Ac2 J Shipman

1694683

Hut B.20 RAF Locking

10d

IBCC Digital Archive

IBCC Digital Archive

BASIC NOTES

Hand Vice Body - steel with hardened jaws Screw - - mild steel.

Bench Vice Body - cast iron, malleable cast iron, cast steel. Jaws - detachable, hardened steel with roughened surface. Screw - mild steel buttress thread.
Classified by weight of jaws (45lb - 4½")

Hammers Head - high carbon steel faces hardened
Shaft - Ash or hicory.
1/ Ball Pane. 2/ Cross Pane 3/ Straight Pane
4/ Hide Faced.

Files Blade hard & brittle. Tang soft & tough
Shapes - Parrallel Tapered & Bellied
Sections - Flat, Half Round, Round, Three Square, Square.
Cut - Single Cut, Double Cut, Dreadnought, Rasp.
Grade - Rough, Bastard, Second Cut, Smooth, Dead Smooth.
In describing state, length, shape, Cut or Grade, Section

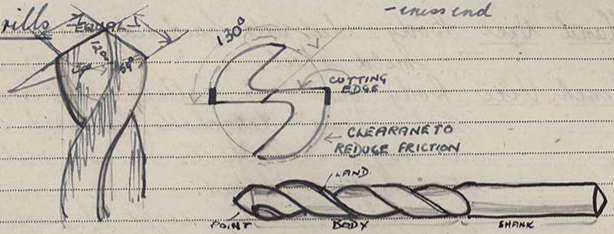
Chisels Forged from high carbon steel, hardened & tempered at business end, left rest is left softer & tougher
ground at 75° for hard steel 60° for soft & 45° soft metals.
Types Flat, Cross cut, Diamond point & round nose.

Hacksaws Frame, mild steel, Blades, High Carbon Steel.
22 to 32 teeth per inch for thin metal
14 " 18 " " " " thick "

IBCC Digital Archive

Material High Carbon steel H & Set the business end

Drills



Reamers High Carbon or Alloy Steel fluted to provide cutting edges

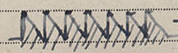
Types Fixed Parallel, Expansion, Expanding, Shell & Taper. RAF Taper Reamers are measured by their diameter 1/3rd of the length from the smaller end.

Threads B.S.W = British Standard Whitworth 55°
BSF = " " Fine 55°
BA = " Association. 47½°

American National Course & Nat. Fine.

Other Types.

Square Thread Acme Thread.

 - Buttress usually found in vices

Taps Made from hardened steel in three sizes - Taper Second, Plug.

A.G.S Parts Light Alloy - Mild Steel - Plain

High Tensile Steel -

" " Stainless as above only with the letters S.S or Z on the head.

Heat Treatment of Duralumin

Annealing (to soften) heat to cherry red and then ~~quench in water~~ allow to cool in air

Normalizing heat to between 480° & 500° C and then ~~quench & scrub to remove salts~~. allow to cool slowly with ashes or fire.

IBCC Digital Archive

PRELIMINARY ENGINES

Otto 4 stroke cycles

Strokes Induction to allow gases to enter cylinder

Compression which compresses gases against cylinder head.

Ignition lights gases which forces piston down cylinder.

Exhaust Valves open gases pass freely into air.

Inlet Valves opens 20° before T.D.C so as to be fully open in the suction stroke so as to keep up with the incoming mixture.

Exhaust Valves Opens before B.D.C to allow the pressure of burnt gases to fall by atmosphere, this prevents back pressure on the piston when it has to push the gases out.

Overlap is when both valves open together before & after at T.D.C.

Lead is when exhaust valves open before & after at B.D.C. Why? because it means greater efficiency to the engine.

Lag is when inlet valves remain open after B.D.C because it packs a greater mixture in the engine.

Valve timing on Gipsy Engine

1. Find T.D.C then D.O.R Exhaust valves always leads.
2. Turn crankshaft back 180° this puts inlet valves on back of cams.
3. Trap 10 thou feeler in rotor arm rocker & valve head.
4. Turn D.O.R to nip 5 thou feeler.
5. Take layshaft out to prevent crankshaft moving.
6. Turn 20° before T.D.C
7. Replace layshaft gear.
8. Turn back 45° degrees to remove backlash then turn D.O.R to 20° before T.D.C
9. Turn back 180°
10. Try 10 then feeler then reduce clearance to 5 thou
11. Then turn to 20° before T.D.C trying a 2 thou feeler.

IBCC Digital Archive

Magneto timing on Gipsy Engine

1. Find accurate T.D.C
2. Set crankshaft 34° before T.D.C
3. Check contactor breaker points with 12 thou feeler + or − 1
4. Innsulate primary winding ~~screw~~ by taking out centre screw and inserting oiled silk.
5. Then turn magneto in DOR until the brush on the rotor faces the segment in distributor cover connected to the plug in No 1 Cylinder and offer up to magneto drive & get final adjustment with Simms Vernier Coupling (19 teeth = 18·9° per t & 20 teeth = 18° per tooth) ∴ fine adjustment is ·9
6. Port Magneto is fitted first and it is different from the starboard magneto in as much that it as an impulse starter fitted. Turn through impulse starter (the impulse starter delays the passage of the space till just after TDC & also induces a hotter spark for easier starting)

Questions & answers

? What is clearance

Ans. Clearance is the space provided between 2 working parts

1. To provide freedom of the movement
2. Lubrication
3. Variation of size or position due to heat or distortion

? What is a housing

Ans Housing a hollow case the main purpose of which is to carry bearings or supports for working parts

? Splines

Ans Splines are a series of axial ridges on the outer surface seperated by grooves of rectangular section to fit into similar grooved counterparts

? Serations

Ans " are similar to splines but more closely spaced smaller & usually of different shape.

? Throw

Ans Throw is the distance between the centre of a crankshaft & the centre of the crank pin

? Stroke

Ans Stroke is twice the throw

? Backlash

Ans Is the clearance between machine gear teeth

IBCC Digital Archive

or splined members, which must be taken up before driving in the reverse direction

? Pre-ignition

Ans Is the combustion starting before the passage of the spark due to some over-heated part in the cylinder

? Volumitric Efficiency

Ans Is the weight of mixture drawn into the cylinder, divided by the weight of a cylinder stroke volume full of air at standard atmospheric pressure & temperature

? Supercharging

Ans Is the artificial filling of the cylinder on the induction stroke to a pressure greater than would have existed there.

? Bearing

Ans " is the part of a machine which directly rotates a rotating shaft

? Burr

Ans " is a rough or sharp ridge or projection at the edge of a working point or part

? Bush

Ans Is a hollow one piece bearing

? Cam

Ans " is a projection from a revolving shaft for the purpose of controlling the extent & rate of movement of other parts pressed against it.

