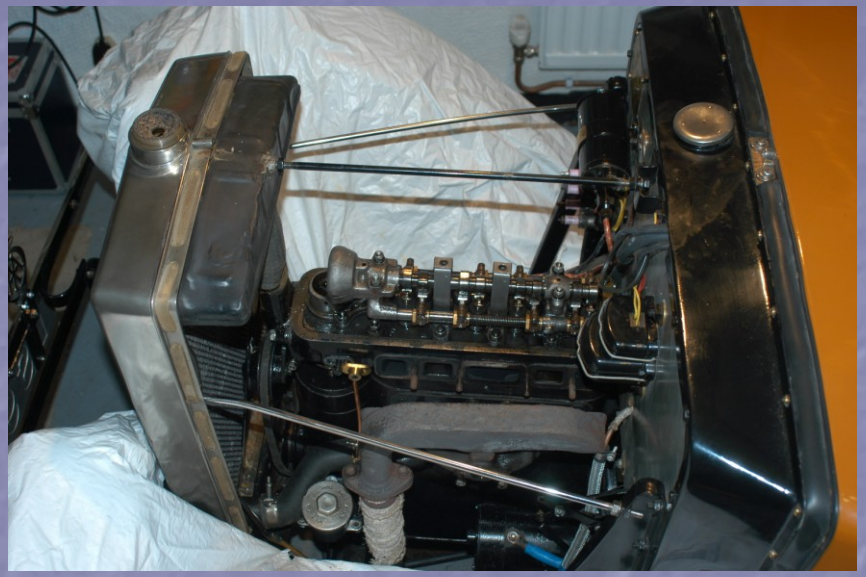
Maintenance – 4300 Mile Decoke Sept2004

- After a 350 mile trip the radiator was drained to fix a leak at the drain tap
- The ‘rad-weld’ was not replaced
- After servicing the carburettor the engine was popping and had no power
- A compression test revealed 70% loss in cylinders 1 & 2 (25psi each)
- It was deduced that either there were sticking valves or leaking head gasket
- **Decision** – remove cylinder head & check then decoke for good measure

Minor Ready for Major Maintenance

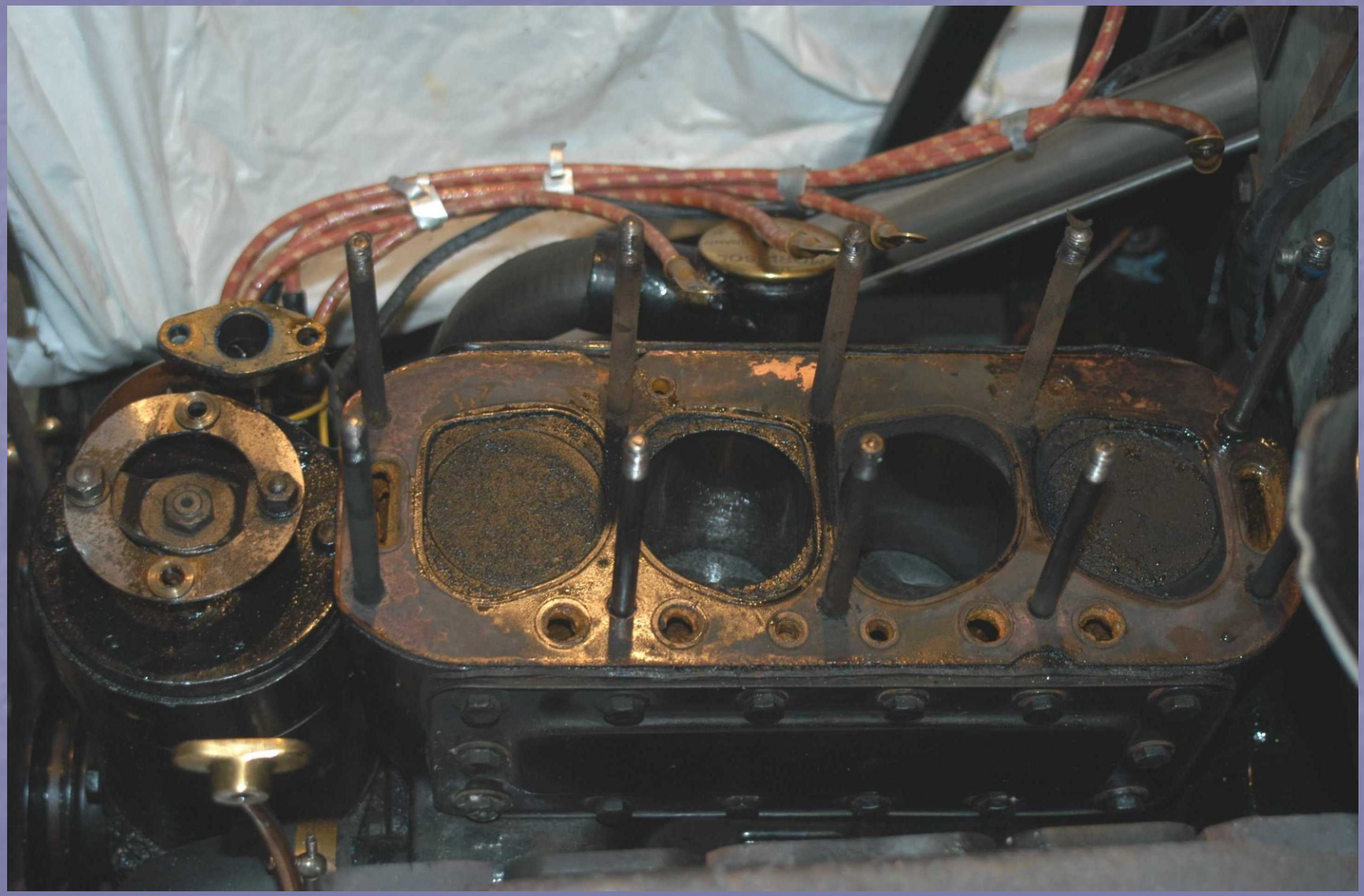
Engine Prepared for Investigation



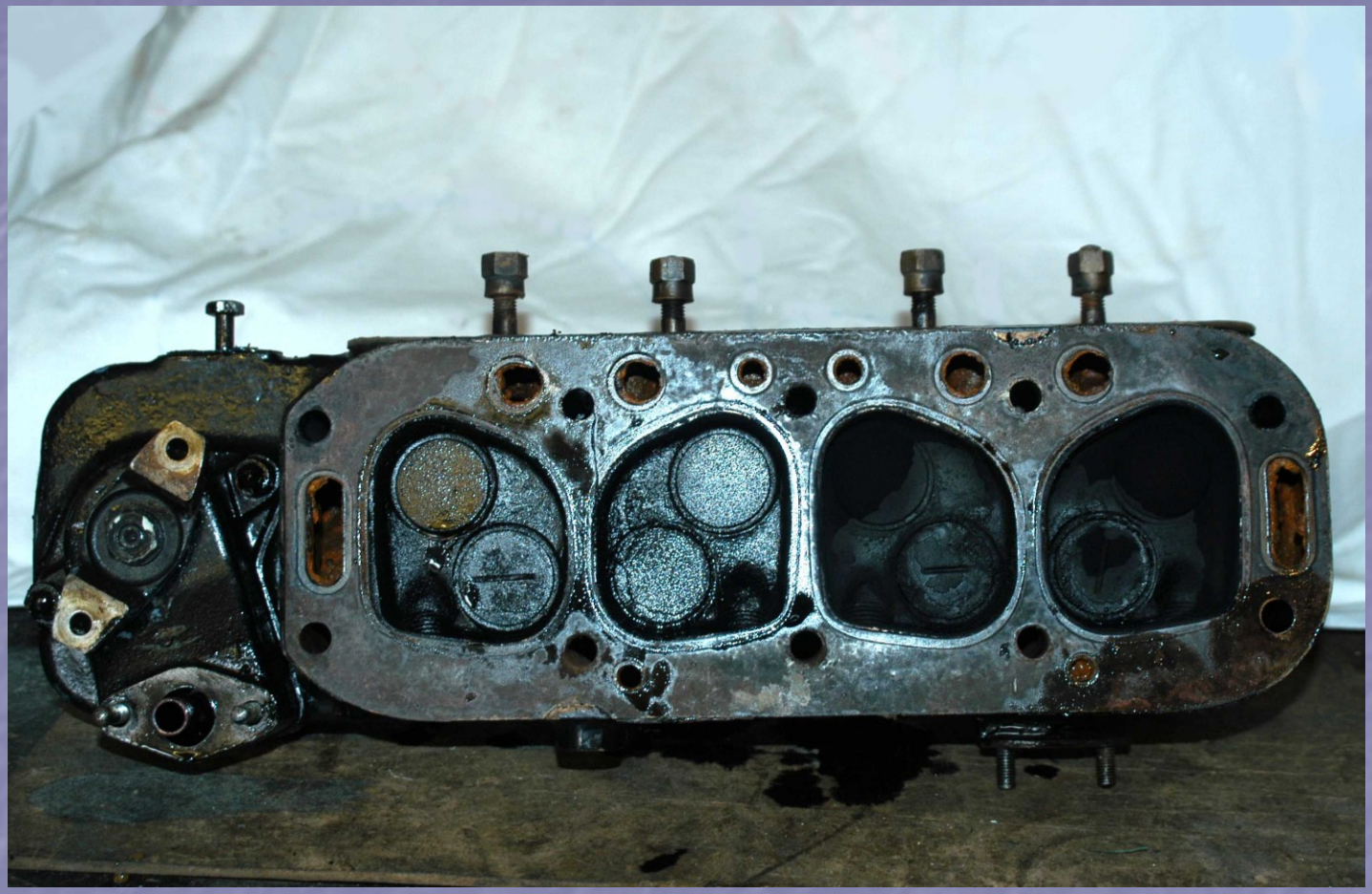
- The carb & exhaust manifold removed but latter left in place
- By removing the water inlet to the head complete with fan, this made head removal easier
- The oil pipe to restrictor was disconnected

- The Distributor was removed to give access to the dynamo bolts
- The front & rear return oil pipe was disconnected

