 in.
spray tube (needle jet) ...	0.1225 in.
float	Lever type
pilot jet	33 c.c.
Reduction gear units (when fitted) choice of ...	2 : 1, 3 : 1, 6 : 1
Centrifugal clutch (when fitted). Free up to 900 r.p.m. fully engaged at about ...	1,100 r.p.m.
Petrol consumption	1 to 2 pints per hour
Engine weight (approx.)	50 lb.

PERFORMANCE CHART.

The figures given in the Performance Chart show maximum H.P. at full throttle and for continuous running 85% of these ratings are shown.

For operation at higher altitudes, the engine power will decrease by 3% for every 1,000 feet above sea level. There will also be a decrease of 1% in power output for each 10 deg. above 60 deg. F. Power will be reduced approx. 5% when using V.O. or power paraffin.



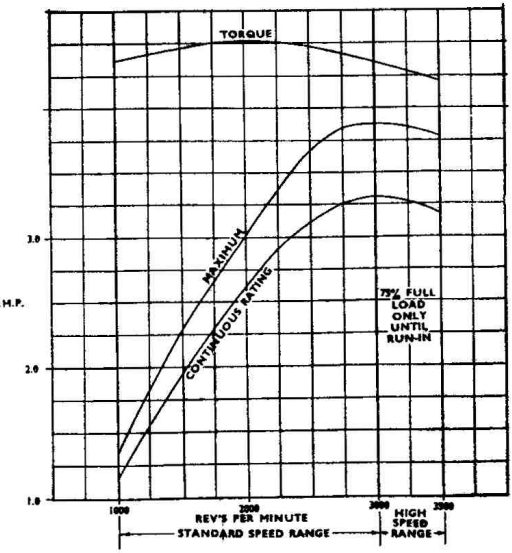
TECHNICAL DATA

	MODEL D 220 c.c.
Petrol tank capacity	1 gallon (4.5 litres)
Oil sump capacity	2 pints (1136 c.c.)
Bore	2.677 in. (68 mm.)
Stroke	2.362 in. (60 mm.)
Compression ratio	4.8
Valve clearances (cold) inlet	.010 in. (.254 mm.)
exhaust	.012 in. (.3 mm.)
Piston ring gap: maximum	.011 in. (.28 mm.)
minimum	.008 in. (.203 mm.)
Sparking plug	Champion N8B
Sparking plug gap	.018—.020 in.
Sparking plug gap for speeds exceeding 2,500 r.p.m.	.025—.030 in.
Contact breaker gap	.012 in.
Valve timing: inlet opens b.t.d.c.	5°
inlet closes a.b.d.c.	45°
exhaust opens b.b.d.c. ...	55°
exhaust closes a.t.d.c. ...	2°
Ignition timing	5/32 in. b.t.d.c.
Engine speeds:	
Standard speed range governed up to ...	3,000 r.p.m.
High speed range governed up to ...	3,500 r.p.m.
Power take off shaft diameter	1 in.
Power take off (direction of rotation) ...	Anti-clockwise
(with 2 : 1 or 3 : 1 reduction gear unit) ...	Clockwise
Carburetter type	Amal 343/13
main jet (petrol)	90
main jet (power paraffin with low compression head) ...	95 (4.07–1)
main jet (V.O.)	110
choke size	17/32 in.
spray tube (needle jet) ...	0.1285 in.
float	Concentric type
pilot jet	30 c.c.
Reduction gear units (when fitted) choice of ...	2 : 1, 3 : 1, 6 : 1
Centrifugal clutch (when fitted). Free up to 900 r.p.m. fully engaged at about ...	1,200 r.p.m.
Petrol consumption	2 to 2.8 pints per hour
Engine weight (approx.)	70½ lb.

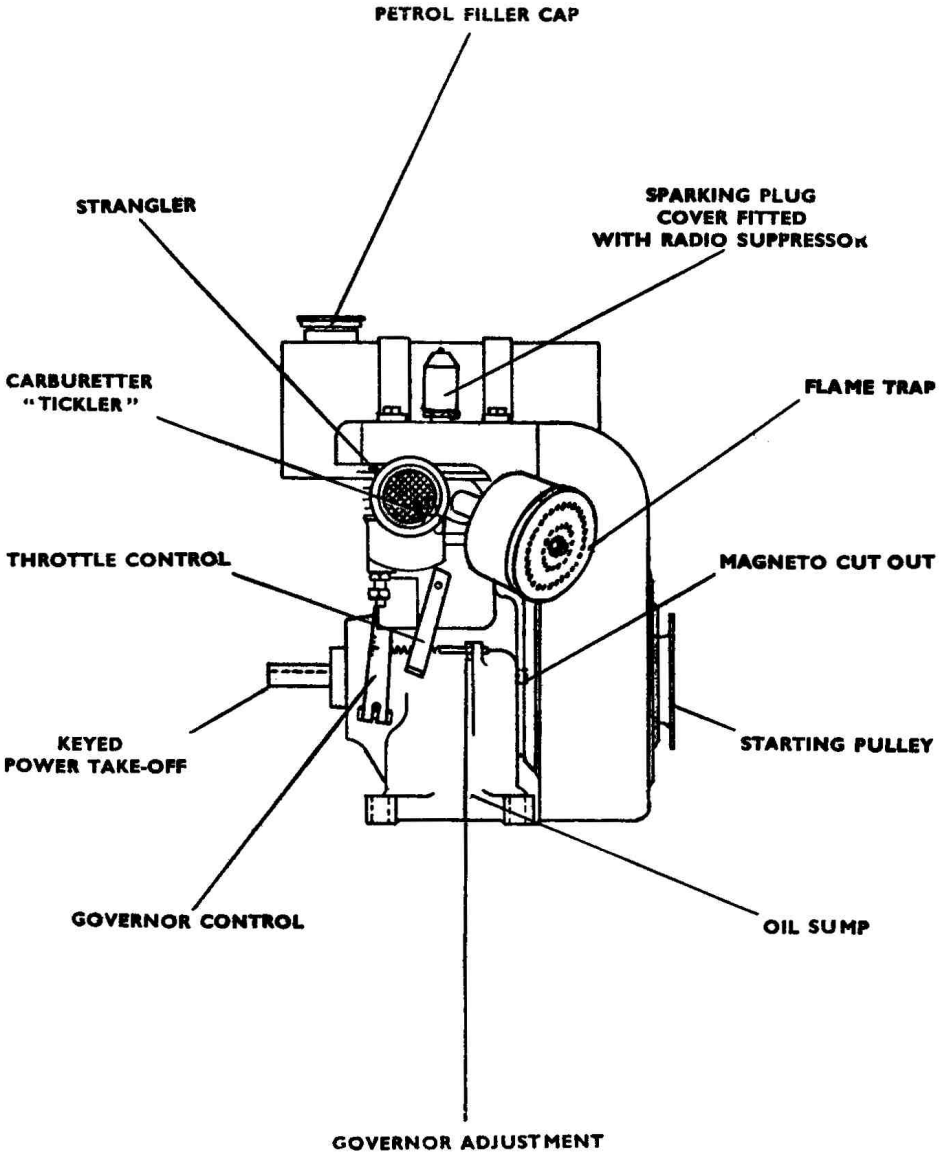
PERFORMANCE CHART.

The figures given in the Performance Chart show maximum H.P. at full throttle and for continuous running 85% of these ratings are shown.

For operation at higher altitudes, the engine power will decrease by 3% for every 1,000 feet above sea level. There will also be a decrease of 1% in power output for each 10 deg. above 60 deg. F. Power will be reduced approx. 5% when using V.O. or power paraffin.