? Bonding

Ans " is the provision of adequate conductors between operated parts of an engine to prevent any one part obtaining a higher potential than any other part with the consequent danger of sparking

? B·H·P (Brake horse power)

Ans " is the useful horsepower obtained by an airscrew

? I·H·P (Indicated horsepower)

Ans " is the H·P developed in the cylinder I·H·P = M·E·P

? Mechanical Efficiency

Ans " " is the amount of work done by the engine, divided by the amount of work developed in the cylinder.

? Screening

Ans " is the provision of earth conductors round ignition apparatus to prevent interference with wireless transmission & reception

? Compression Ratio

Ans Is the clearance + swept volume over clearance volume. i.e

$$\frac{CV + SV}{CV} = \frac{5}{1} = \frac{5}{1}$$

? Detonation

Ans " is the instantaneous explosion of part of the mixture due to:-

1. To high a compression ratio
2. Excessive boost pressure
3. To advanced ignition timing
4. Use of incorrect fuel.

Piston Rings

Only 3 shapes joints - Scarf, Butt, & Stepped joint

The scarfe above the gudgeon pin can be a U or channel type, channel is drilled with holes. On bigger type engines another line of holes is drilled through below the piston on channel type. On late type engines no U type rings, type fitted are dull ring scalloped.

The rings are pressed for elasticity. Rings made of closely grained cast iron.

Pistons are made from aluminium alloy.

The joints are split sometimes at 45° & sometimes 90° very brittle great care must be taken in removal & fitting.

The gap is tested by inserting in the cylinder & ensure it is square with the bore & measure gap with feelers.

Rings must be free to expand against cylinder wall. A small clearance is allowed between ring & groove to ensure piston doesn't nip ring.

A 45° champa is made on outer edge of ring to allow wear to fit piston.

Backlash

The clearance between meshing gears teeth or splined members, which must be taken up in the reverse direction before drawing.

Arbour An accurately ground shaft for supporting & keeping in exact alinement machine parts or cutting tools during machining operations.

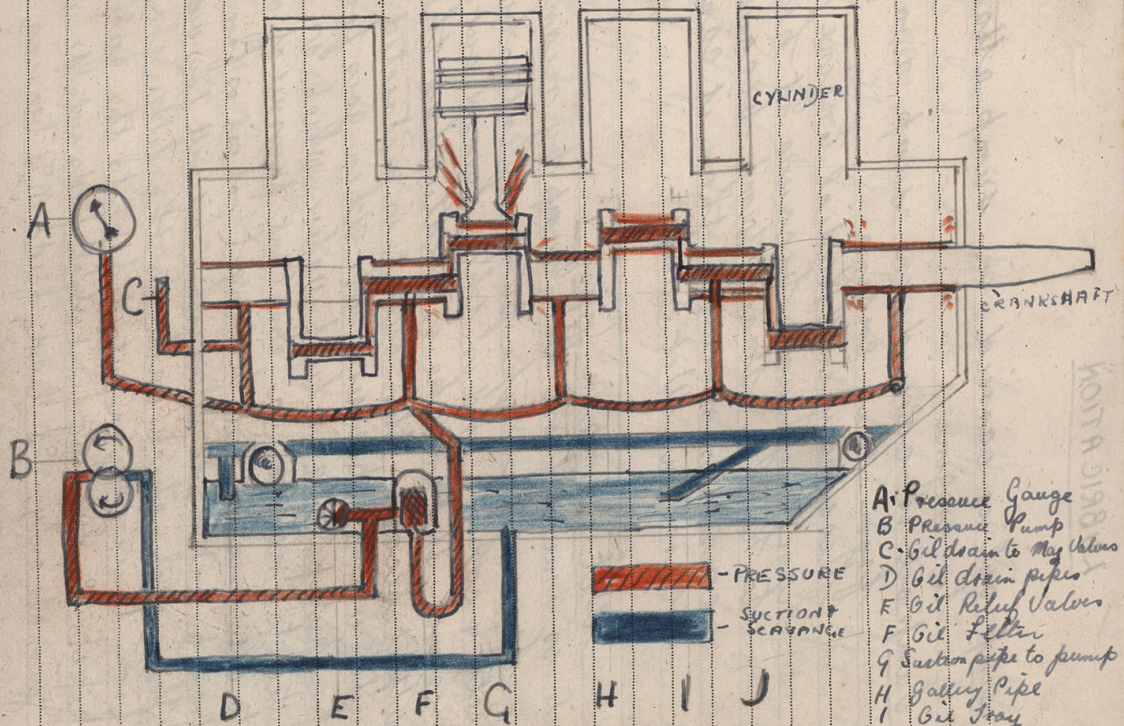
Bearing the part of a mechanism intended to support a roling shaft.

Bore the internal diameter of a cylindrical part

Shim a thin piece of sheet metal cut to shape used between 2 surfaces to adjust accurately their distance apart.

IBCC Digital Archive

LUBRICATION SYSTEM (WET SUMP)



A. Pressure Gauge
B Pressure Pump
C. Oil drain to Ng Valves
D Oil drain pipes
E Oil Relief Valves
F Oil Filter
G Suction pipe to pump
H Gallery Pipe
I Oil Tray
J Non Return Valve

IBCC Digital Archive

IBCC Digital Archive

LUBRICATION

Wet sump oil is carried in sump attached to engine

Dry Sump oil is carried in sump away from the engine

Messacaay in Radial Engine to have dry sump because it has to have a small sump. because it consumes more oil than it can carry in Wet Sump.

Wet sump in Gipsy I

Oil is drawn from the sump by means of a Spare gear type pump, oil enters between teeth & casing and is then forced out with pressure. The intake is greater than the output because the outlet is restricted to build up a pressure. It then goes from the pump to a relief valve which is fitted to maintain a constant pressure of oil to all pressure fed bearing (Good oil is free from paraffin wax. Always use oil with low viscosity) Then from check valve to the filter chamber from there by an outside pipe to the gallery pipe to N°1 bearing first which feeds outside Journal only, N°1 lead feeds N°2 bearing & Journal also N°1 & 2 crankpin & big end bearing N°3 lead feeds just its own bearings, N°4 feeds both & N° 3 & 4 crankpins, N°5 feeds itself.

Then from N°5 lead by a pressure pipe to Magneto drive, there is also a pipe leading to a pressure guage in cockpit. Pistons, gudgeons & cylinders are sprayed from a calibrated hole in big end bearing, the edges of oil hole champhored to stop them blocking. Camshaft tappets & guides are fed by mist & splash from the big end. Overhead gears for valves are hand pressure fed. Gears in timing case are fed by the oil running over them.