Condition of Cylinder Head Block as Found

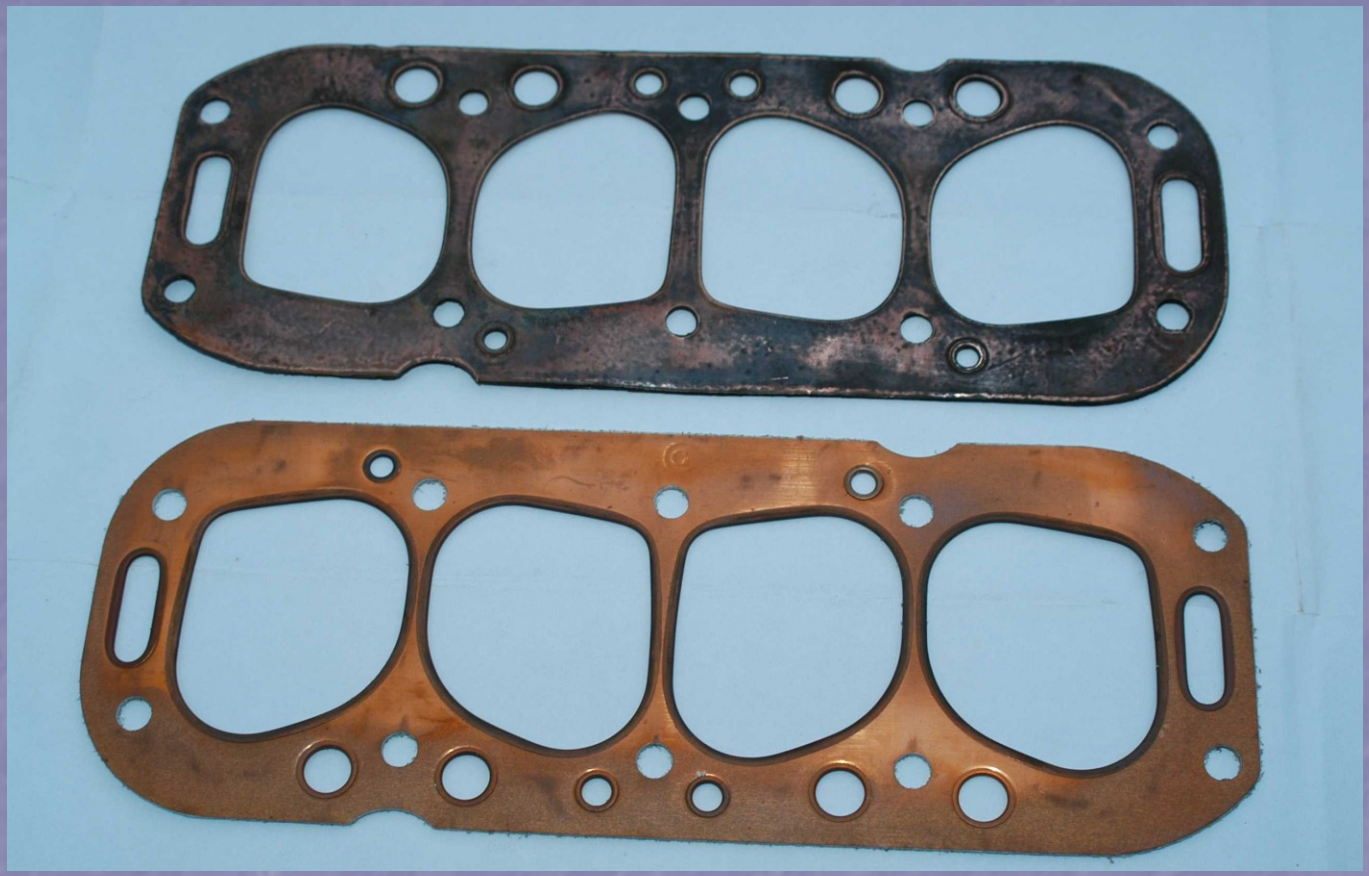


Condition of Cylinder Head as Found



The oily appearance of the combustion areas of Cyl. #1&2 was probably due to the diagnostic 'wet' combustion test. Since only Cyl #1 had added oil, it appears this has leaked to Cyl #2 indicating a faulty head gasket

Head Gasket Old & New



Apart from discolouration and some minor indentations the used Gasket showed no evidence of any cross cylinder leaks

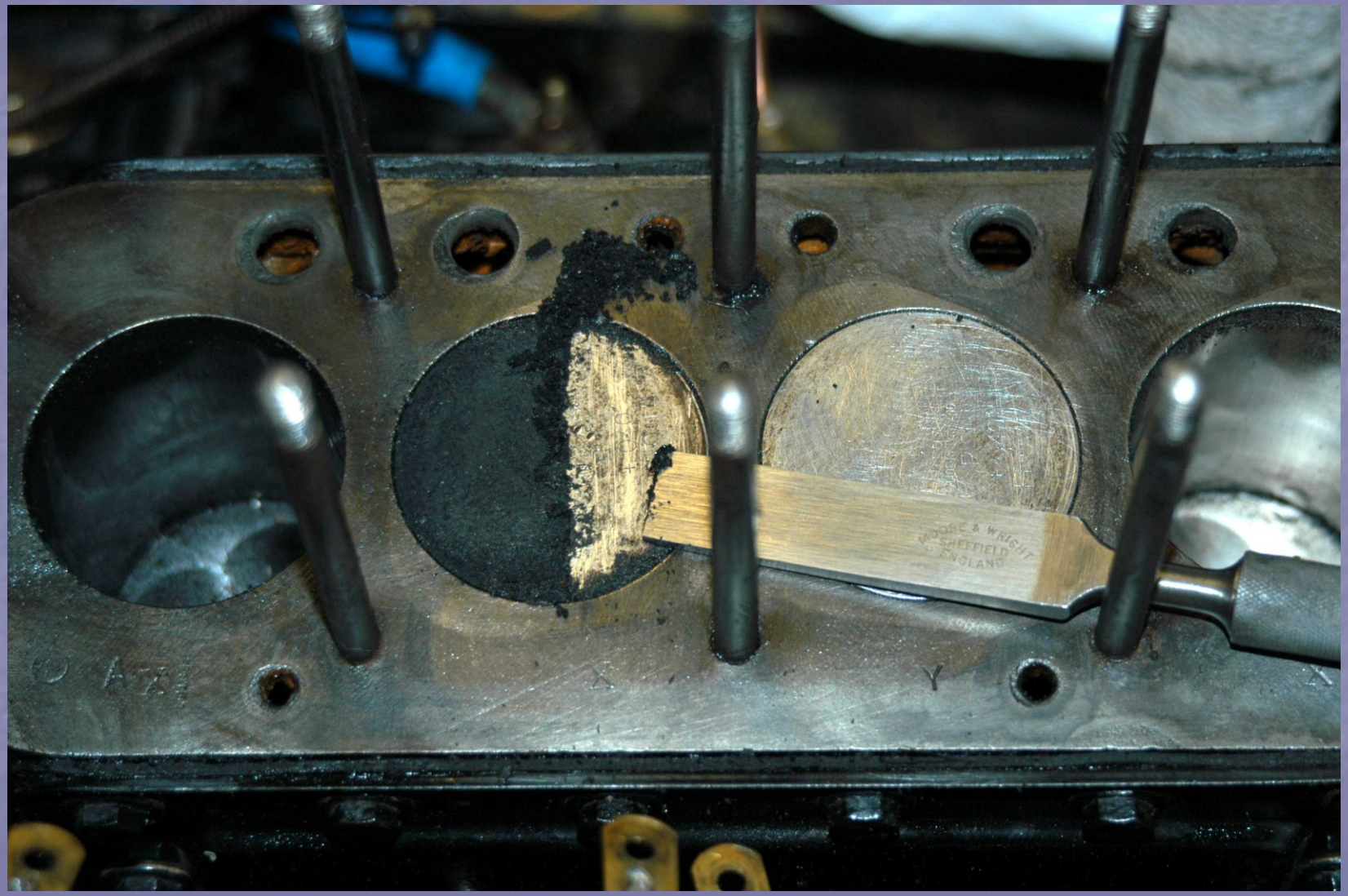
Cylinder Head Straightness Check

No distortion of the cylinder head could be detected ruling out any over heating causing the compression loss

Findings

- No obvious leakage was seen on the cylinder head gasket
- However since only Cyl #1 had added oil for the ‘wet’ compression test, it appears this has leaked to Cyl #2
- The cylinder head gasket had absorbed petroleum and oil products
- The cylinder head was not distorted
- The valves were dirty but no evidence of sticking or leakage
- N.B. - (Before removing the valves I should have done a liquid leak test to indicate any seating problem)
- No water found in the engine oil
- It can be assumed that the head gasket was the cause of the compression loss. Perhaps removal of the ‘rad-weld’ contributed to this?

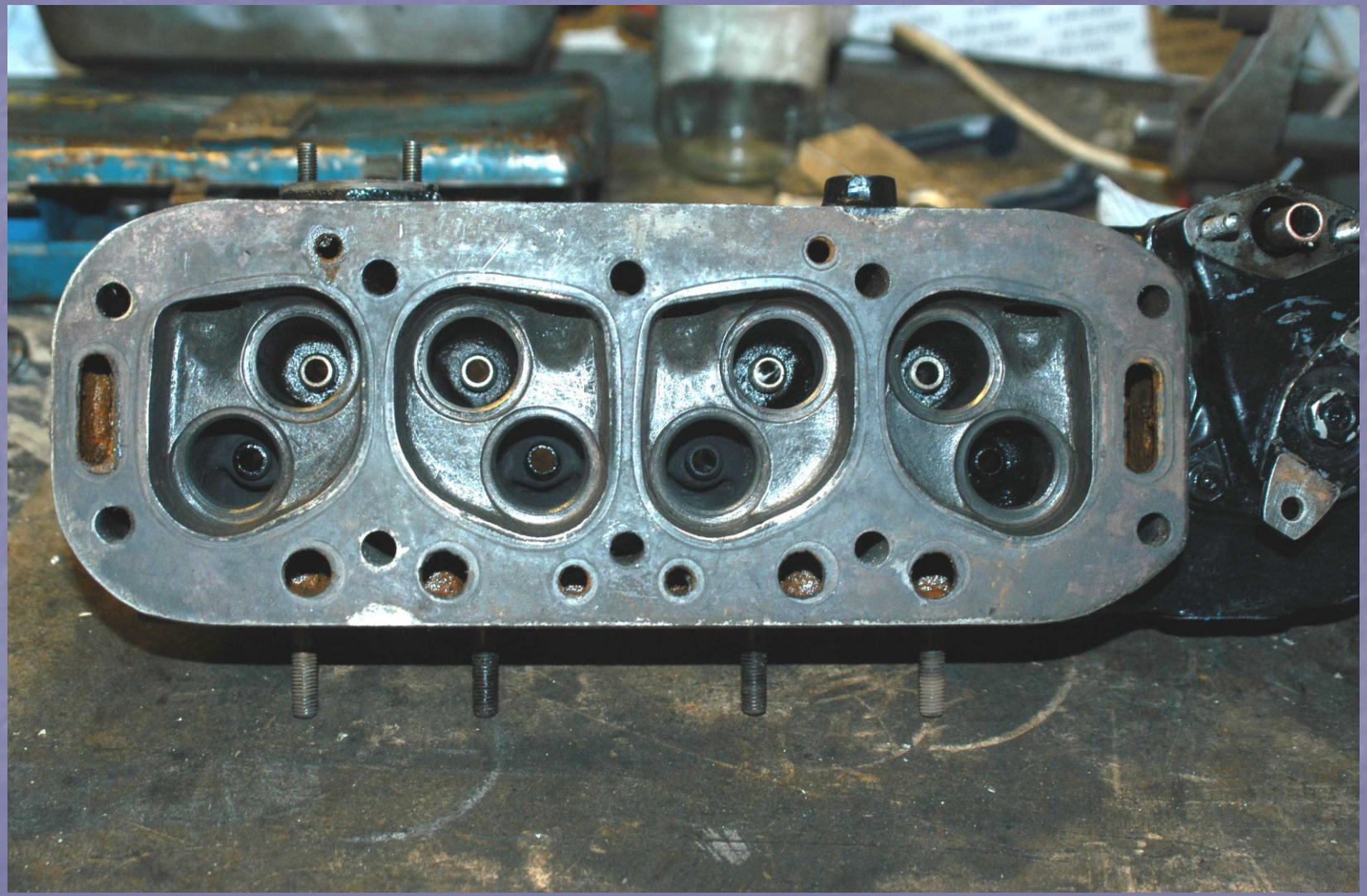
Carbon Deposits Removed from Block & Pistons