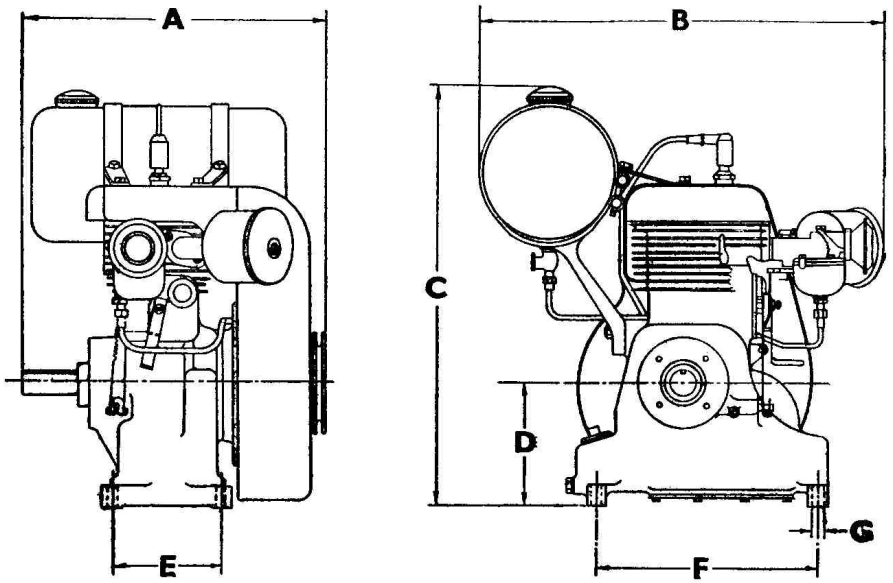


ARRANGEMENT



INSTALLATION

The engine is suitable for mounting on a rigid base or for bolting on to existing stationary or portable apparatus, which it may be required to drive, and for this purpose fixing lugs are provided on the engine base. It is always desirable that the engine should be securely mounted and also that it should be as level as possible in order to ensure correct operation of the carburation and lubrication systems (see Fig. 1).



	98 c.c.	120 c.c.	220 c.c.
A	11-9/16 in.	12⅛ in.	13-13/16 in.
B	15 in.	16¼ in.	18⅛ in.
C	15½ in.	16¼ in.	18-9/16 in.
D	3⅞ in.	4⅛ in.	5½ in.
E	4¼ in.	4¼ in.	5 in.
F	8½ in.	8½ in.	10 in.
G	13/32 in.	13/32 in.	13/32 in.
Crankshaft dia.	11/16 in.	¾ in.	1 in.

Fig. 1. Engine Installation.

When a new engine is to be installed for the first time, certain precautions must be observed. The ignition and valve timing and the tappet clearances are correctly set before the engine is despatched from the factory, so that there is no real necessity to check these points.

Before despatch all working parts are lubricated, but the oil sump is probably empty unless the Dealer has already attended to this point, and it should therefore be checked by removing the filler plug

at the side of the crankcase under the fuel tank. The correct quantity of oil is given in the Technical Data (pages 3, 4 and 5), and the recommended lubricants are specified on page 12.

On engines where a reduction gear unit is used a drain plug is provided for each of the various positions in which the unit can be fitted (see page 10).

The fuel tank (capacity see Technical Data) should be filled with ordinary petrol (see page 29 for other fuels), and during the running-in period at least it is preferable to add a small quantity of upper cylinder lubricant or, failing this, ordinary engine oil, the quantity being about half of a dessertspoonful (98 c.c. and 120 c.c.) and one dessertspoonful (220 c.c.) per tankful of petrol.

Remove the sparking plug and examine the points to see that they are correctly adjusted (see page 28), and also that they are clean and free from any trace of moisture which might have accumulated during storage.

Starting (98 c.c.)

Turn on the fuel tap by pulling out the knurled cap.

In order to start from cold it is necessary to flood the carburetter by depressing the "tickler" on top of the float chamber. Half close the strangler by moving the lever on the side of the choke chamber away from the engine. Then press the slow running lever (A, Fig. 3) downwards to its stop where it is retained automatically.

Starting (120 and 220 c.c.)

Turn on fuel tap by pulling out the knurled cap.

In order to start from cold it is necessary to flood the carburetter by depressing the "tickler" on top of the float chamber and close the strangler. This is done by moving the lever on the side of the choke chamber away from the engine. Then lift the slow running lever (A, Fig. 4) to its stop where it is retained automatically.

All models.

Turn the starting pulley in an anti-clockwise direction until the compression resistance is felt. Then fit the knotted end of the starting rope in the "V" notch on the pulley, and wind the remainder of the rope around the pulley in a clockwise direction. Grip the free end of the rope firmly, and pull smartly to its full extent and clear of the pulley. Do not wrap the cord round the hand, but hold the wooden grip in the palm, allowing the cord to pass between the second and third fingers. In the case of engines with starting handles, turn the handle clockwise until compression resistance is felt. Then turn the handle back again to a position relative to between 6 to 9 o'clock. Pull the handle sharply upwards to start the engine. **Keep**

the thumb on the same side of the handgrip as the fingers. After the engine has been running for a few moments release the choke gradually until it is fully open against its stop. Then either lift or knock down the slow running lever, and let the engine run light until it warms up.

In exceptionally cold conditions easy starting may be helped by turning the engine a few times with the magneto switched off, (i.e. short circuiting the switch with a screwdriver or one or two coins inserted in the cut-out switch, see Fig. 2) and the throttle half open. The strip should then be released, and without moving the throttle start the engine.

To Stop the Engine.

It is only necessary to press the cut-out switch until the engine comes to rest. Turn off petrol. For engines operating on other fuels see page 29.

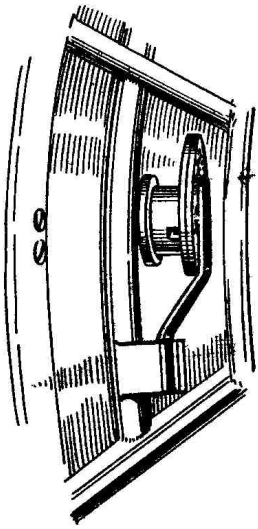


Fig. 2. The Magneto Cut-out.

Routine Maintenance.

The B.S.A. engine is entirely self-contained, and will run for very long periods with practically not attention. Certain routine points should, however, be dealt with as the occasion arises, these being as follows:—

Fuel.

Replenish as required.

ENGINE OIL

Engine Sump.

Check the oil level every eight hours running and replenish as necessary until the level is up to the bottom of the filler hole.

Every 100 hours drain sump by removing the crankcase drain plug. Refill to correct level.

In the case of engines running continually on paraffin fuel, the sump must be drained at intervals of not more than 50 running hours.

Air Cleaner (when fitted).

Clean and replenish as indicated on page 25.

Reduction Gear (when fitted)

Every 100 hours drain and refill to the level of one of the side plugs. In the case of the 6 : 1 unit refill to **lower** side plug (see page 27).

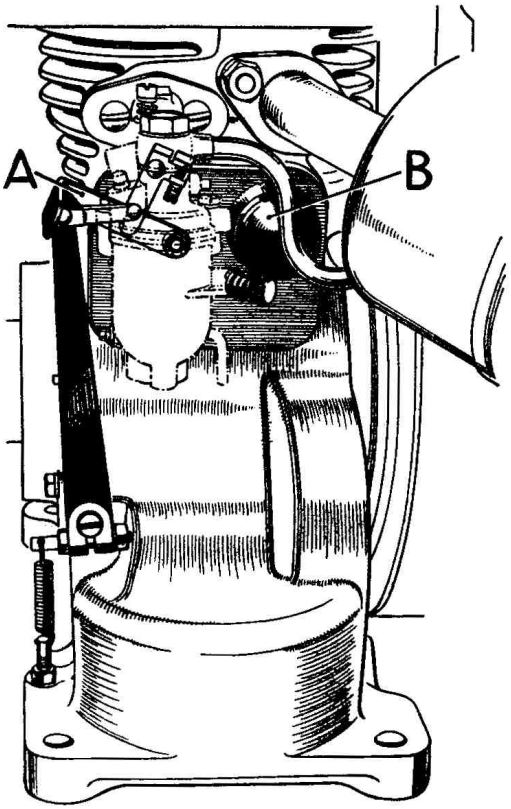


Fig.3. Slow Running Lever (98 c.c.).

CYCLE OIL

Control Rod Joints and Levers.

A few drops of oil weekly.

Magneto Cam Oil Pad.

After every 100 hours re-lubricate the pad by working into it a drop or two of oil. This is done by unscrewing the starting pulley and removing the flywheel cover plate, when the pad can be seen inside.

Maintenance and Overhaul.

Whenever any work is carried out on the engine attention to detail and scrupulous cleanliness must be observed. All joints must be clean and gaskets in good condition before reassembly. Threads must be kept clean and free from grit, and exposed threads should be oiled or greased before assembly. Good fitting spanners should be used at all times and nuts must be done up quite tight, but spanners of greater than standard length should not be employed as they may cause failure through overtightening.