Dry Sump

The oil falls by gravity to a filter then from there to a spare gear type pump on which is the relief valve any surplus oil is passed back again to intake side, then past the check valve to pressure guage.

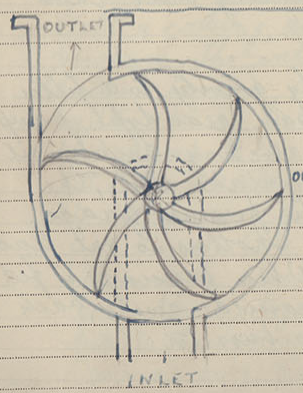
The Whole shaft is hollow so one lead can feed all bearings. When bearings is fed it drops down and is carried away, back by scavenge pump. to carburettor.

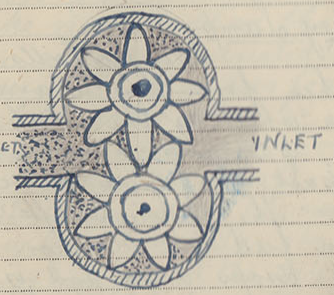
IBCC Digital Archive

TYPES OF PUMPS USED ON ENGINES

There is a pump known as a centrifugal pump these are effecient for cooling because they increase speed with the engine. When the pump is working with full throttle open it can pump approx 120 galls per min. The method to stop backspurg is to put restriction washers in block.

Fuel Pump is Diaphram.
Spare Gear Type for oil.
Plunger Type for oil
Excentric type pump is for oil





SPARE GEAR TYPE

INLINE ENGINES (THINGS TO SWAT)

1. Setting of tappet clearance
2. Changing broken valve springs
3. Priming crankshaft with oil
4. Cylinder Numbering
5. Cleaning agents
6. Timing & running clearances
7. Magneto timing & procedure
8. Tappet clearance & external connections
9. Inserting scraper rings
10. Examining & fitting airscrew hubs.
11. Direction of rotation of crank.
12. Layout of coolant system.
13. Repacking pump gland.
14. Prop. hub centralizing cone & locking sleeve.
15. Relationship of stroke to throw.
16. Measuring backlash of gears.
17. Grinding valve faces & seats.
18. Testing crankcase.
19. " faces & determing joint ring thicknesses
20. ~~Mg~~ Mag timing.

IBCC Digital Archive

RADIAL ENGINES

1. Changing broken valve springs
2. Oil pumps
3. Position of nipples
4. Removal of pushrods from rods
5. Setting of tappet clearances
6. Cleaning joints
7. Finding highest dwell
8. Checking angle of attack
9. Jointing material
10. Hand oil pumps

COOLING SYSTEMS

Cooling system is necessary to remove the surplus heat which would have otherwise caused trouble by destroying the properties of the lubricant and by distorting the working parts. So much cooling leads to a loss of power & irregular running, a constant normal temperature is desirable.

AIR COOLING

The air rushing over the exposed surface of the cylinder & cylinder head carries away the heat. To get rid of the heat quicker fins are provided of large area but small thickness.

Control of air flow is effected by cowlings, moveable shutters or gills the details differing from engine to engine. Sometimes a thermometer in the cockpit records the cylinder head temperature.

LIQUID COOLING

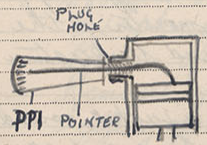
The liquid contained in a jacket round the cylinder & cylinder head absorbs the heat and carries it to a radiator which has a large surface exposed to the air. Here the liquid is cooled & carried away by the air, then the liquid is returned cool to the jacket. Circulation is effected by a small centrifugal pump driven by the engine, by speeding up the flow less liquid can carry away the same amount of heat. Drain taps are provided at the lowest point in the system to ensure complete drainage when required.

TYPE OF LIQUID USED

The liquid coolant used may be plain water, ethylene glycol or a mixture of the two. Ethylene Glycol has a higher boiling point & lower freezing point than water, a higher working temperature can be used without loss of coolant through cooling & damage by heat is prevented. The higher temperature of working makes the use of smaller & smaller radiator possible. Water if used by itself must be pure & soft: rain water is best, failing that the water must be tested for its hardness & treated by the necessary chemicals.

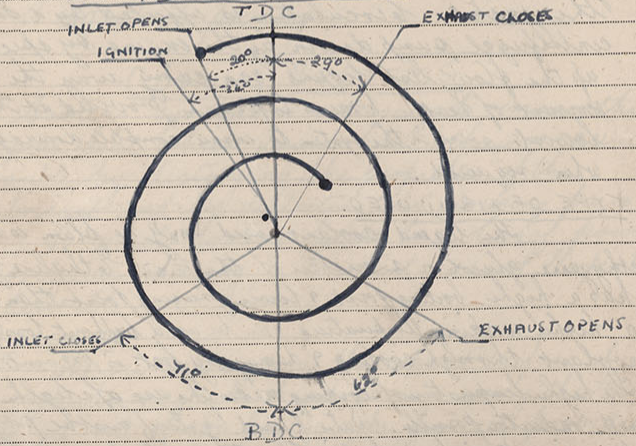
IBCC Digital Archive

HOW TO FIND T.D.C (P.P.I METHOD)



(a) a spring loaded lever pivoted in a block which screws into the plug hole is used, one end bears the piston the other moves over a scale. If the engine is turned till this pointer moves to its extreme position on the scale the piston is approx at T.D.C.

TIMING DIAGRAM ON GYPSY

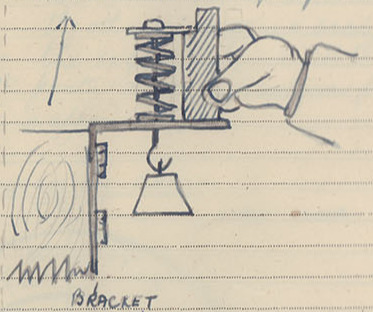


IBCC Digital Archive

ATTENTION TO VALVES & SEATS

The springs must be tested eg. for strength, the test consists of loading spring with specified weight & noted that it has not compressed to less than a specified length.

The valves are examined for pitting & burning on the sealing face badly affected valves are reconditioned by a special grinding machine slightly affected valves are lapped to their valve seat



The valve seatings may be pitted & burned. Special cutters are used to remove bad pitting, slight pitting is removed by lapping. Note:- when reconditioning the valves or seatings is done, always check the dimensions using the appropiate guages.

Lappings consists of rotating the valve forwards & backwards on its seating with a small amount of abrasive between. The valve should be held firmly on seat to help the abrasive to work (a special tool is provided) every few half turns it should be lifted & placed in a different position. This helps to stop the formation of hollows. The lapping is continued until the whole face is making a perfect seating as tested by marking with a thin coat of liquid colour. Every trace of grinding paste must be removed when finished.