Carbon Deposits Removed from Cylinder Head

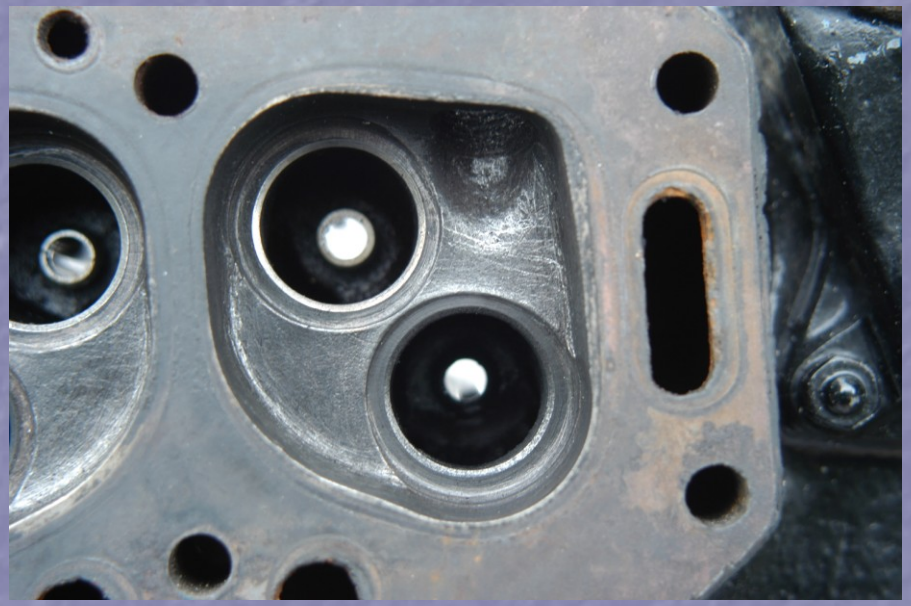
Considering that only 4000 miles had been covered the amount of deposit was less than expected. However, the engine had a history of running rich.

Cylinder Head Cleaned Prior to Grinding Valves



Inlet & Exhaust Valves as Removed

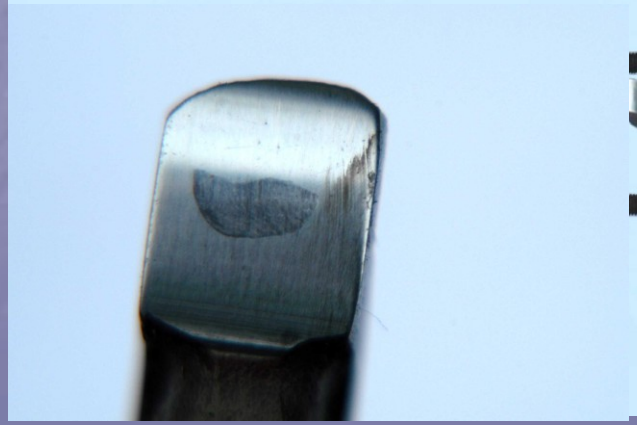
Valves Seats Cleaned Prior to Grinding In

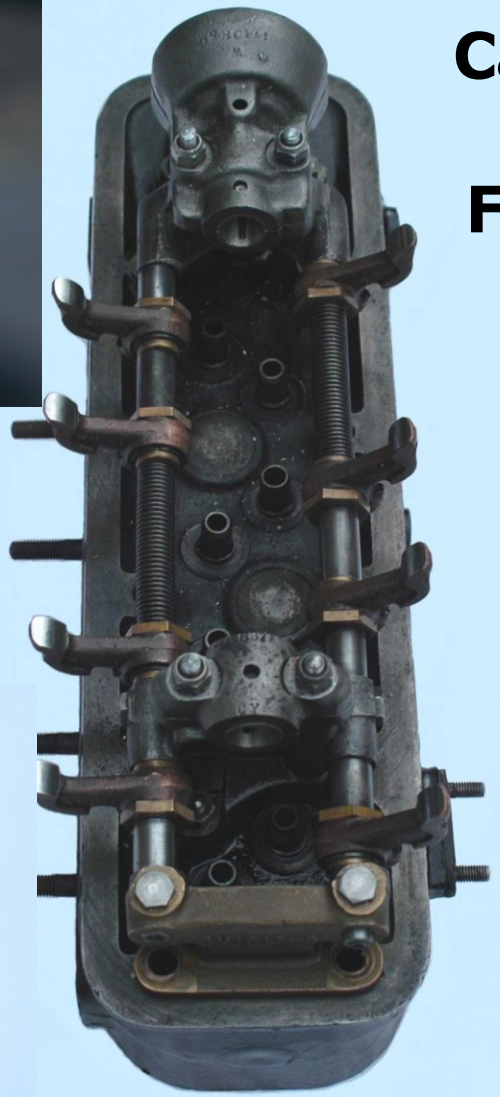


- The Valves as removed before cleaning.
- No indications of poor sealing were seen

Over Head Cam Assembly

Valve Follower Wear

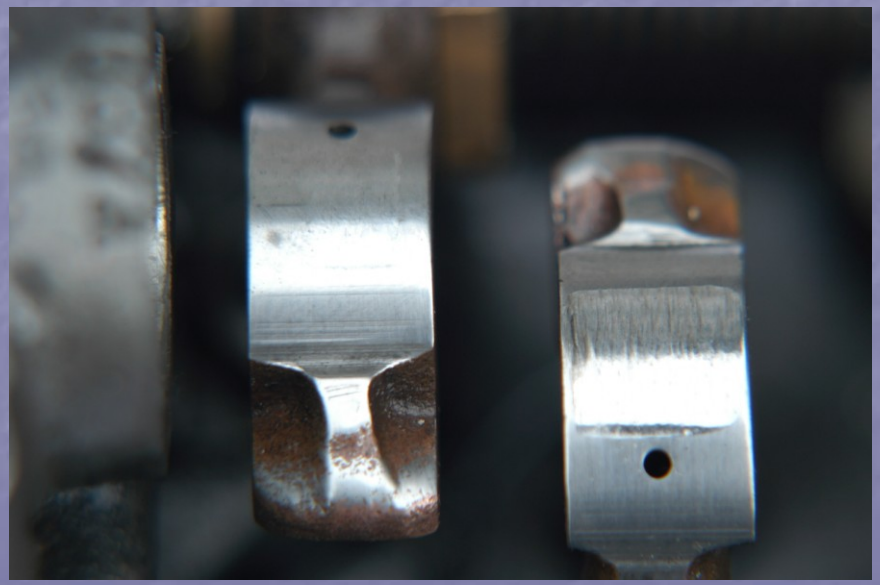




Camshaft & Valves Removed Cam Followers Opened Out

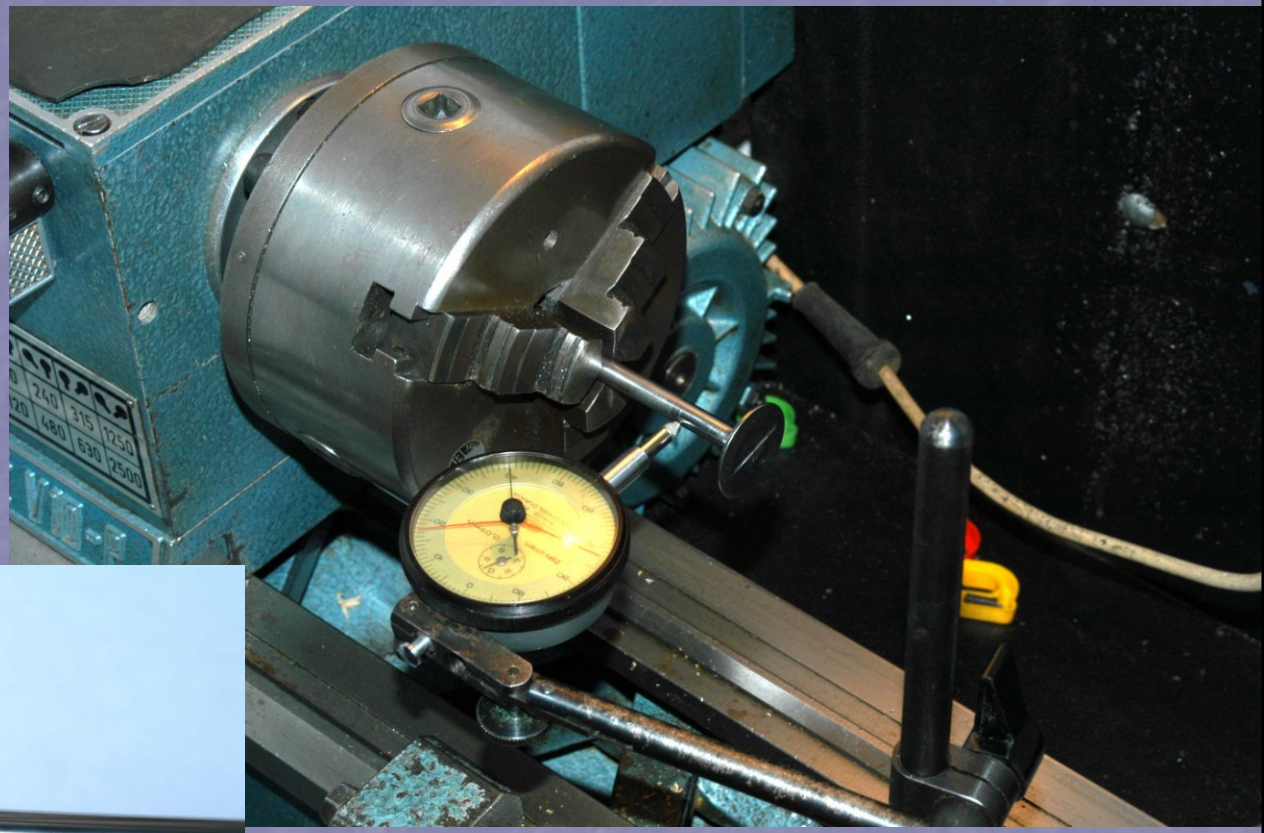
The valve follower wear is considered acceptable