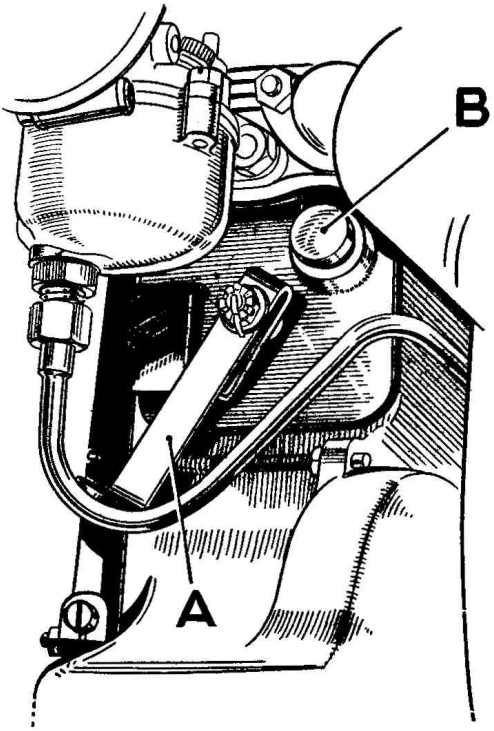


Fig. 4. Slow Running Lever (120 and 220 c.c.).

The Lubrication System.

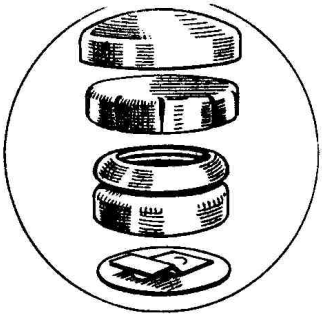
The lubrication of working parts is accomplished by the splash system through an arrangement which involves no special pump or gears, and is thus completely foolproof, as long as the oil level is maintained correctly.

The camshaft gear, operating in the oil trough at the bottom of the crankcase, picks up a quantity of oil in the teeth as it revolves, and as each tooth comes into mesh with a tooth on the crankshaft pinion, oil is squirted with considerable pressure from between the teeth. Each time the crankpin passes the meshed pinions this squirt of oil is injected into the hollow crankpin, which is drilled to allow oil to pass into the big-end bearing.

The remainder of the time, this squirting process is building up a thick oil mist inside the crankcase, with the result that the cylinder, small-end, main bearings and all other working parts receive an adequate supply of lubricant the whole time the engine is running.

Crankcase breathing is controlled by a single non-return disc valve (see Fig. 5), fitted into the tappet cover plate on the 98 c.c. and 220 c.c. engines as shown at (B) Fig. 4, and pressed into the crankcase on the 120 c.c. engine. This prevents oil leaks with a consequently clean engine exterior at all times, and of course, enhanced oil economy.

Note.—The baffle and plate, which is the lower component shown in Fig. 5 is not used on the 98 c.c. engine.



EXPLODED VIEW of CRANKCASE BREATHER

Fig. 5.

Recommended Lubricants.

ENGINE OILS

Brand	Above 32°F.	0° to 32°F.*	Below 0°F.
Mobiloil ...	BB	A	Arctic
Shell	X100–40	X100–30	X100–20
Castrol ...	XXL	XL	Castrolite
Esso Extra...	40/50	20w/30	20w/30
B.P. Energol	S.A.E. 40	S.A.E. 30	S.A.E. 20

*For easy starting in very cold weather S.A.E. 20 may be desirable.

For Overseas.—Recommendations as above if obtainable. If not use:— Summer, S.A.E. 40–50; Winter, S.A.E. 40–20.

Tappet Adjustment.

To remove the tappet cover plate, take off the split pin and central nut holding the carburetter slow running lever. Then remove the lever and the stud (A, Fig. 6) and spring washer underneath holding the actual tappet cover plate.

Tappet adjustment must always be carried out when the engine is cold and with the piston set at top dead centre of the compression stroke so that the cams are in the correct position. With the piston in this position both valves should be closed. The correct clearance is as follows:—

	Inlet	Exhaust
98 c.c. ...	.012 in.	.012 in.
120 c.c. ...	.012 in.	.012 in.
220 c.c. ...	.010 in.	.012 in.

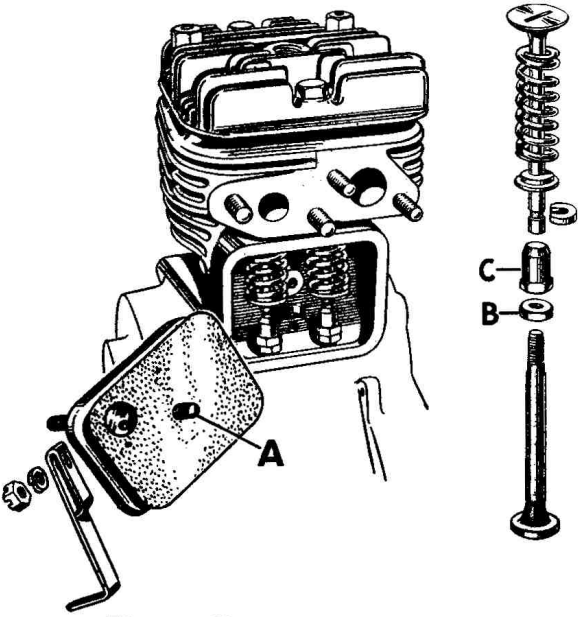


Fig. 6. Valves and Tappets.

There may be a tendency, after a very considerable period of running, for the tappet clearances to become less and this is also liable to happen when the valves are re-ground.

Tappet Clearance Adjustment.

The adjuster, which is of the screwed type, is at the top of the tappet. The clearance is measured by means of feeler gauges inserted between the bottom of the valve stem and the tappet head.

If adjustment is necessary hold the tappet head (C) and release the locknut (B). Then hold the tappet by means of the flats on its stem and screw the tappet head up or down until the clearance is correct. Tighten the locknut (B) and re-check the adjustment.

Replacement of the tappet cover, etc., having first made certain that the washer is sound, completes the operation of tappet adjustment. It may be advisable to smear a little jointing compound on the joint washer, to ensure an oil-tight joint.

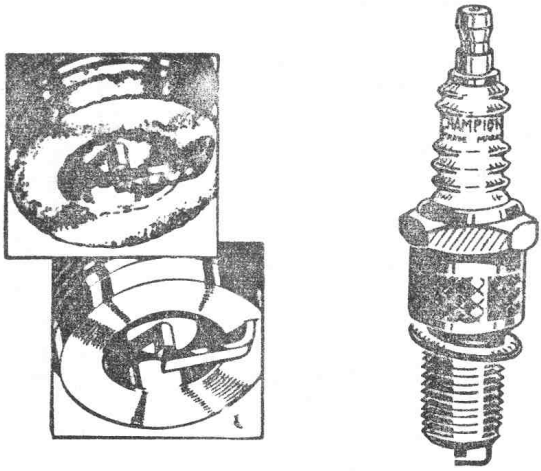


Fig. 7. Sparking Plug.

Sparking Plug.

The satisfactory running of an engine depends among other things upon the correct functioning of the sparking plug, and it is, therefore, essential to examine this periodically in order to ascertain that it is still in good condition. The plug fitted to this engine is Champion model N8B (14 mm.), and provided that the carburation and lubrication systems are in good order, it should continue to function faultlessly for very long periods without attention. If, however, the mixture from the carburetter is too rich, carbon deposit will form on the plug points and plug end face (see upper view, Fig. 7), and these will eventually become so fouled as to interfere seriously with the running of the engine, and will certainly make starting difficult.

Too much oil getting past the piston and into the combustion chamber will also foul the points with carbon deposit, but this will not occur unless the cylinder is badly worn or the piston rings, particularly the bottom oil control ring, are so badly worn as to need replacement.

A light deposit due to any of these causes can easily be cleaned off, but if it is allowed to accumulate, particularly inside the body, the plug may spark internally with an adverse effect on engine performance—if, indeed, it does not stop the engine altogether—and the

plug should be taken to a garage for cleaning. If eventually the cleaning process fails to restore the plug to its original condition of efficiency, it should be replaced by a new one.