GASKETS & JOINTS

Sometimes called joint washers are thin sheets of metal cut to shape & inserted between the face to make an airtight joint. (Aluminium & Vellumoid are a sandwich of asbestos rubber & other materials. Jointing compound is a sticky substance to form airtight joints. Where accuracy of joints are necessary dont use a gasket but a very thin coating of jointing compound.

GEARS

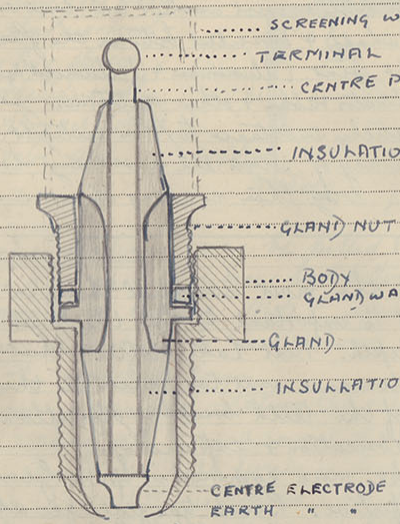
Alinement is the most essential thing in fitting gears. also it is important to see the mesh is the right depth. Next take notice that the backlash clearance isnt too much or there is the danger of the teeth breaking off, allow just enough for lubrication & expansion.

The type most common is Spare Gear which are very effective. Bevel type gears are at an angle. Ethel types are Worm Gear, Helical Gear

IBCC Digital Archive

& Skew Gear which is very awkward because it will only drive one way & also there is a terrific amount of friction. Epycyclip Gear is an combination of gears to drive the airscrew

SPARKING PLUGS



Body - Machined steel with hexogan for spanner one end of body as earth electrode, also has an internal thread for the centre of plug which is called the centre assembly. There is a small gap at the end of the centre pin to keep it off the earth electrodes, also the centre pin as a copper sleeve & ~~the~~ insulation to keep it off the body. The material used for this insulation is mica or the present day aluminium oxide which is white, but plug makes colour it for identification purposes The gland of the plug assists in making a gas tight joint between centre Assembly & the body, Also between gland & body is a washer usually made of iron soft, copper, phosphor bronze & nickel, but in Mica insuall a copper sleeve is used. In modern types of plugs we have what is called a ~~steel~~ screen which is an extension from the gland nut in form of a tube to cover external insul. the reason for the screen is where radio is used. On inner side of screen there is a Mica lining to prevent H.T current from the terminal to the screen itself. The part of the plug in the cylinder gets a

IBCC Digital Archive

carbon coating, but in cases of Aluminum Oxide insul. it burns itself clean.
In using sparking plugs they have to be cleaned every 30 or 40 Flying hours.
Most common makes of plugs used by RAF. are Lodge K.L.G & A.C Sphinx.
The Al. XIDE type plug is called Ceramic type. In order to fit different engines there are 3 sizes in millimeters 12-14-18

Cleaning & testing of Mica Type

Cleaning, inspection & testing are 3 very important items. All Aero engine plugs are made demountable ∴ a bench jig & stock & die nut must be used to dismantle & assemble. Mica type plugs, never mix up parts of plugs because they are not interchangable.

Wash all parts in lead free petrol type used is DTD224 then proceed to clean plug parts on Plug Cleaning Machine a split collet is provided to hold the plug in the chuck of machine. Clean insul. with No. 0 Glass cloth & oil after this repolish with Crocus Powder & oil then for a final polish use rouge & oil or chamois leather which must be dry.

To clean carbon out of body of the plug, use wire brush or scraper.

Inspection

Look for damage to thread & hexogans, cracking of metal parts & security of electrodes & condition of mica insul.

Testing

1st test is called insul. test of centre assembly (Insul. test ring) to set gap of test ring insert ring guage the "not go" end should rest on the points & the "go" end should drop thro, spark jumps across gap is plug is clean & insul.

2nd test is for gland leakage.

replace new washer every time the plug is dismantled. Test on gland leakage tester. Insert plug then pump up tester 100 lbs per sq inch, then immerse plug in a beaker of Sozol if it bubbles relighten plug in bench jig if it still bubbles plug is U.S.

3rd Test is sparking under pressure test is carried out on Spark Plug Tester

IBCC Digital Archive

pump up tester up to 100 lbs 100 lbs per □ inch window to look in for protection of flying glass. Then apply H.T current on plug terminal, observe sparking earth electrodes & centre pin failure to spark at 12,000 volts means a V.S plug.

Mark all VS plugs with red paint.

~~MAGNETOS~~

Ceramic Type Plugs

Aluminium Oxide which form insullation goes through a process of cindering which means a very high temperature. The above plugs are sometimes called Cinder Aluminium Oxide Type, it is very hard & as a high melting point up to 4000° C it also wont burn & will not allow H.T Current to flow through it & it is not affected by fuel which is used in modern engines. Insullator is light coloured. KLG are White LODGE pink, AC Brown for recognition.

It is very little different in construction from Mica Type & when run at very high temperature any deposit on insullator burns off.

Three main items are Cleaning Inspection & Testing. Sand blast cleaner for plug with 1 lb Silver Sand in it. Four precautions when using 1st Correct air Pressure 2nd clean it only for 10 seconds maximum time. 3rd Apply compressed air intermittantly. 4th Rotate plug while cleaning. Body is cleaned with sand blast as above.

Inspection Much as on same line as Mica Type. Inspection Thread, Hexagon & Body for cracks also insullation, screen & mica-lining & gland washers.

Testing is carried out in 3 stages as later type.

1. Assemble on Constant Torque Fixture with weights as specified.
2. Gland leakage test @ 150 lbs per □" with white spirits DTD 224.
3. Sparking under pressure @ 100 lbs per □" constant sparking at plug electrodes.

Marking Etching Pencil, centre punch △ file, red paint for VS plug.

Life 180 Flying hours
Inspection 30, 60, 90, 120, 150, 180
Cleaned ↑ ↑
Gap Setting 15 thou gap on all plugs is standard distance. Errosion is the burning away of electrodes in order to check gap a gap guage is used 12 thou at one end & 15 thou at the other.
1. Oval Centre Pin applys only to 12MM. Micro Type
2. Hammer & Pin Punch for Heavy Nickel Electrodes
3. Gap Setting disc & setting tool
4. Lodge tube & lever
5. KLG Composite Gapsetting tool
6. AC Gap setting Pliers

High Voltage test of Breeze Harness Insullation
1. High voltage test plug.
2. Earth body of H/S Mag to A/F
3. Connect lead to dist. segment & place plug on appropiate plug connected
4. Turn H. Starter Mag Indication:- constant sparking = good innsullation.
5. Test all leads same way.