Cam Shaft & Wear to Cam Followers



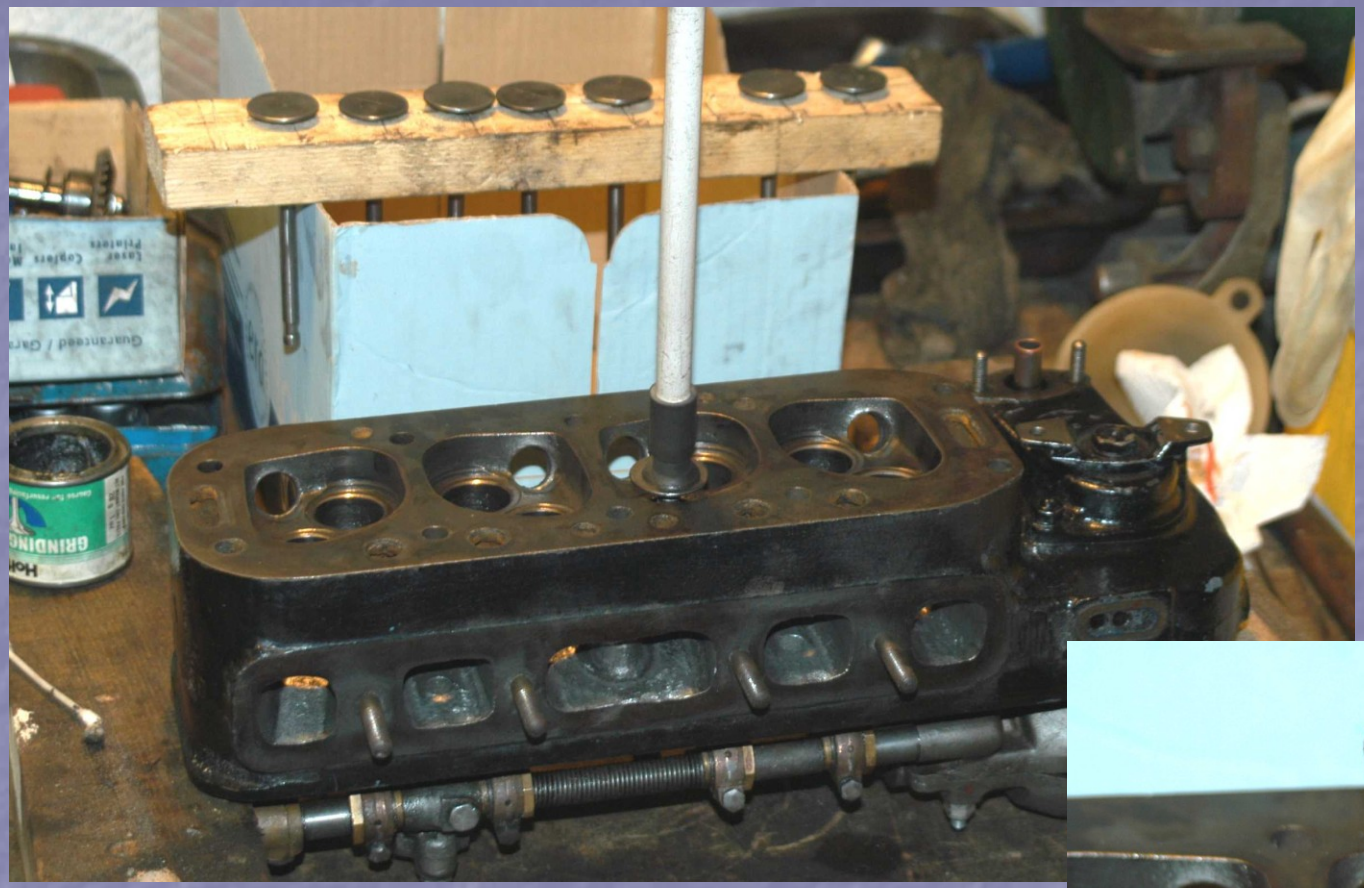
Valve Inspection

Valves were checked for straightness in a lathe

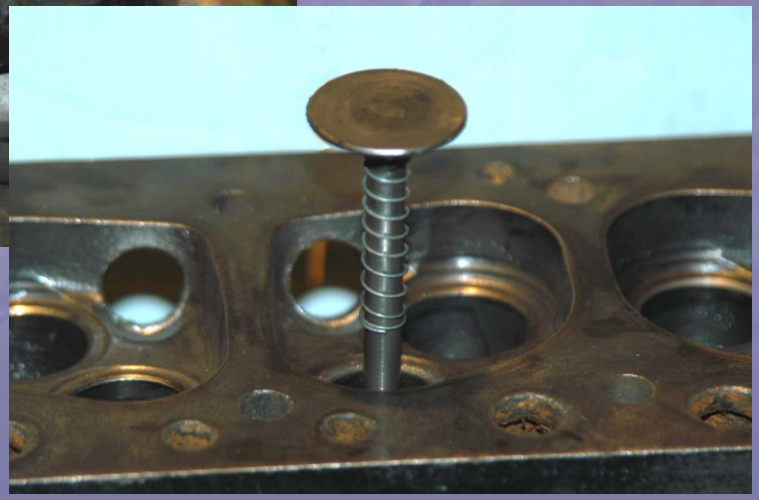


Exhaust Valve on #4 Cylinder was found to have a metallic deposit on its shaft. This was carefully removed.

Valve Grinding



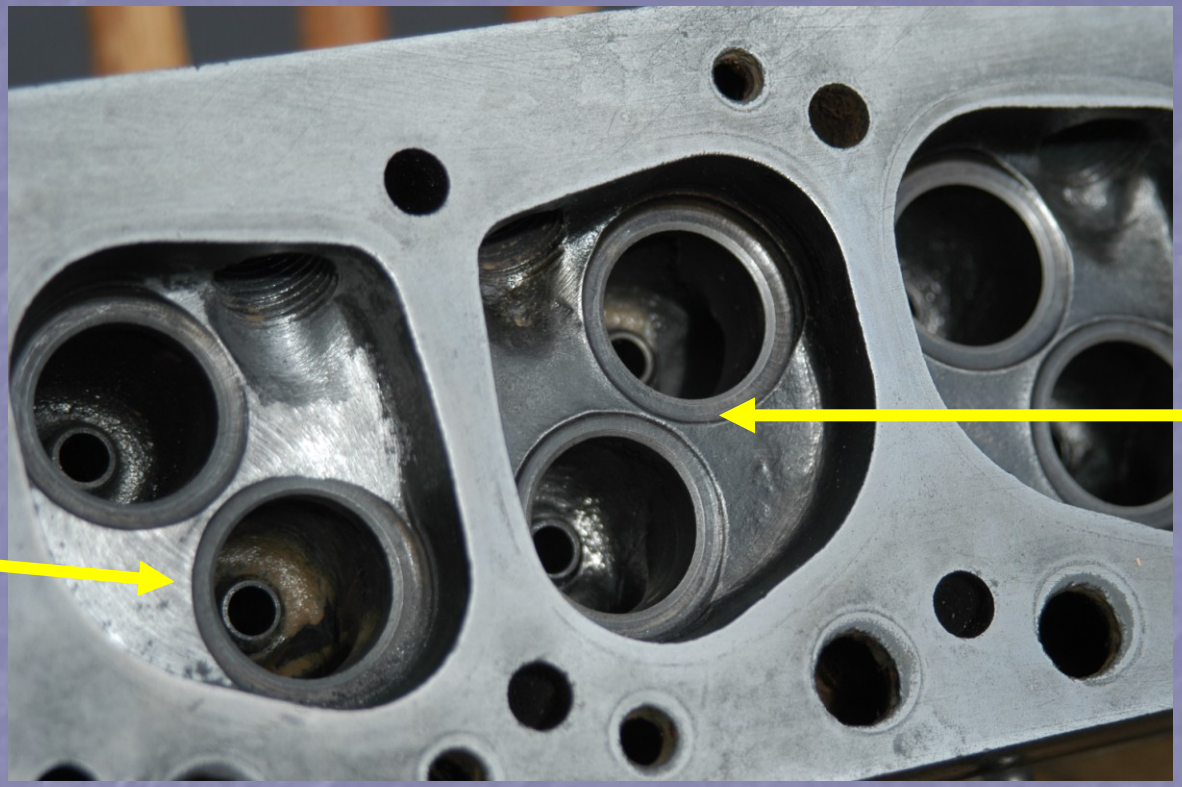
Each Valve was ground with a rubber suction on a stick. First with coarse then fine grit.



To ensure that there are no groves ground in to the valves & seats, a spring is employed to lift the valve after every few forward & reverse turns

Valve Seats

After Grinding Valves Lips



Before Grinding Valve Lips

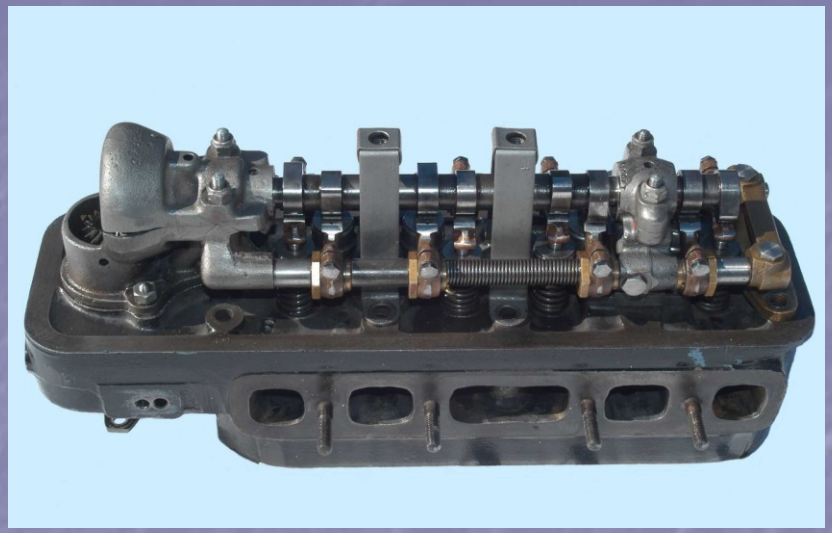
When valve seats are cut and ground a ridge is left that allows carbon to build up on the high ridges causing potential pre-ignition etc. It is advisable to remove this.