When inspecting a plug, also check the gap between the points. This should be .018—.020 in., and adjustment should be made by bending the side wire (see Fig. 8). **Special Note.**—If the governor is set to operate at speeds in excess of 2,500 r.p.m. the plug points gap should be increased to .025—.030 in. Never attempt to move the centre electrode, and it is always advisable to use the special plug gap tool illustrated, obtainable at 2/- from any Champion Plug stockist or from the Champion Sparking Plug Co. Ltd., Feltham, Middlesex. Feeler gauges are attached to verify correct gap.

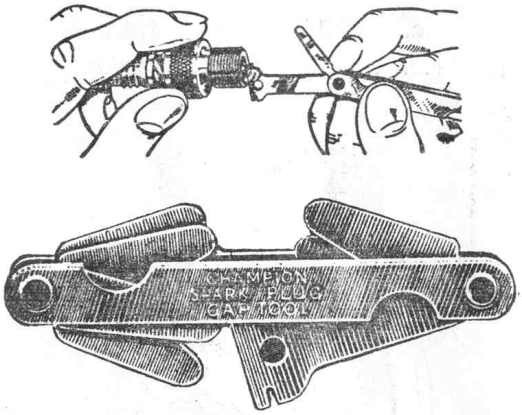


Fig. 8. Setting the Plug Points.

Before replacing the plug make sure that the threads are clean and that the copper washer is in good condition. If it has become worn or badly flattened a new one must be fitted to ensure a gas-tight seal. Screw the plug in as far as possible by hand, then use a tubular box spanner for final tightening, to avoid the possibility of damage to the insulator. In no circumstances should an adjustable spanner be used.

The insulation on the top of the plug should be wiped quite clean before replacing the cap, and then finally, the cap itself should be wiped to remove dirt and grease.

Ignition and Valve Timing.

These are, of course, correctly set before the engine leaves the factory, and there is normally no occasion to disturb the settings. If, however, the engine is dismantled for any reason, or the settings are to be changed, the ignition and valve timing can be set as follows:—

Ignition Timing.

The ignition timing is accurately set within close limits and there is no manual adjustment as this has been found quite unnecessary in practice. A small amount of adjustment can be obtained however.

To make this adjustment, it will be first necessary to unscrew the starting pulley, remove the nut and withdraw the flywheel with the aid of an extractor.

Any variation in timing can only be secured by moving the contact breaker housing. This can be rotated through a very small angle by releasing the nuts (E) Fig. 14 (98 c.c.), screws (E) Fig. 15 (120 and 220 c.c.), move the plate radially in its slots, re-tightening after the adjustment has been made. It is emphasised that this is a works adjustment rather than one which the owner is ever likely to carry out.

The correct timing is:—

98 c.c.	...	1/8 in. before t.d.c.
120 c.c.	...	1/8 in. before t.d.c.
220 c.c.	...	5/32 in. before t.d.c.

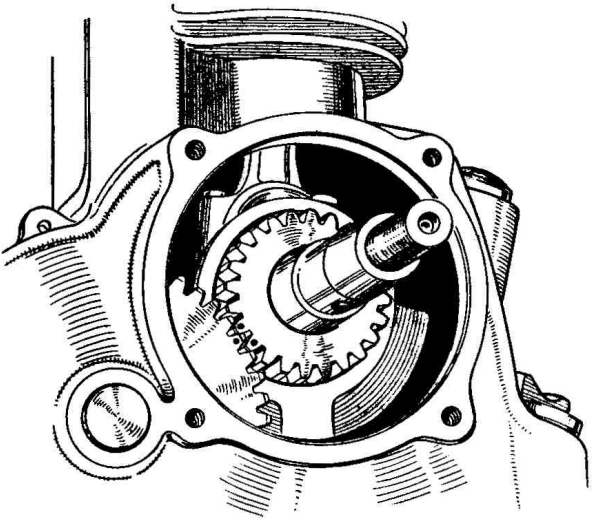


Fig. 9. Valve Timing.

After any adjustment has been made, the contact breaker points must be checked or adjusted as described on page 28.

To check the actual timing, remove the sparking plug and turn the engine until the piston is felt to be at top dead centre by means of a suitable rod inserted through the sparking plug hole, and then turn the engine back until the piston has descended 1/8 in. on the 98 c.c. and 120 c.c. engines, 5/32 in. on the 220 c.c. engine. With the piston in this position, the contact breaker rocker arm should just be commencing to rise on the contact breaker cam, and the points should have opened not more than .002 in. If they are open more than this then the engine is too far advanced. If they are open less, the timing is excessively retarded, although a small variation in either direction is not detrimental to the running of the engine.

Valve Timing.

This is carried out during the process of assembling and when the crankcase is completely stripped, the first component to be inserted should be the crankshaft (centre, Fig. 9). Take care not to damage the oil seal in the crankcase. When fitted, turn the crankshaft until the marked space in its timing pinion is pointing towards the axis of the camshaft. Then fit the camshaft in such a position that the marked tooth on its gear engages in the space between the marked teeth on the crankshaft pinion just referred to (see Fig. 9).

This is followed by the camshaft fixed spindle which is pressed into position and located by a peg in a groove in the cylinder block. Finally tap in the retaining cover.

Governor Adjustment.

The governor mechanism is entirely automatic in operation, and once set for the desired speed it needs no further attention or adjustment. To set the governor at a different speed it is only necessary to release the locknut and screw the adjusting screw holding the governor spring, in or out as the case may be, until the desired speed is obtained.

Important.—In certain cases the engine speed has been adjusted at the factory to meet special requirements. In this and in all other circumstances the governor adjustment must be left in its original setting if the engine is to run efficiently and the correct speed maintained.

Decarbonisation.

Decarbonisation should only be carried out when there are definite symptoms that excessive carbon build up inside the engine is interfering with performance. The usual symptoms are an increased tendency to "pink" (a metallic knocking when under load) and a general falling off in performance with a tendency for the engine to run hotter than usual.

It is customary to attend to the valves during decarbonisation as this provides a reasonable interval between valve overhaul and avoids the necessity for dismantling the engine especially for this pupose at a later date.

First turn off the fuel tap, and detach the fuel pipe by unscrewing the union nut underneath it. It is only necessary to remove the two bolts above the cylinder head, the fuel tank remaining in position on its lower support brackets. Disconnect the carburetter lever, the exhaust flame trap and carburetter, taking care not to damage the joint washers. Next detach the high tension lead from the sparking plug and remove the latter from the cylinder head. The cooling duct or cowl can then be detached by removing the shaped end piece and the four screws by which it is located at the starting pulley side of the engine, and then sliding it off, the two other fixing bolts having been already removed as these are also used for attaching the fuel tank. When the cowl is taken away it will be seen that the cylinder head is fixed to the barrel by means of six bolts. Remove these and

the head can then be lifted clear of the cylinder. Remove also the copper asbestos cylinder head gasket, which may be quite free or which may adhere to the top face of the cylinder barrel. In the latter event, prise it off gently in order to avoid damage, and if it is found on examination to be sound, it can be put one side for refitting when reassembly is carried out. Take care that it is replaced with the same face upwards to ensure a gas-tight joint.

Remove the valves by inserting a screwdriver or similar lever under the valve spring cup and levering upwards. This will either free the valve cotter (see Fig. 6) or raise the valve head. In the former case the cotter should be placed on one side and the valve can then be lifted out. If the cotter does not free and the valve is raised bodily instead, give the valve head a sharp tap with the shaft of a hammer or soft mallet while still exerting pressure with the screwdriver or lever. This will release the cotter and the valve can then be taken out. Place both valves on one side together with the appropriate spring cups and cotters in order that they may be replaced correctly during reassembly.

With a screwdriver or scraper, or other suitable tool, carefully remove the carbon deposit from the piston crown and cylinder head, bearing in mind that both of these are made of aluminium alloy which is relatively soft and therefore liable to be damaged by injudicious application of the scraper. Remove also the carbon deposit from the top face of the cylinder barrel around the valve seats and wipe all these surfaces with a slightly oily rag in order to remove the last traces of loose carbon.

Grinding-in Valves.