Old type CISE End of block is split like clamp. first stacken lockingnut, then clamping screw and adjust to ·012.

DISTIBUTOR CLEANING AND INSPECTION

A CLEANING
1. Wash in lead free petrol.
2. Wash in hot water 70 to 80° C
3. Rinse in fresh hot water
4. Dry thoroughly

B INSPECTION
1. Inspect block for warping, distortion cracks & clearness of vent holes.
2. Insput segment & rotor brush for excessive burning & corrosion
3. Check for good connection of H.T Leads (Lamp & Battery or Visual)
4. Check width of auxhilary spark gap ·011 to ·019 is correct width

Lubrication of Magnetos
C.I.S.E
1. Inductor rotor & distributor rotor ball bearings are grease packed by makers or M.O. Sufficient for 500 FH.
2. Rocker arm wick 1 drop of oil at 1.1.0
3. Cam lubricating pad is grease impregnated

IBCC Digital Archive

and is changed complete with chip every 120 hrs

4. Contact Breaker base spigot wipe clean & reamer with lightly with grease H.M.P at 1.1.0.

N.B Always refer to instruction. above all. avoid excess. The oil used. is D.T.D. 109 Winter Grade

BREEZE & MARCONI HARNESS

4 Millimeter Lead for low voltage current.

9 Millimeter Lead consists of stranded wire which can be copper but latter type is stainless steel, round that is wrapped pure rubber & round that a coating of vulcanized grey rubber & on top of that is wrapped cambric tape & a layer of metal braiding which keeps in magnetic field when current is passing through.

Continuity & Insul Test of H.T. Leads

Put lamp on each end of lead & take out the 1 ohm Holmes resistance block if lamp lights it a good lead.

Insulation Test as on Plug Bay

Advancing & Retaring Magnetos

1st method contact breaker.

Run normally in advanced position meaning the engine is run at high speed.

To advance move base opposite DOR

To retire " " DOR.

Advancing moves contact breaker round cam. advancing opening of points.

But it affects inbuilt timing & gives weak sparks when large are required.

Automatic Timing Device.

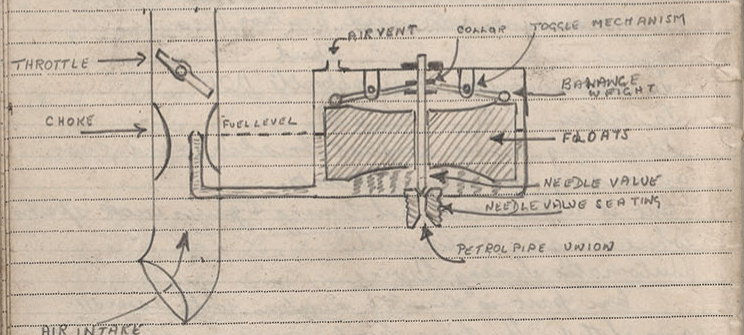
One part is driving member with 2 small cams fitted. The driven member as 2 weights with 2 small rollers also a screwed coupling for small measurements. Used for advancing mag in relation with the engine. Advantage does not affect inbuilt timing. Keeping advanced all the time

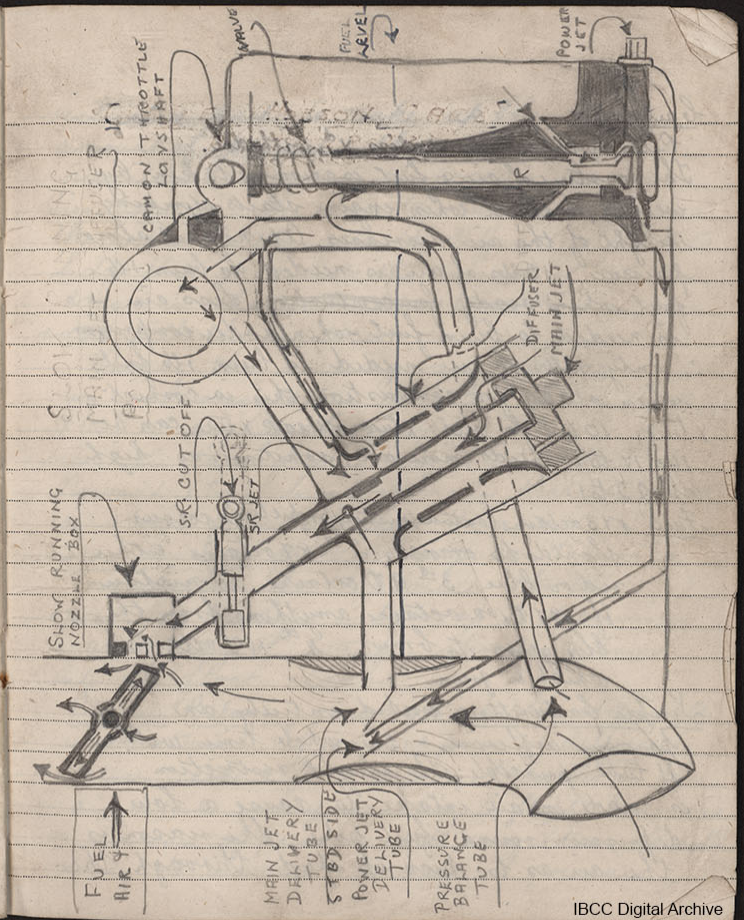
HS Magnetos

2 Sparks per revolution, every time handle is turned the E.B points turn 2 times i.e. 1 turn of handle gives 10 sparks this is operated by gears inside mag. From mag there is 2 leads to dist rotor of main mags.

IBCC Digital Archive

CARBURETTOR'S





IBCC Digital Archive

IBCC Digital Archive

Carburettor

Petrol wont burn unless x^d with air.
The mixture of air & fuel is always taken by weight, because when engine starts climbing weight of the air decreases. At normal atmos pressure 15 lbs of air is needed to burn 1 lb fuel ~~when ready for combustion~~. Less air is needed to burn fuel when under compression ∴ only 13 lbs of air needed to burn 1 lb fuel when ready for combustion this is correct x ture. 10 to 1 for rich x ture. Weak x tures can be 16 or 17 to 1 needs more air, sometimes as high as 22 to 1.

Fuels ~~of~~ 73 octaine (anti-detonation properties) colour should be orange. 2nd 87 octaine either red or blue. 3rd 90 octaine is mixture of 87 & 100 octaine anything from the blue green to brown. 4th 100 octaine which is green.

Simple Carburettor worked entirely on pressure differences the whole time with U tube principle. A slight restriction is made in air intake to cause a low depression round fuel pipe. The reason is the air as to pick up speed through the restricted part to make up the same amount of pressure the other side, this resistance is called the CHOKE or VENTURI.