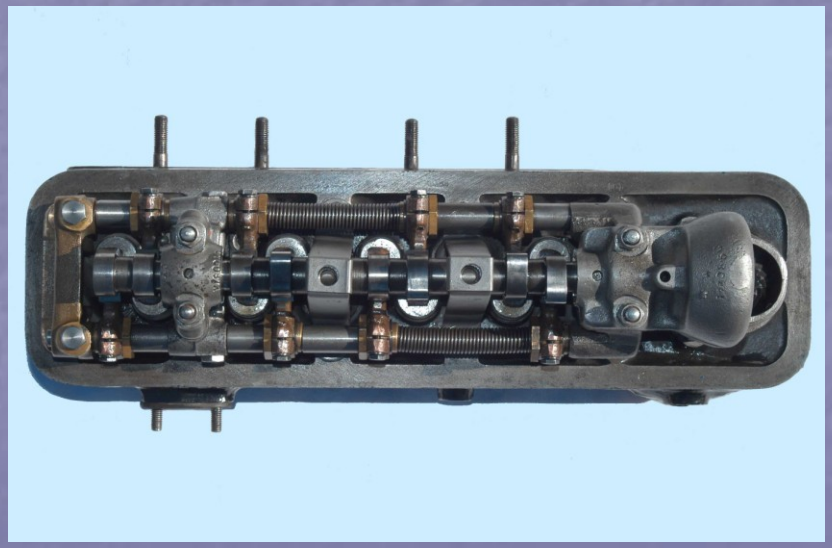
Valve Seats Ground & Cleaned

Valve Leak Test

After Fitting Valves (without springs) and Spark Plugs –
Leak Test Carried Out with dyed White Spirit

OHC Assembled





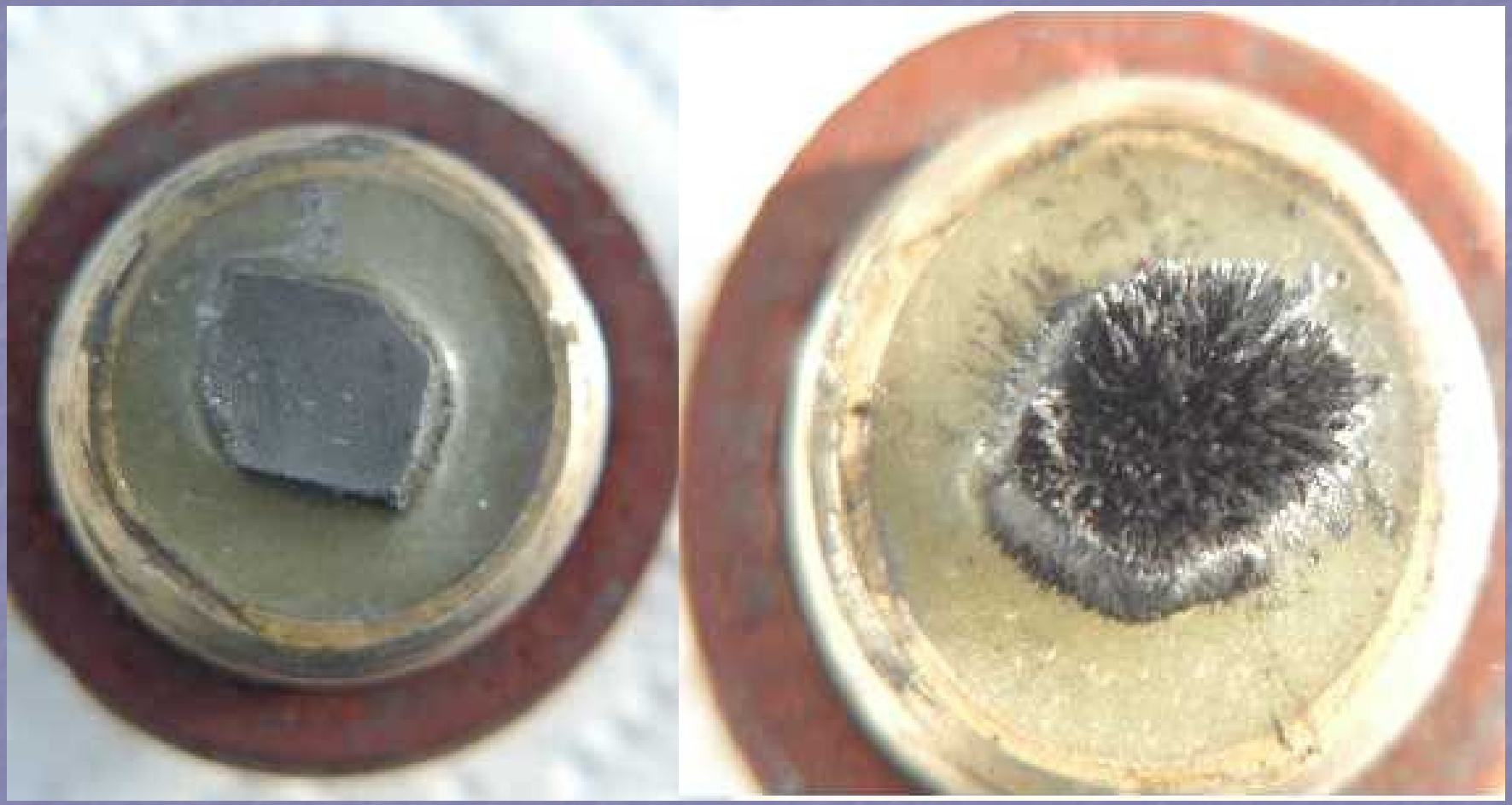
Magnetic Debris Collection

- The fact is that the moving metallic parts wear
- Wear debris exacerbates further wear
- By capturing debris avoids it acting as grinding paste
- The Minor engine has an wire oil filter only suitable for catching mosquitoes!
- At the outset rare earth magnets were fitted in all 3 oil sumps of DS9936 (Engine, Gear Box, Differential)
- Each time an oil change is undertaken the magnetic debris collectors are cleaned of captured particles
- The following slides illustrate typical oil change findings
- After just 1032 miles the amount of debris seems significant, what would it be like after say 5,000 miles?
- It can be assumed that magnetic debris capture devices are extending the life of the critical moving parts
- It is recommended that all such vehicles do the same

Lubrication Change 19/11/04 After 1032 Miles - Engine

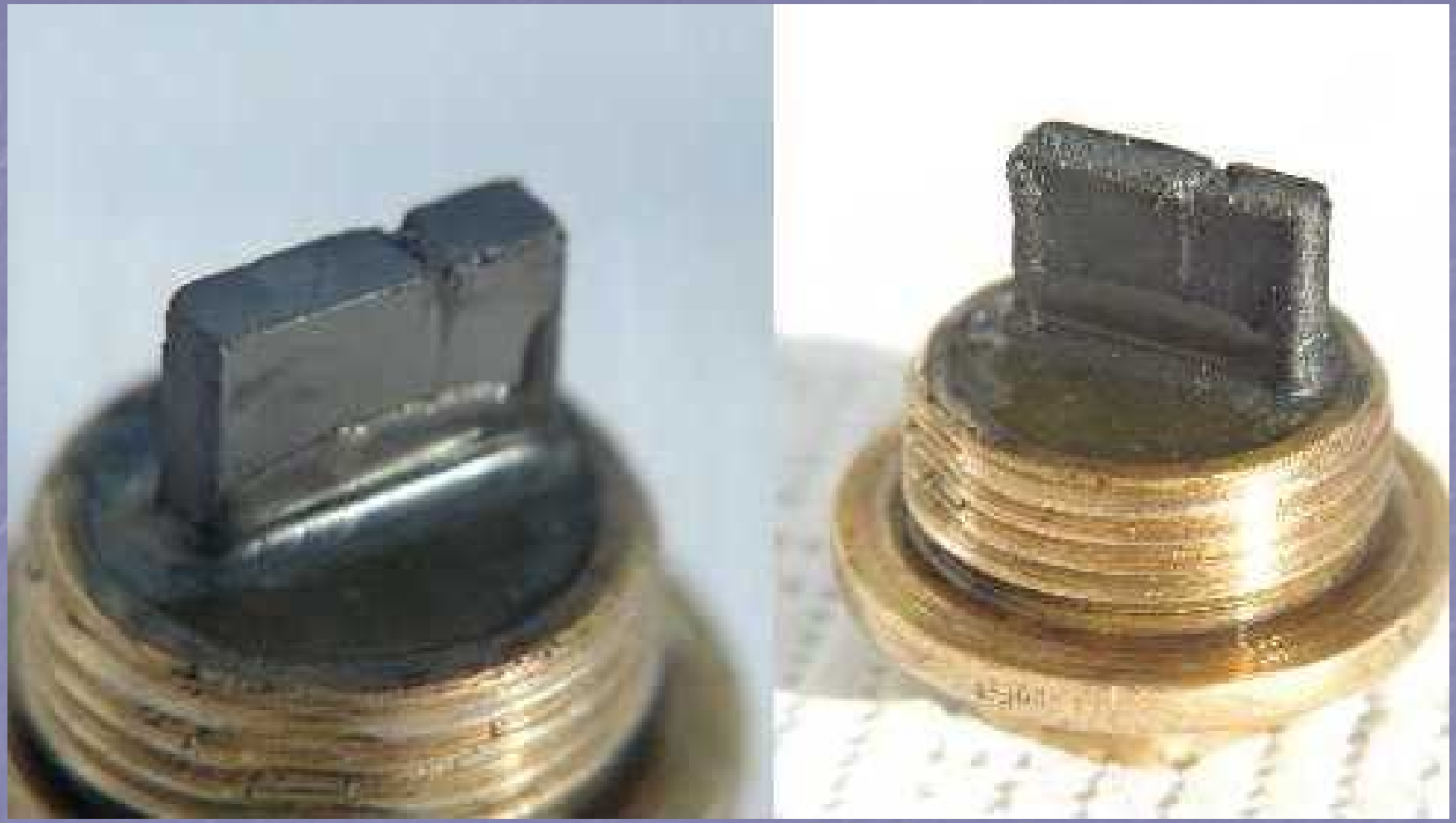
The debris right is a combination of Fe particles & gasket sealant 'Hylomar'

Lubrication Change 19/11/04 After 1032 Miles – Gear Box



The amount of Fe debris on the right is indicative of excessive wear in the 'crash gear box'