While the valves are out, their seatings and those in the cylinder barrel should be examined for condition. Valve grinding should only be attempted if pitting is not deep. If deep pit marks appear, return the valve for re-facing to your local B.S.A. Power Unit Service Dealer or the B.S.A. Service Department, Armoury Road, Small Heath, Birmingham 11, as attempts at grinding-in in this case will result in wear of the valve seat and the valve may become pocketed.

Smear a small quantity of grinding compound (obtainable from any garage or accessory shop) over the face of the valve, and return the valve to its seat. Note that a light spring inserted under the valve head greatly facilitates the grinding-in operation, allowing the valve to lift and to be rotated to a new position periodically. With a screwdriver applied to the head, rotate the valve backwards and forwards whilst maintaining a steady pressure. The valve should be raised and turned to a new position after every few strokes. Grinding should be continued until the valve seat and face show a uniformly matt metallic surafce all round. It is most important that valves should be ground-in on their original seats.

Should the valve seats be badly pitted, the cylinder block should be returned to the above-mentioned, for re-cutting, and this may necessitate the fitting of new valves.

Before replacing the valves and springs, all traces of grinding compound must be removed from both face and seat, and the valve stem smeared with engine oil.

Valve Springs.

Periodically it may be desirable to re-new the valve springs as these tend to lose their efficiency due to heat. If the springs are re-newed whilst decarbonising, it will save dismantling specially to replace them at a later date.

Piston and Rings.

The operation of decarbonisation does not necessitate the removal of the piston, since the surfaces on which carbon becomes deposited are immediatly accessible when the cylinder head only is removed. If, however, the performance of the engine indicates that an examination of the piston and rings might be desirable, this should be carried out as follows:—

In order to gain access to the piston it is first necessary to remove the complete connecting rod and piston from the crankcase. Undo the bolts underneath the crankcase which retain the sump plate and withdraw the plate. Undo the two connecting rod stud nuts and remove the big-end cap. Lift the piston and con-rod out through the top of the cylinder barrel. If any difficulty is experienced the carbon ring around the top of the cylinder bore, should be carefully scraped off. Note the position of each half of the split big-end bush so that they may be reassembled in the same order.

Examine the cylinder carefully for wear and if a deep ridge has formed at the top of the bore then a rebore may be necessary and you should consult your Dealer for confirmation. Pistons $\frac{1}{2}$ mm. and 1 mm. oversize are available for rebore purposes but owners in Great Britain can take advantage of the Exchange Replacement System to obtain a rebored barrel with matched piston through their local B.S.A. spares stockist. The barrel will also require a rebore if there are any deep scores as this will cause loss of compression and excessive oil consumption. Any shiny marks on the bore are indications of seizure and the cause of this should be determined and rectified.

The outside face of the piston rings should possess a smooth metallic surface and any signs of discolouration or shiny portions mean that the rings must be replaced. The rings must also possess a certain amount of springiness so that the ends lie at least 3/16 in. apart when released from the barrel.

The rings should be free in their grooves but with a minimum side clearance. If the rings are stuck in the grooves remove them and clean out all the carbon from the groove and the inside face of the ring. Care is necessary when removing the rings as they are brittle and only permit a minimum amount of movement. A suitable tool for removing the carbon from the ring grooves is a piece of old piston ring ground as a chisel.

To check the piston ring gaps place each ring in the least worn part of the cylinder bore and make sure that it is square in the bore

by locating it with the top of the piston. Measure the gap between the end of the ring with a feeler gauge. The correct gap when new is .008—.012 in. and although an increase of a few thousandths of an inch is not important, any large increase to say 25 thou. means that the ring should be replaced. If a new ring is being measured the gap may be less than the amount specified and in this case the ends of the ring must be opened out with careful use of a very fine file. Take care that no ridge is left on the edges of the ring which could score the barrel.

It is not necessary to remove the piston unless it requires replacement or further dismantling of the engine is to be carried out. If removal is necessary first prise out one of the wire gudgeon pin circlips by inserting a suitable pointed instrument in one of the two notches provided. Before the gudgeon pin can be withdrawn the piston must be warmed by wrapping it in rag that has been soaked in boiling water and wrung out. Alternatively, an electric iron can be applied to the crown of the piston until it is thoroughly warmed. When the piston is warm withdraw the gudgeon pin with the suitable extractor. If an extractor is not available the gudgeon pin can be driven out with a good fitting punch but the piston must be carefully supported to avoid any side strain on the connecting rod. As soon as the piston is removed mark the inside of the skirt at the back so that it can be replaced the correct way round.

98 c.c. with Zenith 13T.

The carburetter consists of two principal castings. The upper portion or throttle body incoporates the right angle inlet bend and the fixing flange which can be bolted directly on to the inlet port or cylinder; the lower portion consists of the float chamber (or bowl) and the air intake. The choke tube is cast integral as part of the air intake.

Fuel Supply and Metering System.

Petrol entering the banjo fitting (2) Fig. 10, is filtered by the gauze screen (1) and passes through the combined needle and seating valve (12) into the bowl (9). The float (15) will rise and close the needle valve when the correct petrol level is reached in the bowl. A tickler or flooder (5) is provided which enables the float to be depressed, and as a result the fuel level will be raised in order to assist starting.when cold. A small overflow hole in the bowl above the normal fuel level prevents excessive flooding. A small drain cock is fitted to the base of the bowl for engines running on Power Paraffin or Vapourising Oil.

High Speed Operation.

Fuel metering is controlled by an adjustable main jet. The outlet of the main jet discharge tube (14) is placed at the restricted part of the choke tube which forms part of the bowl. The main jet adjusting screw (13) has a tapered end which enters the tube (14), thus controlling the quantity of fuel passing into the choke tube. The volume of petrol/air mixture passing into the cylinder is controlled by the butterfly throttle (7) which in turn is operated by the throttle lever (8). A small air-bleed hole (10) is provided in the main jet system; inside air is used for this purpose.

Idle Operation.

The slow running channel carries fuel from the combined jet and dip tube to the small idling hole (6) on the engine side of the throttle. Air for slow running is taken from inside the carburetter, and is controlled by the adjusting screw (3). Turning this screw clockwise enriches the slow running mixture and vice-versa.

Easy Starting.

This is ensured by the air strangler or choke (17) and during very cold weather the tickler (5) can also be used. If the engine has only been switched off for a short period it is not usually necessary to use the choke when restarting; it may, however, be an advantage to use the tickler in order to ensure an immediate fire when the engine is turned over.

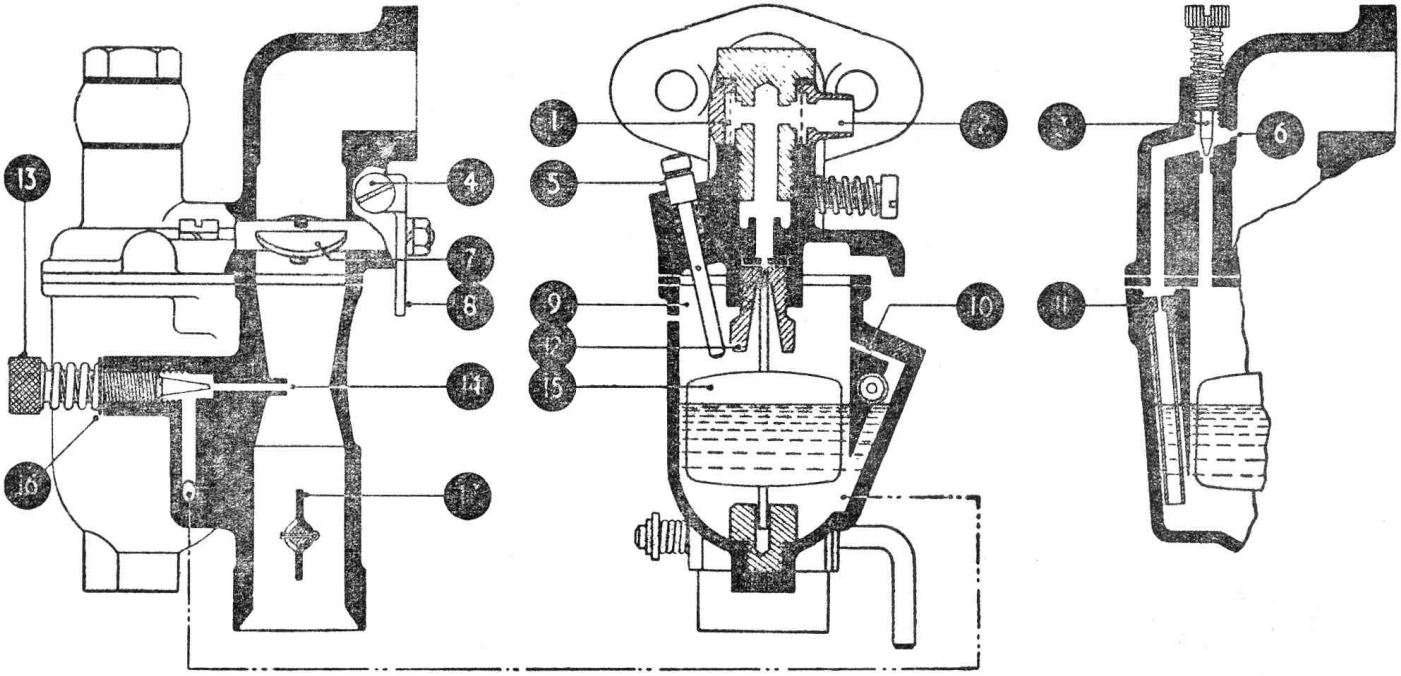


Fig. 10. 13T Carburetter.