Disadvantage the more the throttle is opened the richer the x ture gets. A Diffuser is fitted to help this it controls the amount of mixture drawn in the air intake to make an even ratio with the air drawn in.

During the cruising range flying is done on economic x ture 14-15 to 1, with a weak x ture a slightly slower spark because of more air than fuel ∴ ~~mag~~ as to be advanced. Normal x ture burns normally. Rich x ture gets a slower flame rate than the normal.

Slow running pilot jet is put in to give a correct x ture for very small throttle openings. Pilot jet is taken up to depression against edge of butterfly throttle & down into the float chamber.

Pressure Balance gives 13 to 1 mixture strength is maintained by constant pressure difference between choke & float chamber. Pressures in the air intake vary according to flight. Increase or decrease of pressure will vary x ture strength owing to increase & decrease of pressure

IBCC Digital Archive

Float chamber & air intake are joined together by pressure balance passage, thus ensuring constant pressure difference.

CLAUDEL HOBSON CARBR A.V.T 80.B

(A.V.T Aero Vertical Twin) vertical means up draft. 80 is the diameter of the throttle tube in millimetres. It is a double carbR made in 2 halfs the joint is made of wellmaid glass jointing compound. Bottom half are 2 pipes which leads to the float chamber these are the Pressure Balance Passages. There are 2 float chambers because when the aircraft banks the centrifugal force isn't enough to keep the fuel at the bottom, the 2 float chambers doesn't allow 1 fuel pipe to starve. The floats are made of cork in 3 layers (a laminated cork float). The needle valve is made of stainless steel. In the base of each float chamber there is what is known as a Main Jet Wells which are put there to collect all foreign matter which might get into the jets & block it up. Before removing plug for cleaning ascertain the fuel is turned off. Secondly have a receptacle handy for the fuel which will drain out of the chamber. By removing the whole of the main jet well you can remove the main & SR jets without splitting the carbR. To clean jet revise out in fuel if it then can't clean apply compressed air reverse direction of flow. Don't use any metal to clean out the calibrated hole. The washer on top of the jet well & should be renewed each time (made of cork).

SLOW RUNNING

The slow running jet is only a small restriction in the tube itself the whole thing is screwed into the main jet which is screwed into the diffuser body. The body is screwed into the top half of the carb. The top of the SR tube is connected to the SR Nozzle box. In between Butt. Throttle & throttle tube is clearance of 6 thou when engine is slow running. The only way the fuel can get into the SR jet is through the M. jet holes. The depression exists throughout the whole length of the throttle this is when the engine is SR. Before the fuel gets to the nozzle box there is some

IBCC Digital Archive

air already x^d with it through a hole in the tube which is put there to vaporize the ~~the~~ fuel before it arrives at the box. You also get a very rich ~~x ture~~ vapour from the bolt to the top through the air coming in from the main jet. The fuel goes evenly through the holes in the throttle & so gives an even distrib. of the x ture. Slow running x ture is rich for 2 reasons. 1st we require a rich x ture to get a very even burning rate as the engine is only taking over slowly. 2nd is because of condensation when the engine is cold. The x ture a SR is rich enough to start with so that by the time it reaches the cylinder it is correct. When the engine is hot you do not let it stay SR because of rich x ture doing damage to the engine.

When the throttle is opened up the depression will fall on the lower hole in the mixed box. The second hole is put there for more of an overlap between jets so as there are no flat spots. The fuel will flow through both holes until the lower choke depression is great enough to draw the x ture through the main jet.

Slow Running Cut off is for stopping the engine providing the throttle is in the slow running position. The waisted portion does not cut off the x ture but when pulled out a wider portion at the end stops the flow of the x ture. Pull the cut out knob then stop the flow of the x ture. If engine catches fire cut off fuel & then open the throttle. Fuel must not be cut off damage to the fuel pump which is lubricated by the fuel flowing through it.

Main jet & Diffuser forms 3 functions

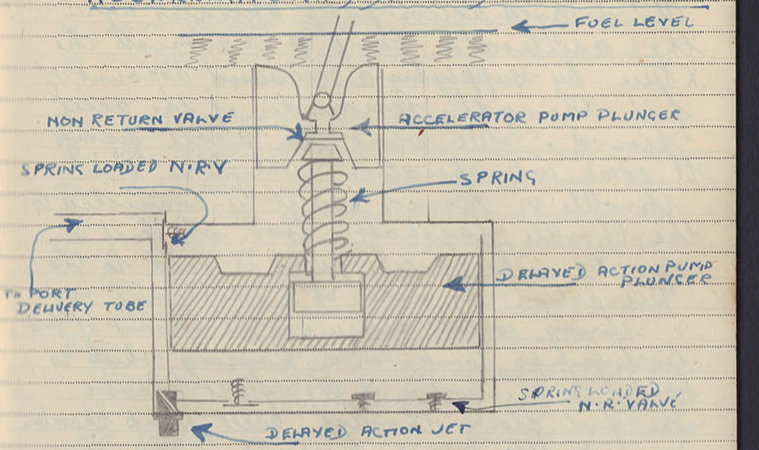
1. It corrects the flow for all throttle openings after slow running.
2. It vaporizes the fuel from the main jet
3. It provides a reserve of fuel for acceleration.
4. As throttle opens depression at choke & diffuser draws air through P.B.J. which picks up the fuel in vapour form.
5. As throttle opens level of fuel will drop in diffuser because the engine is demanding for more fuel than the main jet will pass ∴ more holes are uncovered in diffuser this

lets in more air to break down the depression & ∴ break down the fuel supply this happens only on cruising range. The diffuser helps prevents you getting to rich a mixture when you open the throttle. In the cruising range the main jet is calibrated to give us an economical X turn.

RATING is the maximum power position.

POWER JET comes into operation when the lever is moved from cruising to rating. The additional fuel wanted to mix with the change of air due to the opening of the throttle at maximum speed. The power jet is operated by means of a cam and the throttle layshaft. It is so timed that when the lever is moved to rating position in the cockpit a cam works on the valve head. as the cam is pressed down the valve opens & allows fuel to pass thro' a waisted bolt & by pipe to the choke. The power jet is always delivered from the starboard side.