Lubrication Change 19/11/04 After 1032 Miles - Differential

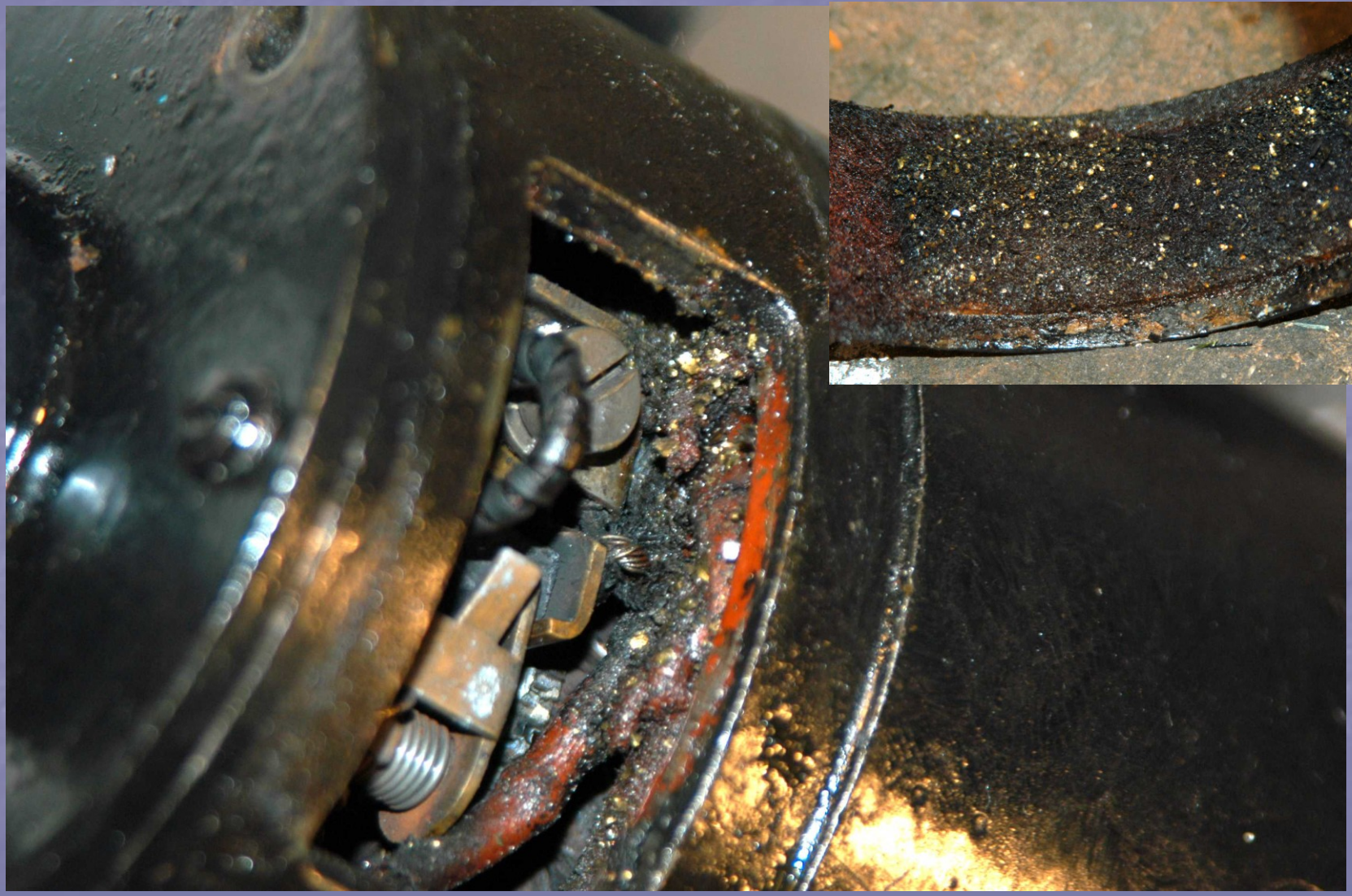


The Fe debris particles is minimal indicative of a healthy Differential

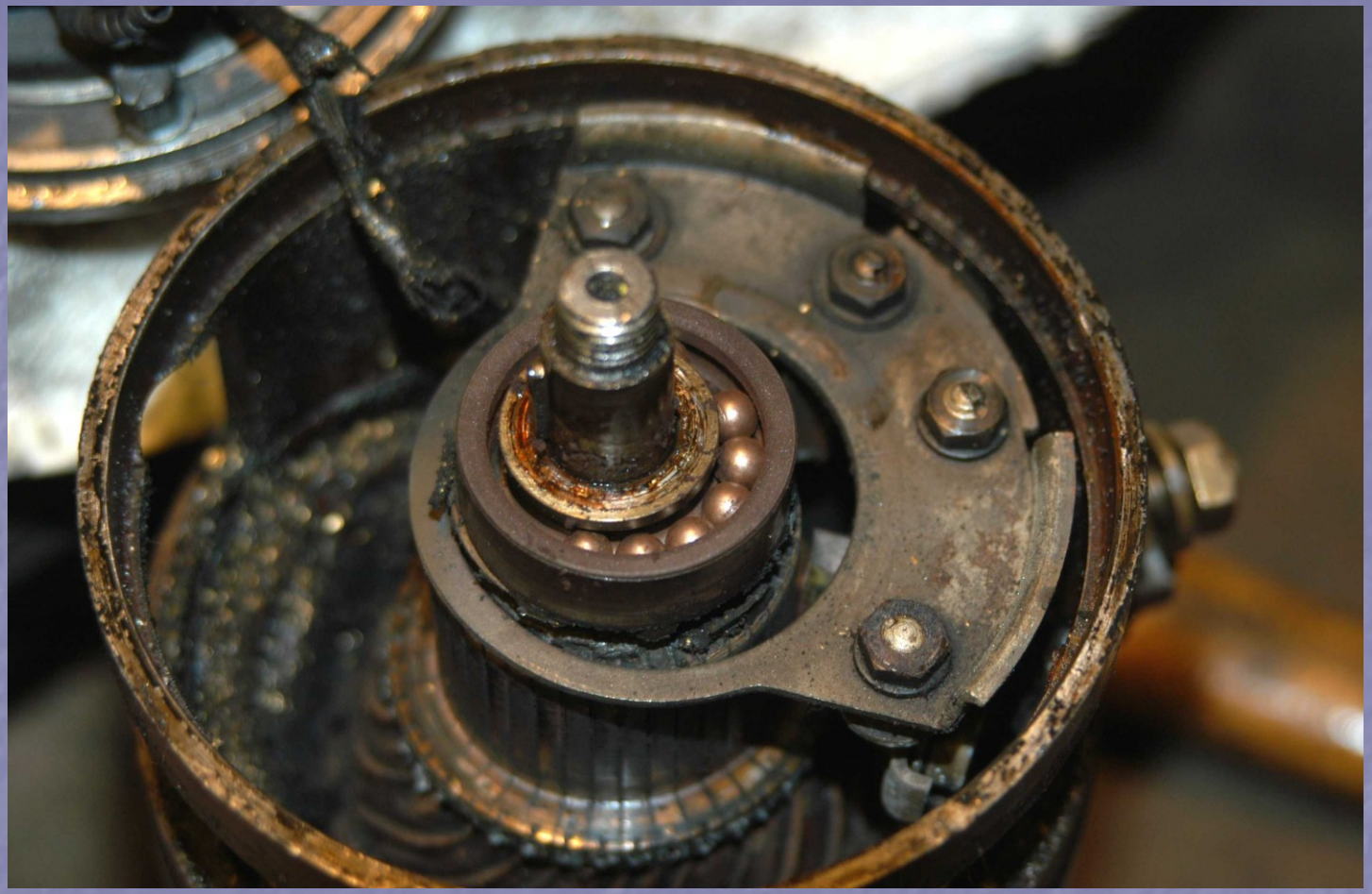
Dynamo - Overhauled

- When the Cylinder Head was removed it was found that the dynamo top bearing was suspect
- On inspection it was found that the top bearing had virtually disintegrated.
- The bronze cage had totally broken up with metallic debris in the stator & armature.
- In the past the dynamo only delivered just +ve Amps
- When the lights are on the ammeter shows full negative
- It was known that some solder for connections to the commutator had 'spun off' probably due to excess heat
- This probably cause 'high resistance' joints & over heating
- The unit was in desperate condition and its discovery had probably saved the engine from catastrophic damage