(The drain tap shown in Fig. 11 is fitted to this carburetter when the engine is running on Power Paraffin or Vapourising Oil).

Adjusting Main Jet.

The main jet adjustment (13) is set before the engine leaves the factory and should not be altered without good reason. This adjustment is always somewhat sensitive on small engines, consequently it should not be altered more than one-eighth of a complete turn until the effect of any such adjustment has been carefully noted. (The shallow notch in the head is provided only to indicate the position of the screw). Always make this adjustment with the engine under load at normal full speed with the throttle wide open. It is not satisfactory to adjust the main jet when the engine is running light on the speed governor with the throttle nearly closed. Turning the screw (13) to the right, i.e. clockwise, will reduce the fuel flow and weaken the mixture supplied to the engine. Turning the screw anti-clockwise will increase the fuel flow and provide a richer mixture. **Do not force the screw into its seating as this will damage the taper,** thereby making correct adjustment difficult. If the setting is too weak it will result in lack of power and possibly overheating of the cylinder, together with poor pick-up or cutting-out when the load is applied. Do not attempt to operate on a very lean mixture, as better performance and fuel economy will be obtained if the mixture is set for full power. An excessively rich mixture will produce black smoke from the exhaust and will cause rapid carbon formation in the cylinder head and on the piston crown. Also carbon will quickly form on the sparking plug points resulting in difficult starting.

Adjusting Idle Speed.

The throttle stop screw (4) should be turned clockwise to increase the idle speed. Turning this screw anti-clockwise will reduce the speed at which the engine runs with the throttle in the closed position. It is usual to set the idling speed at 600—700 r.p.m. Smooth idling is ensured by regulating the mixture screw (3). In case of difficulty in obtaining satisfactory idling, make quite sure the gasket between the bowl and the barrel is in good condition and that the attachment flange on the barrel portion is perfectly flat. A thin gasket should always be used at this flange joint.

Flooding.

This may be caused by excessive vibration, dirt in the needle seating, or possibly by the tickler (5) sticking down and depressing the float. Should the flooding continue after cleaning and checking the carburetter, the next step is to fit a new needle seating (12) as this part is subject to wear as a result of engine vibration. Check and clean the filter gauze in the banjo fixing the petrol pipe to the carburetter. It is not intended that the petrol level should be altered.

120 c.c. and 220 c.c. with Amal.

The Amal carburetter (see Fig. 11) is tuned at the factory before delivery and the only point likely to require attention during running

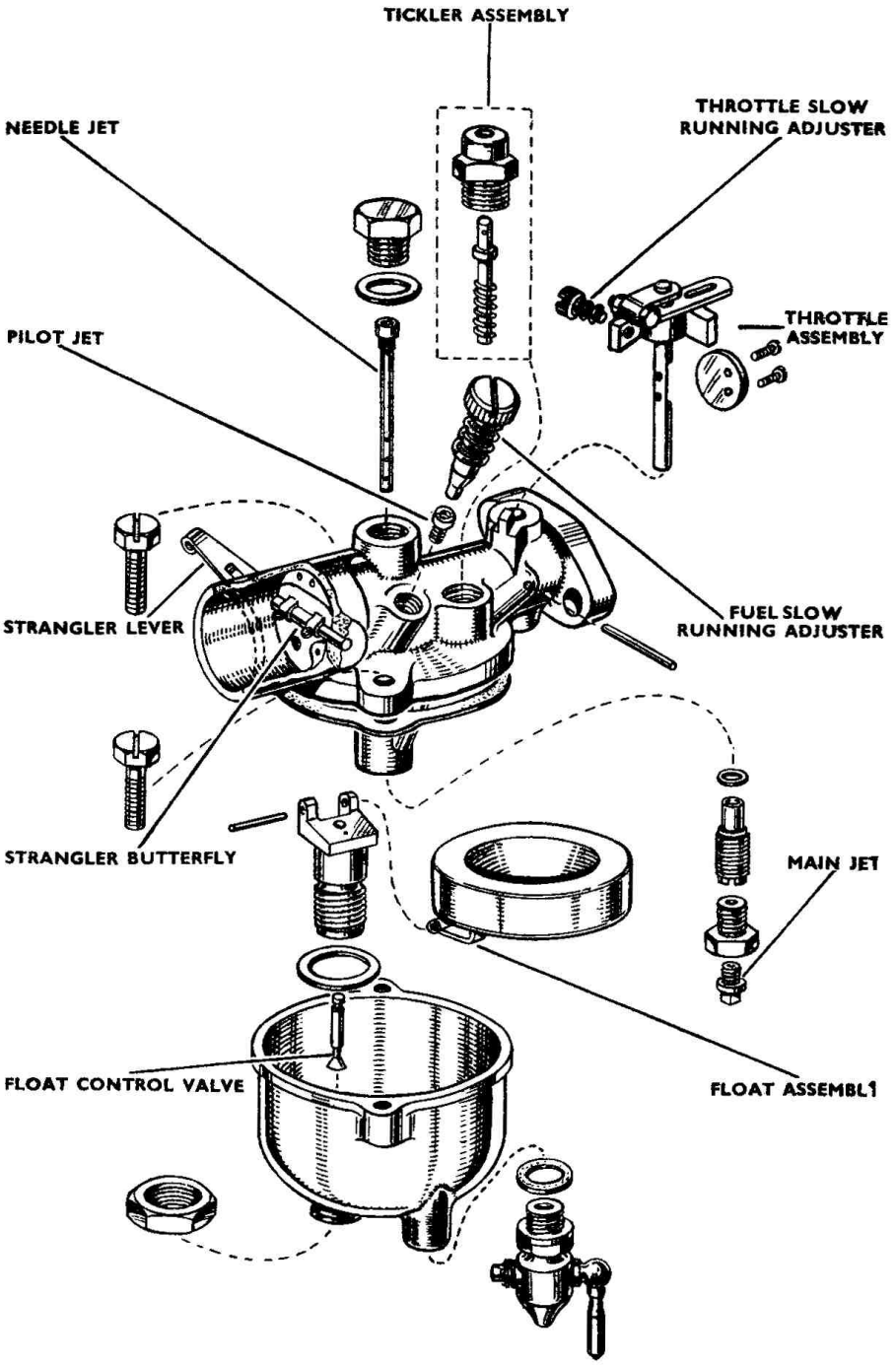


Fig. 11. The Amal Carburetter.

(The drain tap shown above is only fitted as standard with engines running on Power Paraffin or Vapourising Oil).

is the setting of the throttle slow running. This item is dealt with as follows:—

Slow Running Adjustment.

The throttle slow running adjustment screw is mounted on the throttle body, and limits the closing of the throttle, thus regulating the rate of idling. Clockwise rotation of the screw increases the speed of idling and vice-versa. In addition, the (air) fuel slow running adjuster is intended, within certain limits, to alter the amount of air supplied to the pilot jet. By rotating the air screw clockwise, the mixture is richened and vice-versa. An indication of the idling mixture can be assessed by the following rules:—

If the engine is missing intermittently, generally mixture is too weak.

If the engine should "hunt" mixture is too rich.