ACCELERATOR AND DELAYED ACTION PUMPS



When engine is running at any throttle opening we should be producing from carb^r. 15 to 1 ratio. Acc. Pump if fitted to overcome a flat spot, when the throttle is opened, ~~the air increases its weight of flow~~ caused by temporary weakening of the blue due to the fact that when the throttle is opened the air increases its weight of flow very much faster than the fuel does. The acc pump is provided to mass discharge the fuel to overcome the

IBCC Digital Archive

temporary weakening of the mixture.
The delayed action pump operates after the accelerator pump & it corrects the X ture by supplying a measured amount of fuel during the remainder of the accel period. We want the accel pump to come into operation everytime the throttle is moved so it is connected to the throttle layshaft from which it is operated. The accel pump is held to the Del. action by means of a distance rod & spring which measures the amount of fuel Both pumps works in a housing which is bolted to the bottom of the float chamber. The fuel flows through accel pump chamber down to the D.A pump chamber from then it can go by a duct to a N.R Valve underneath & into the bottom of the D.A from there it is delivered through a N.R. Valve by a duct to the port delivery tube. The fuel on top of the pump is also delivered to the ~~top~~ port chamber by means of a N.R. Valve. The pressure that holds the D.A pump back is the fuel having to go through a very small hole, with the pressure of the top

S.L valve pressing & holding it back but as soon as the fuel between the 2 valves is released. it then comes into operation

MIXTURE CONTROL ALTITUDE

As the aircraft climbs the density of the air decreases this gives us a rich X ture. So we have to cut down the amount of fuel supplied this is not weakening the X ture but correcting the weight of both are in direct relation with each other.
There are 3 types of mixture control.

1. Variable jet type fitted so ~~as~~ to SU Carb^R & is entirely automatic, its worked off the old barometer principle, fuel is controlled as aircraft climbs the needle is lowered into the jet further & controls the amount of fuel supplied.

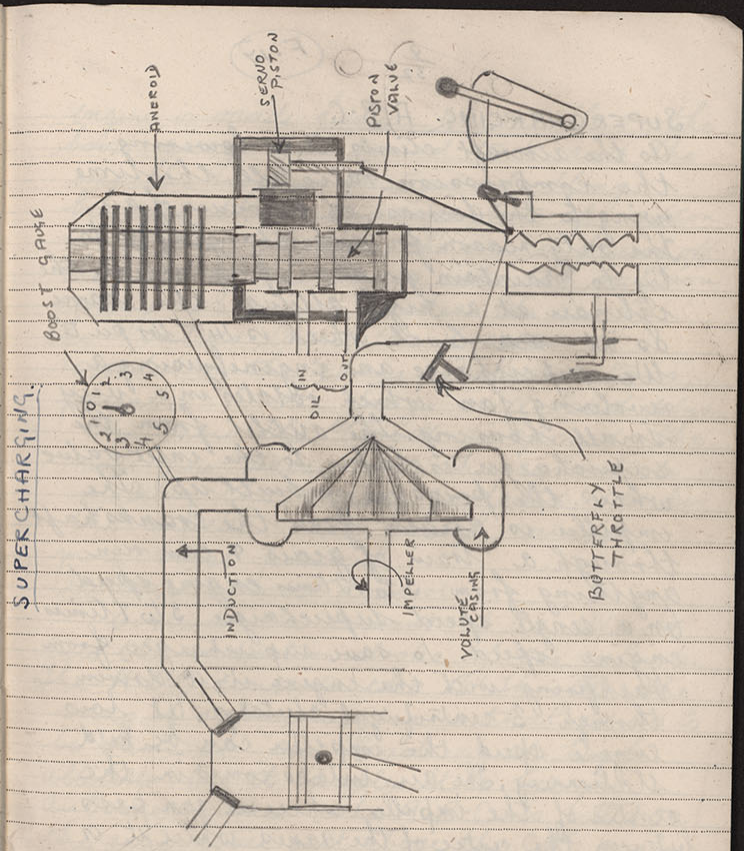
2. VARYING AIR PRESSURE CLAUDEL HOBSON

Air leak or bleed type On modern carbs the X ture is controlled automatic. In this type we break down the depression over the diffuser by allowing the air from the pressure balance passage to leak through a mixture control cock. The pressure

IBCC Digital Archive

passage leading to the centre of the cock as the cock is rotated we can bring the 2 square holes opposite 2 others in the cone & from this they lead down to the area above the diffuser. So it depends on the opening of the cock on how much air is let down over the diffuser. As the aircraft rises the cock is Automatically opened & more air gets into the diffuser i.e. breaking down the depression but the amount of air must be calibrated otherwise the fuel would cease to flow.

Vacuum Type comes into operation at roughly about 15000 ft when the control cock is coming into the fully open position vacuum type is automated bought into operation, the small hole comes opposite the small duct leading down into the float chamber. This cock is operated from the throttle control layshaft.



IBCC Digital Archive

IBCC Digital Archive

9/32 (F.14)

SUPERCHARGING A.B.C

As the aircraft climbs it is lowering the compression ratio all the time owing to the decrease of pressure of air. The only reason for supercharging is to try to maintain a same pressure in the cylinder at a high altitude the same as at sea level which is 14.7 lbs per □". We supercharge an engine by using a revolving fan which rotates in a very small housing. The outlet from the supercharger is taken to the inlet valve where the pressure is built up. The impeller is driven from the crankshaft through a train of gears & can run anything from 5 to 12 times engine speed On a single speed supercharger 5 to 7 times engine speed. To save supercharger from backfiring with the engine it is driven through 3 centrifugal clutches. At low engine speed the impeller can be held stationary. The air intake comes in the centre of the impeller where it can pass between the centre of the vanes where it is thrown into the casing as soon as the engine is made faster the needle on the boost gauge goes round to + and the impeller howlves instead of idling because the gears come into operation. When this happens the air is flung off the end of the vanes into the balloon casing where it pushes the air to the valves, then the pressure is recorded on the guage, 0 being atmos. pressure : the guage will read plus.

The more the throttle is opened the more gas passes into the cylinder : making the engine go faster & makes the impeller run faster causing more boost pressure.

Automatic boost control

controls the amount of air allowed into the induction stroke of the cylinder. The A.B.C controls the B. Throttle. The snag of supercharging is that it as to be same at sea level as at high altitude but it enables it to become airborne quicker. The A.B.C is fitted on the rear cover just above the C.R. main components :- a bevel which fits into

the aneroid chamber and that is fixed to the lid of the chamber, attached to the bottom of the aneroid is the piston valve which works in a sleeve (on one side of the casing is a cylinder wherein a Servo Piston works, the union on the side is joined up to the inductor system of the pressure side of the supercharger. Pressure oil is fed into the system by 2 holes the top onto let in oil & the bottom to the scavange. The A.B.C is adjusted to the amount wanted by the engine. Screw in for high boost & out for low.

The time when the throttle is full open at rated altitude is the height to which the engine can maintain its Sea level power.