Metallic Debris in the Brushes

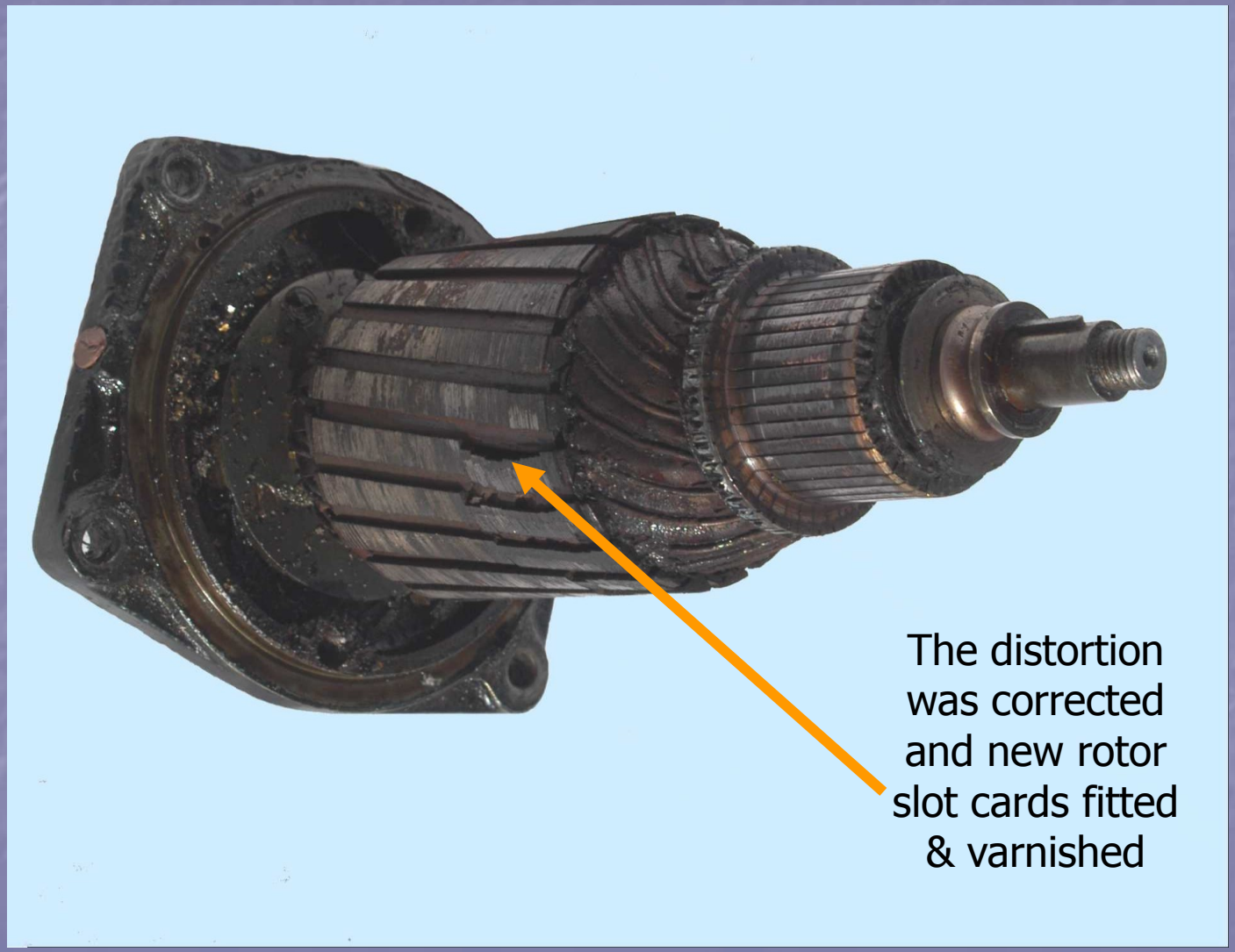


Remains of Top Bearing Revealed

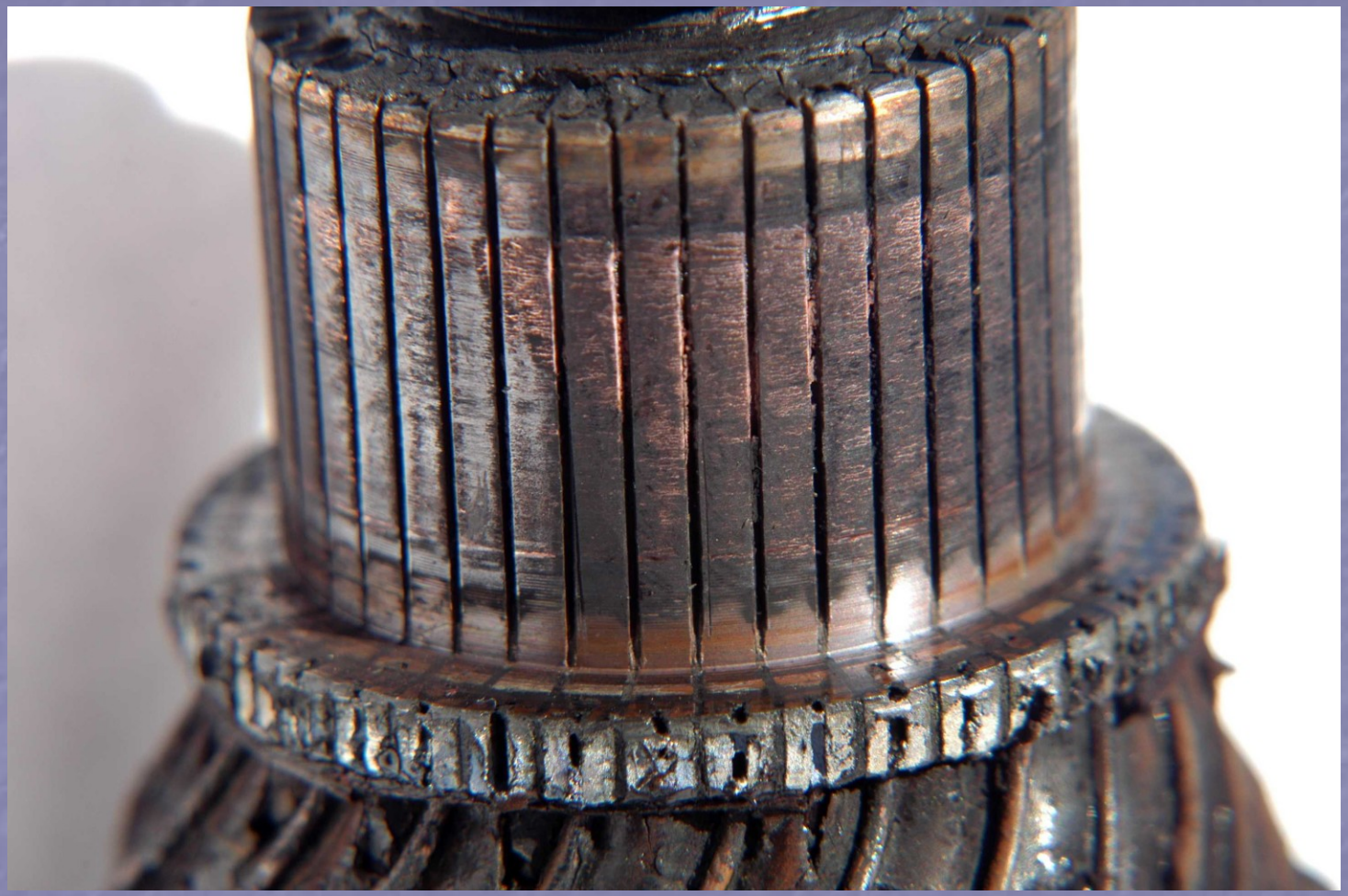


The cause of the collapsed bearing was lack of lubrication. Since the OHC drive was modified with a sealed bearing, any past oil leaks would have lubricated the dynamo top bearing! Future replacement bearings will be the sealed type.

Dynamo Rotor Laminations Distorted

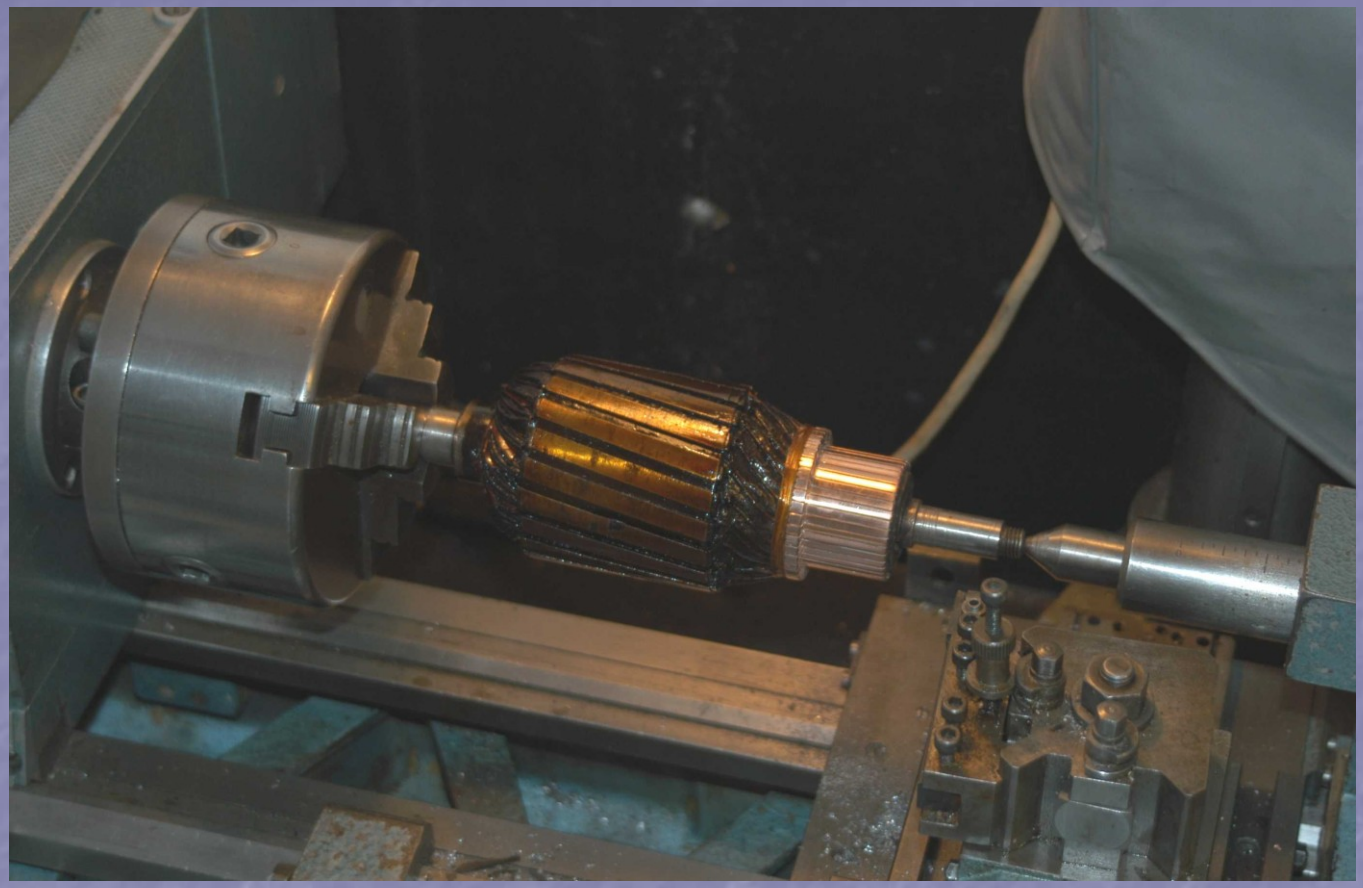


Dynamo Condition as Found



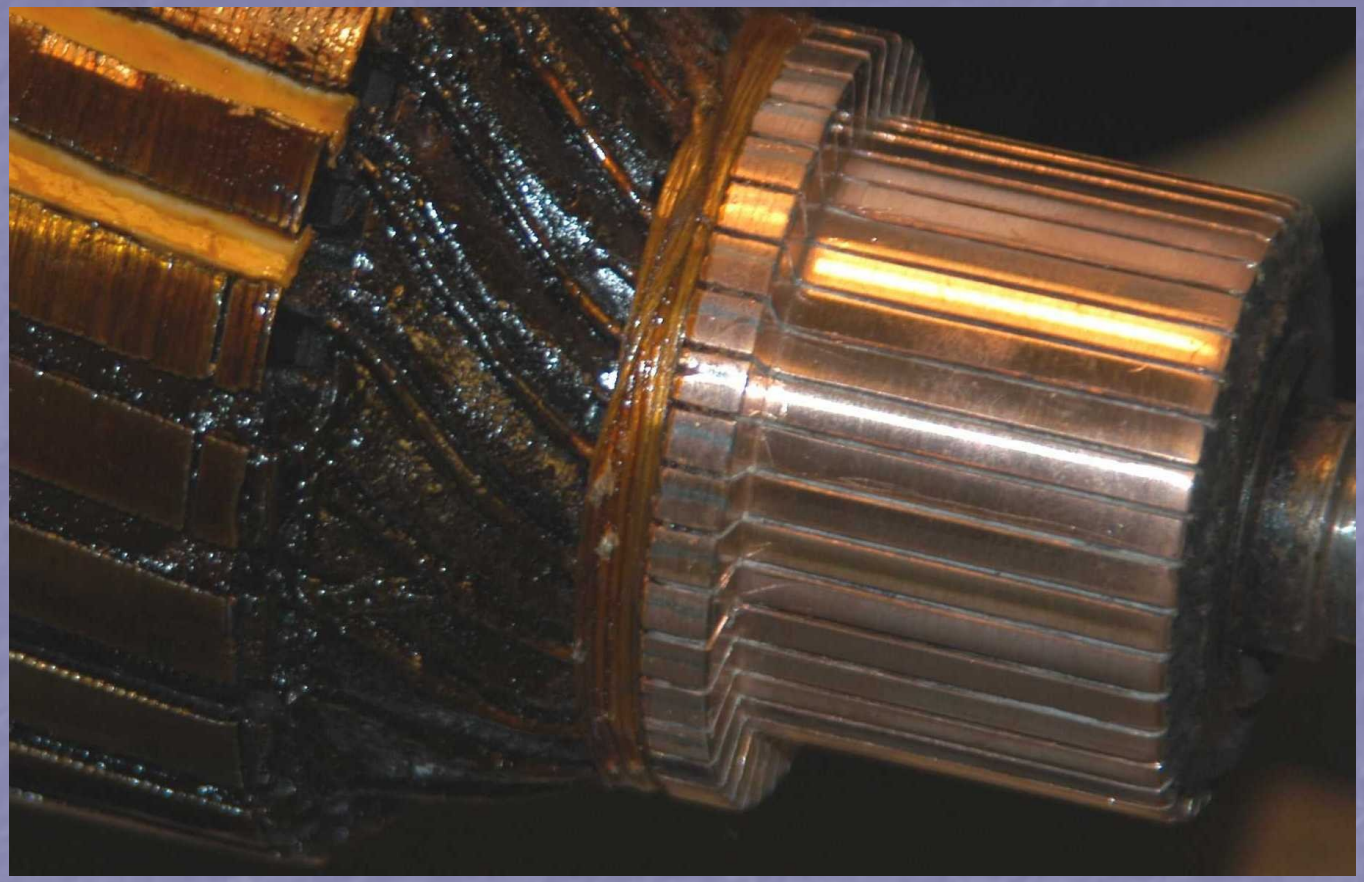
Commutator – Brush Arcing Burns & Poor Soldered Connections & Over Heating (Overload?)