The method of slow running adjustment is as follows:—

Commence with the air adjuster fully screwed home, and the slow running screw set at the slowest tick-over possible, when the engine should "hunt" due to the rich mixture from the pilot jet. Then rotate the air adjuster, screw anti-clockwise until the engine runs evenly. As the engine speed will increase slightly it will be necessary to make a further adjustment at the slow running screw.

In exceptional cases, the range of the air adjuster screw is insufficient to obtain the results required, and a larger or smaller pilot jet, whichever is necessary to adjust the even running of the engine to normal must be used.

Air Cleaner (if fitted).

When engines are equipped with air cleaners the cleaner should be dismantled periodically, depending on the working conditions, cleaned and re-charged with oil. It is advisable to remove the air cleaner from the intake elbow first by slackening its pinch bolt.

The element should be thoroughly washed in petrol and allowed to dry.

The oil-wetted element can then be submerged in light engine oil for a few minutes, the surplus oil allowed to drain off and reassembled.

In the case of the oil bath unit the body must be emptied, cleaned and filled to the correct level with a light engine oil as indicated inside the body, then the element and top can be replaced (see lubrication recommendations page 12).

Centrifugal Clutch (when fitted).

The only bearing surfaces, apart from those between linings and drum, which, of course, are designed to run dry, are the pivots.

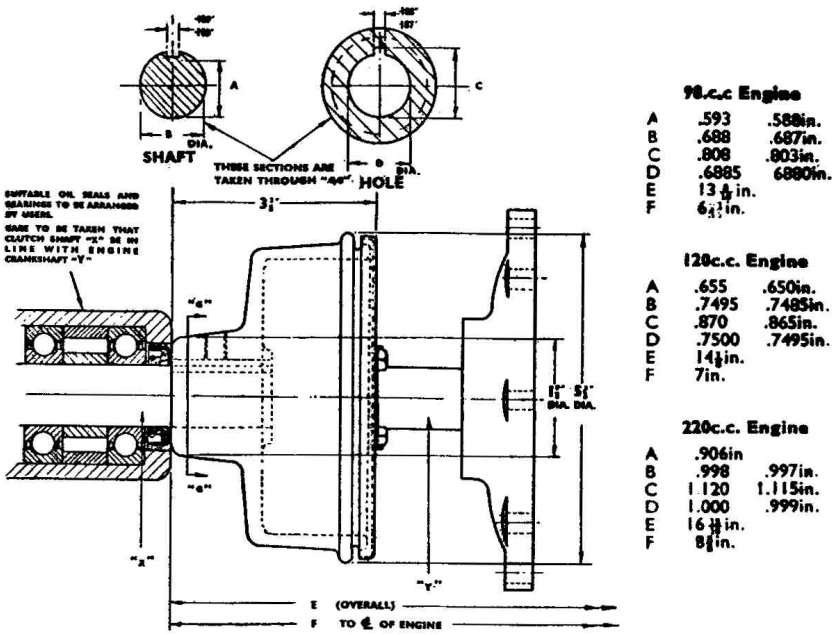


Fig. 12. Centrifugal Clutch.

the two shoes and these are provided with self-lubricating graphite-impregnated bushes which will require no attention whatsoever throughout their life.

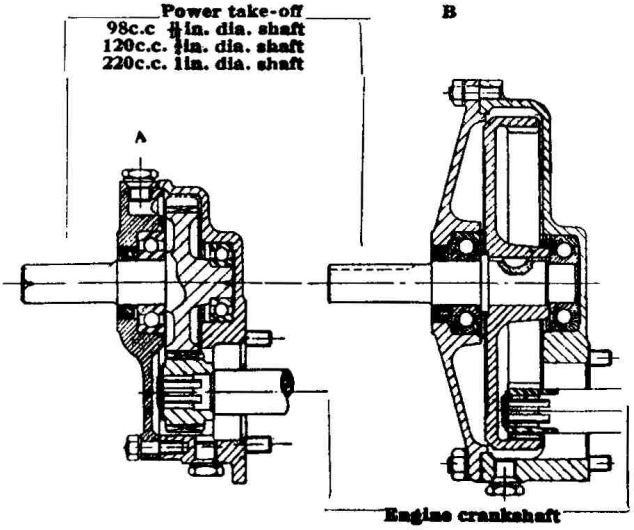


Fig. 13. Reduction Gear Units.

Reduction Gear Unit (when fitted).

The 2 : 1 and 3 : 1 units are practically identical. These two units produce a clockwise drive and can be fitted in one of four angular positions relative to the engine crankshaft to suit individual requirements (see A, Fig. 13).

In the case of the larger 6 : 1 unit the large driven gear has internally cut teeth and gives an anti-clockwise drive. This unit has three alternative angular positions (see B, Fig. 13).

See page 10 for correct oil level.

Note.—A drain plug is provided for each of the alternative positions described above.

Contact Breaker Points (98 c.c.)

The gap between the points when they are fully open should be .018—.020 in. Rotate the engine until the rocker arm (A) Fig. 14, is on the peak of the cam, then check the gap between the points with the aid of feeler gauges. If the gap is incorrect, slacken the screw (B) which locks the breaker plate (C) and turn the eccentric head screw (D) until the adjustment is correct. Then lock the plate (C) securely by re-tightening the screw (B). Finally re-check the adjustment.

Contact Breaker Points (120 c.c. and 220 c.c.)

The correct breaker point opening is .012 in. When re-adjustment is necessary, loosen the screws (B) and (C) Fig. 11, which lock the fixed contact plate (A), and move the plate until the correct opening of points is obtained. Then lock the plate securely. If the points need replacing, both the fixed and moving points should be replaced at the same time. On the 220 c.c. engine the contact breaker points are identical but are in a slightly different position.

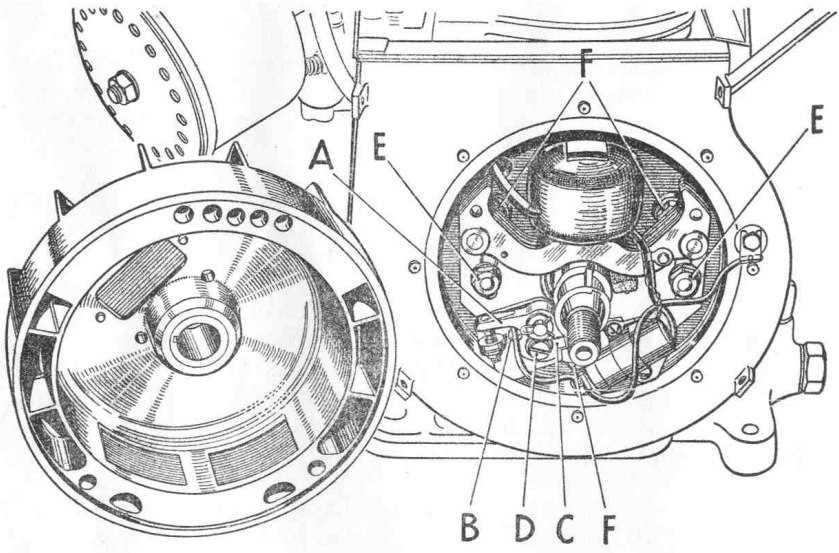


Fig. 14. Contact Breaker Points (98 c.c.).

To remove the breaker arm, take off the breaker arm spring clamp nut, lockwasher and clamp washer together with the breaker arm connections and pull the assembly off the breaker arm pivot. The fixed contact plate (A) may then be taken off the breaker arm pivot, after removing the fixed contact screws (B) and (C).

Instructions for models B/VO, C/VO, D/VO, B/PP, C/PP, D/PP, (V.O. or Power Paraffin Fuels).