To obtain maximum power for take off we override the boost in other words we give the engine more boost pressure than it was originally designed. To do this we push the whole aneroid & piston valve down by means of a lever which presses on top of the aneroid i.e opening the throttle. It takes more pressure to bring the piston valve back to normal position when the aneroid is depressed.

Detonation will set in with overriding the boost, it is cured by cooling the inside of the piston with fuel. The x tree is connected for take off with the Enrichment valve. Jet & provides additional fuel for internal cooling of the cylinder a rich x tree as a slower flame rate than a normal x tree this cuts the temperature down.

Enrichment jet cam, spring loaded valve same as power jet, it is on the port side of the float chamber, into jet housing, when the valve is compressed by cam, it allows the x tree to flow to the jet in the port intake. Boost override & Enrichment jet are both operated from the x tree control layshaft. To overcome any detonation the enrichment jet is brought into action before boost override.

Adjustments

Slow running is a small screw on the end of the butterfly throttle shaft (on port side) this adjusts the slow running speed by

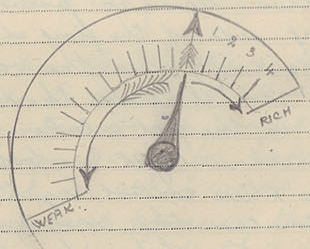
IBCC Digital Archive

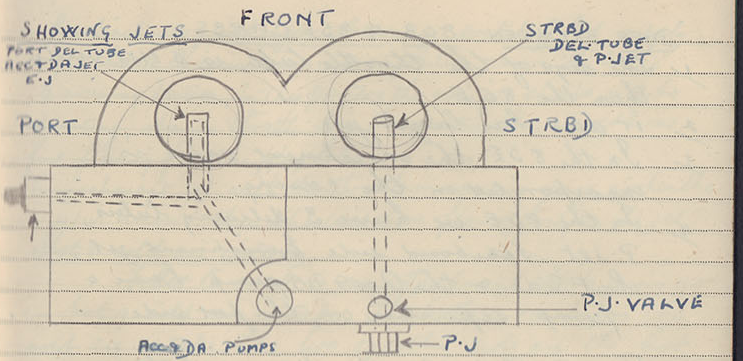
varying the gap between butterfly throttle & throttle tube. By screwing it in the gap is made wider ∴ letting more fuel in making the engine go faster.

Power jet adjustment adjusted to come into operation at 42° of butterfly throttle opening, adjusted by means of a serrated ring

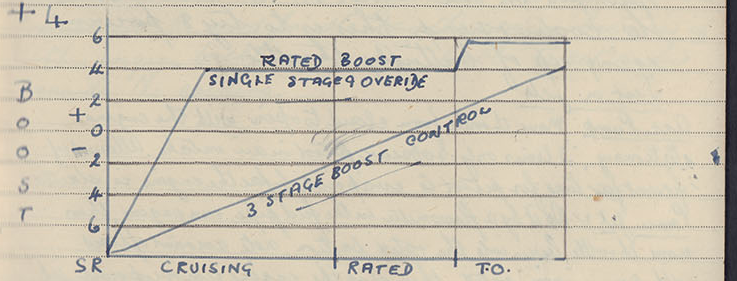
Boost override is timed to come into operation at take off after the enrichment jet, it E.J is timed to come of 2 marks after arrow

1 = Cam on E.J VALVE 3 = forks just on arrows
2 = E.J in operation 4 = B. override in operation





SHOWING BOOST STAGES



IBCC Digital Archive

DIFF BETWEEN 80B & 85E CARBS

1. The size of the throttle tube is 5 MM wider than the 85E.
2. It also has larger jets.
3. In the 85E the enrichment valve is incorporated in the casing.
4. In the 85E we have 3 delivery tubes, P. Jet Starboard side, Enrichment jet, Port Side & the Acc & DA pump have a pump separation on the port side.

Round the throttle tube is fitted an oil filled carb^r Jacket, the hot oil is pumped in one side & out the other back to cooler & sump, this is to try & prevent icing up of butterfly throttle.

Test on jets

Acc Pump Move throttle from closed to open with the engine stationary, 3 times only & observe petrol in air intake. Allow sufficient time for petrol to evaporate before the engine is started.

Power jet: Do it by a flowometer in the feed pipe, run engine, then move throttle lever into the rated position, note amount of flow with power jet in rated, then stop the engine remove power jet & put a dummy power jet in, run engine again, & note the difference of flow it should be 8-7 pts per minute difference

2. Practical way with engine stationary, switch off fuel supply & put throttle lever in slow running position, move the lever to cruising position, in this position the main jet should only be operating, when the throttle is in this position there should be no fuel flowing from the plug holes.

Enrichment jet with the throttle in cruising range, & when the jet is removed there shouldn't be a flow of fuel from the jet

Hot & cold air intake

Fitted to carb is an attachment which gives us an hot & cold air intake. The bottom cowling is the cold air intake. The two on either side are the hot intakes. Either can be banked off by two moving plates on the inside. The hot air intakes are in a position behind No^s 5 & 6 cylinders. The hot air intake must not be used for starting the engine because if the engine backfires you are liable to get a fire inside the cowling.

IBCC Digital Archive

The A.V.T. 85 M.C. Carburettor

The operation is the same as 85 E type carb^r. The jets are all on the base of the float chamber altogether. The jets are all marked for identifaction.

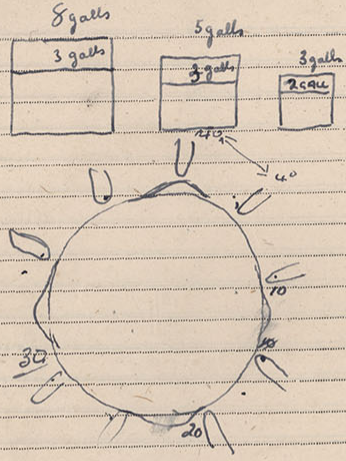
On the back is 2 automatic controls, one is Automatic Mixture control which automatically opens the cocks this is on Starboard Side, on the port side is the A.B. Control. The are 2 mixture control cocks, 1 on either side, no vacuum type M.C is fitted. The slow running cut off is controlled by a lever at the side of the carb. There is only 1 operating shaft on this which is controlled from the cockpit, this is the throttle layshaft

From Starboard to Port it Operates:

1. Enrichment jet, 2. Acc & D.A Pump, 3. Then the 3 cams for 3 stage boost control. 4. The cam for the power jet. On either side of front carburettor are 2 pipes, 1 inlet & 1 outlet for oil which operates the Automatic Controls. At the bottom is the 2 Servo pistons. There is a seperate main & slow running jet. The power jet is delivered from the port side.

IBCC Digital Archive

Polar Index Marg Apparatus -
R A Marg 2



IBCC Digital Archive