A slightly larger main jet is required for V.O. (see Technical Data). Where power paraffin between 35 and 50 octane is used a low compression head must be fitted. It is necessary to start and warm the

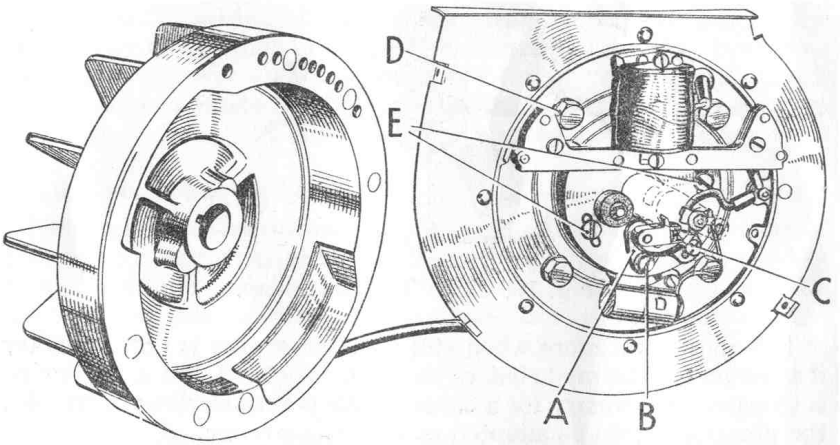


Fig. 15. Contact Breaker Points (120 c.c. and 220 c.c.).

engine on petrol before changing over to the heavier fuel. For this purpose the engine is supplied with an auxiliary tank to hold a small quantity of petrol mounted adjacent to the main fuel tank. These tanks are connected to the two-way tap and common pipe which eeds the carburetter.

The two-way tap which is used for the main fuel tank and the auxiliary petrol tank has two positions. When the lever is turned clockwise as far as it will go the petrol tank is connected to the carburetter, and if it is turned anti-clockwise as far as it will go the petrol supply is cut off and the main tank containing paraffin or vapourising oil is connected to the carburetter.

When starting from cold use the auxiliary petrol tank. Start the engine up and as soon as the engine is running at its normal temperature, switch the fuel tap over to the main fuel supply. The change over from petrol will then take place quite smoothly and imperceptibly as the float chamber empties and refills with the new fuel.

In order to ensure a correct supply of petrol in the carburetter for the next start after stopping, especially if an interval of time is involved which would allow the engine to cool off, it is desirable to stop the engine by turning the fuel off. This will allow the float chamber to be emptied in readiness for the next start up on petrol.

Alternatively, there is a drain tap screwed into the base of the carburetter float chamber, to facilitate draining of the carburetter. This tap is closed when the lever is pointing downwards and opened for draining the float chamber when the lever is turned to the horizontal position.

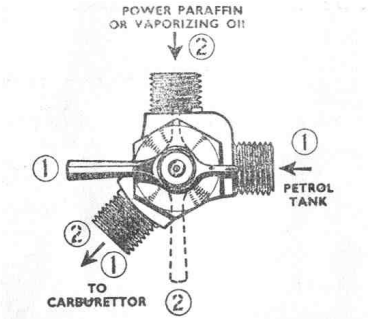


Fig. 16. The Two-way Tap.

The above procedure when stopping the engine is not necessary if a restart is to be made before the engine cools off, but if the engine is to remain stationary for a considerable period, such as overnight, the practice should be adopted as a regular routine.

Engine Stops or refuses to Start.

Carburation Trouble. Empty petrol tank—choked petrol pipe—air leak in fuel system—water or foreign substance in petrol tank—carburetter choke not functioning—clogged jet—choked filler cap bleed—carburetter float punctured or sticking.

Ignition Trouble. High tension lead detached—incorrectly adjusted or dirty plug points—plug insulation cracked or broken—plug insulation wet—magneto contact breaker points dirty, pitted or incorrectly adjusted—loose or detached electrical connections in magneto—defective condenser—defective magneto armature.

Engine runs unevenly.

Float control valve incorrectly adjusted—air leak in fuel system—governor controls damaged—governor spring incorrectly adjusted—plug points dirty or incorrectly adjusted—magneto contact breaker points incorrectly adjusted—loose connections in magneto—weak condenser.

Engine loses Compression.

Valves not seating properly—valves sticking in guides due to excessive carbon—piston rings stuck in grooves due to excessive carbon—cylinder head gasket damaged or cylinder head not tightened down.

Engine Overheating.

Oil level in crankcase too low—carburetter slow running adjuster screwed out too far causing weak mixture—restricted air flow round engine—engine overloaded—sticking or leaking valves—piston rings stuck in grooves—excessive accumulation of carbon—air leak at carburetter flange joint.

Engine Knocking.

Engine mounting loose—engine overloaded—carburetter adjusted too rich—flywheel loose—excessive accumulation of carbon—wrong fuel—connecting rod big-end bearing worn—gudgeon pin bearing worn.

STORAGE OF ENGINE

If the engine is stored for considerable periods (e.g. three months or more), the following precautions should be taken to ensure that it is maintained in a sound condition.

1. Grease all exposed levers and control rod joints, etc.
2. Remove sparking plug, turn engine over until piston is at t.d.c., at the end of the compression stroke to ensure that both valves are closed, and inject about a tablespoonful of thin oil into the cylinder and replace plug.

3. Store in a dry place and/or cover with an adequate waterproof sheet.

Before bringing engine into use again, attion should be given to the following items:—

1. Examine sparking plug for condensation, dry out and adjust as necessary.
2. Check that high tension lead is dry and sound.
3. Examine magneto contact breaker for condensation, clean and adjust as necessary.
4. Test all controls for freedom of movement, remove surplus grease and then oil.
5. Drain and refill engine.
6. Examine carburetter for presence of foreign matter and clean if necessary.

Service and Spares Facilities.

Spares ording is facilitated if the engine number is quoted.

This number is stamped on the crankcase under the carburetter between the mounting lugs.

Spare parts or complete Service Units and Illustrated Spares Lists are obtainable through your local B.S.A. Power Unit Service Dealer or direct from the B.S.A. Service Department, Armoury Road, Small Heath, Birmingham 11. A list of official B.S.A. Stockists will be found on pages 33 to 34.

POWER UNIT SERVICE DEALERS

The following is a list of appointed B.S.A. Industrial Engine Main Service Dealers offering spares and service facilities. In areas not covered by a Service Dealer further appointments will be made, but clients in these territories should, for the time being, refer their requirements to the Service Department.

Northern Area

Scotland	Southern Cylinder Grinding Co. Ltd., 55 Nithsdale Drive, Glasgow.
Westmorland **Cumberland**	West Cumberland Farmers' Trading Society Ltd., Clowers Engineering Works Penrith, Cumberland.
Yorkshire	W. Mountain & Son, Jackson Lane Works, off Victoria Road, Moreley, Nr. Leeds.
Northumberland **Durham**	Garden Mechanisation Centre 58-60 Scotswood Road, Newcastle-on-Tyne.
Lans. **Cheshire (except Wirral)**	Central Garage (Reddish) Ltd., 181 Gorton Road, Reddish, Stockport.
Wirral	J. Mealor & Sons Ltd., Burton Road, Neston, Wirral, Cheshire.

Midland Area

Lincoln **Leicester** **Rutland** **Notts.**	Boston Diesel Engine Co. Ltd., The Lockpit, Boston Dock, Boston, Lincs.
Derbys.	The Holden Engineering Co., Ascot Drive, Osmaston Industrial Estate, Derby.
Warwick **Worcester**	Henley Garages, High Street, Henley-in-Arden.
Northampton	B.S.A. Service Department, Armoury Road, Small Heath, Birmingham 11.

Stafford	Cars & Tractors, Belmont Road, Hanley, Stoke-on-Trent.

Western Area

North Wales **Shropshire**	E. B. E. Davenport, M.I.M.I., The Battlefield Garage, Shrewsbury, Salop.
South Wales	O. L. Davies Ltd., Baglan Plant Depot, Port Talbot, Glam.
South Somerset **Devon** **Cornwall**	F. Glass & Co., 10 Fore Street, Okehampton.
North Somerset **Gloucester** **North Wilts.**	W. L. Bartrop & Co., Market Place, Highworth, Swindon, Wilts.

Southern Area

Middlesex **Bucks.** **Oxford** **Berkshire**	J. Gibbs Ltd., Bedfont, Feltham, Middlesex.
Surrey **Sussex** **Kent** **London**	H. R. Nash Ltd., Craddocks Parade, Ashtead, Surrey.
Herts. **Essex** **Beds.**	Relf & Kendall Ltd., Station Road, New Barnett, Herts.
South Wilts. **Hants.**	A. Brewer & Co. Ltd., Wilton, Nr. Salisbury.
Dorset	J. T. Lowe, Longham, Wimbourne, Dorset
Channel Islands	Renouf Bros., St. Mary's Garage, St. Mary's, Jersey, C.I