Dynamo Restoration



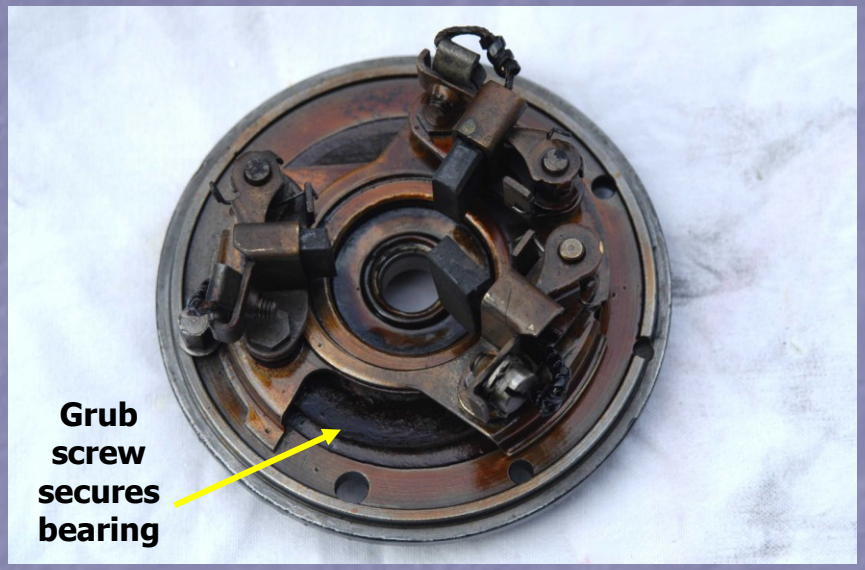
- The lathe enabled the units alignment to be checked & made repairs much easier
- A number of rotor winding packing pieces were replaced
- The commutator was lightly machined

Dynamo Commutator Undercut



1. The commutator connections were re sweated and machined
2. Each commutator segment was undercut
3. The windings to comm. were re- bound and all was varnished

Dynamo Assembly Varnished

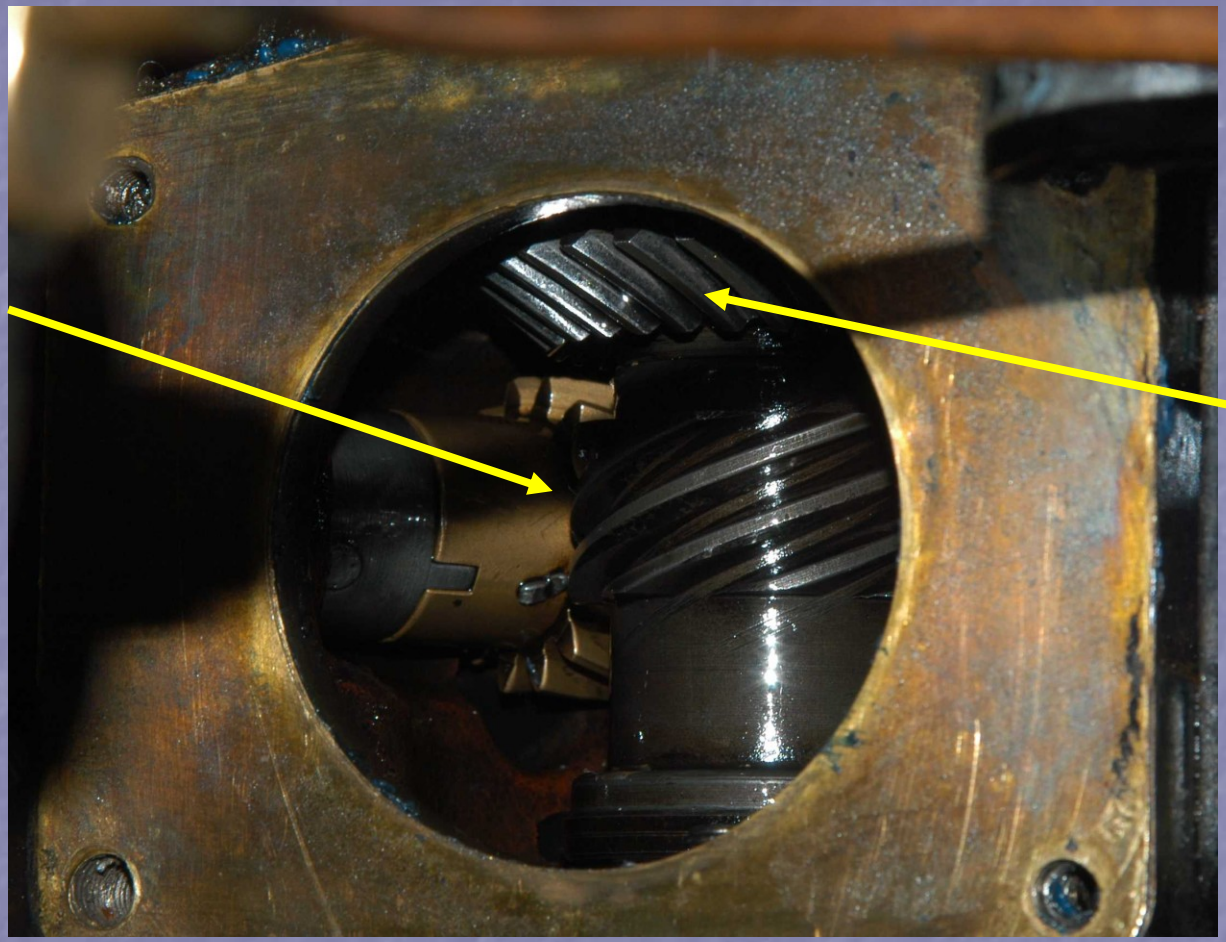


- The brushes connections were insulated
- Connection sleeves replaced on the stator & varnished
- Both Top & Bottom bearings replaced

Dynamo Bearings

- The Top and Bottom bearings were replaced with ‘sealed types to avoid the need to lubricate which was the cause of the original bearing collapse
- Replacement Top was Model LJ ½” 2RS
- Replacement Bottom was Model LJ ¾” ZZ
- Note: the Top Bearing is locked into the housing by a grub screw concealed under the insulating ring
- The Bottom Bearing had moved in its housing so “Loctite Bearing Fit” was applied to alleviate this

Relocating the Dynamo to the Drive



With the Flywheel at Top Dead Centre and the Dynamo drive yoke in line with the engine the Dynamo is positioned on the gear drive of the Crankshaft. Also shown is the drive to Distributor and Oil Pump

Timing - Flywheel at Top Dead Centre

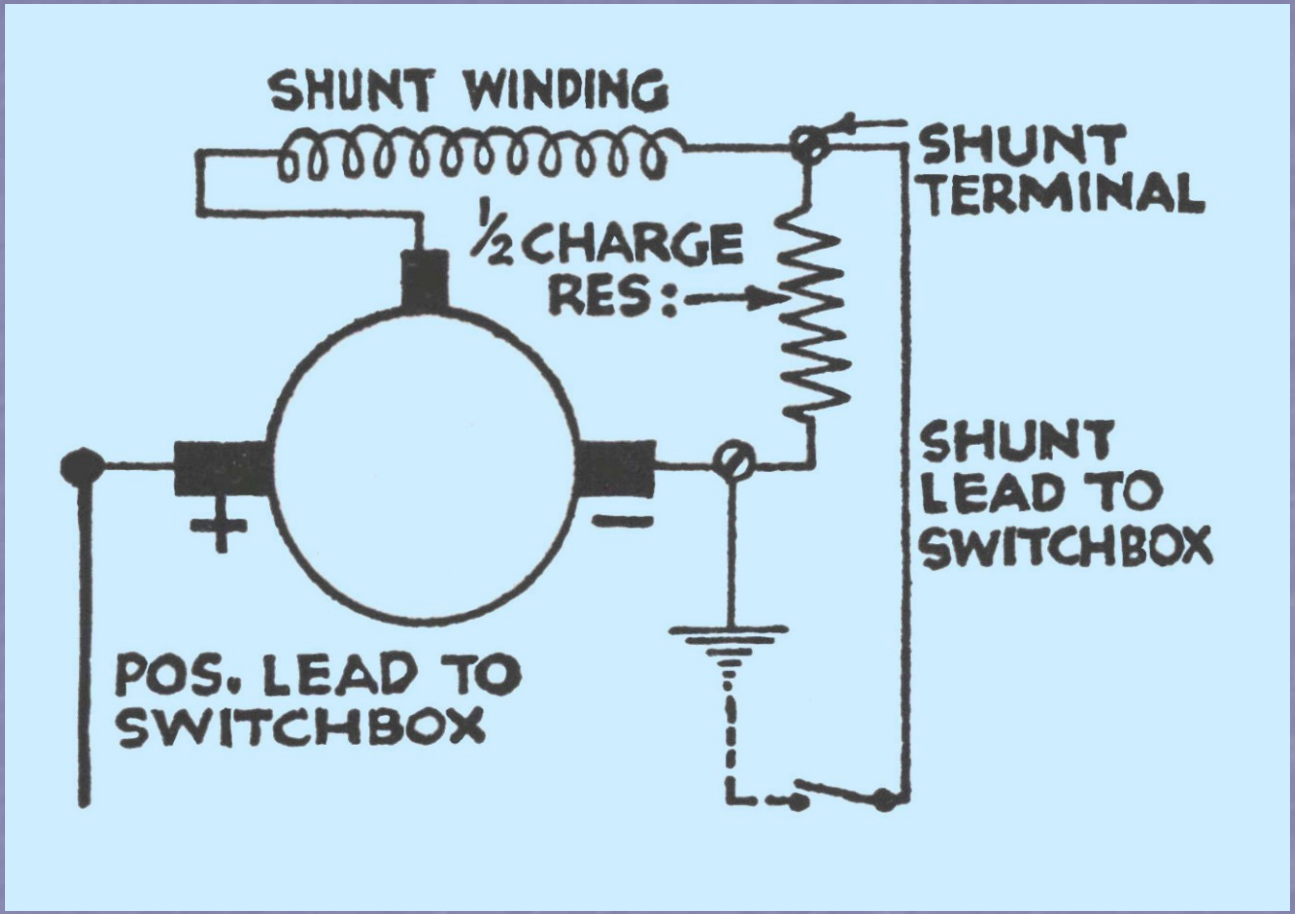
When #1 Piston is at TDC and Rotor Arm at #1 Spark Plug. the Flywheel TDC mark should align with the Centre Mark at the Clutch inspection cover. (remember to check clutch finger gap and lubricate each finger and Clutch Thrust Bearing

Dynamo Not Charging?

- Check the Shunt Fuse (3 amps)
- If the Fuse keeps blowing then there is a high resistance in the circuit causing excessive voltage when the engine is revved high
- To locate a high resistance disconnect the wires to the Dynamo and rev the engine quite high.
- With a piece of wire bridge the Dynamo terminals briefly, if a spark emanates on breaking the circuit the unit is charging
- The current may not be getting to the battery owing to defective wiring or terminations
- Check that the Cut Out is functioning and that the contacts are clean
- If no spark then the Dynamo is not building a voltage
- If no charge then remove the Dynamo cover & examine the commutator for lost solder due to over heating or charging on an open circuit
- If the Commutator is blackened & sooty, the brushes would have been sparking excessively. The commutator unit will need to be removed, lightly machined and segments undercut.
- If adjacent segments are badly burnt, this indicates an open circuit on the armature
- Check that the Brushes are not sticking and making poor contact with the Commutator (check brush spring tension)
- When removed power up and see if it runs as a motor. If the 3rd Brush varies its speed then the electrical circuit is functioning correctly.

Dynamo DS5 – 3rd Brush 4 Pole Circuit

(see following alternative circuit)



NB – The ½ Charge Resistor can be either in the Dynamo or at the Dash Switch Panel. The resistor is reported to be 1.5 Ohm and 30 watt. A ceramic resistor is recommended.

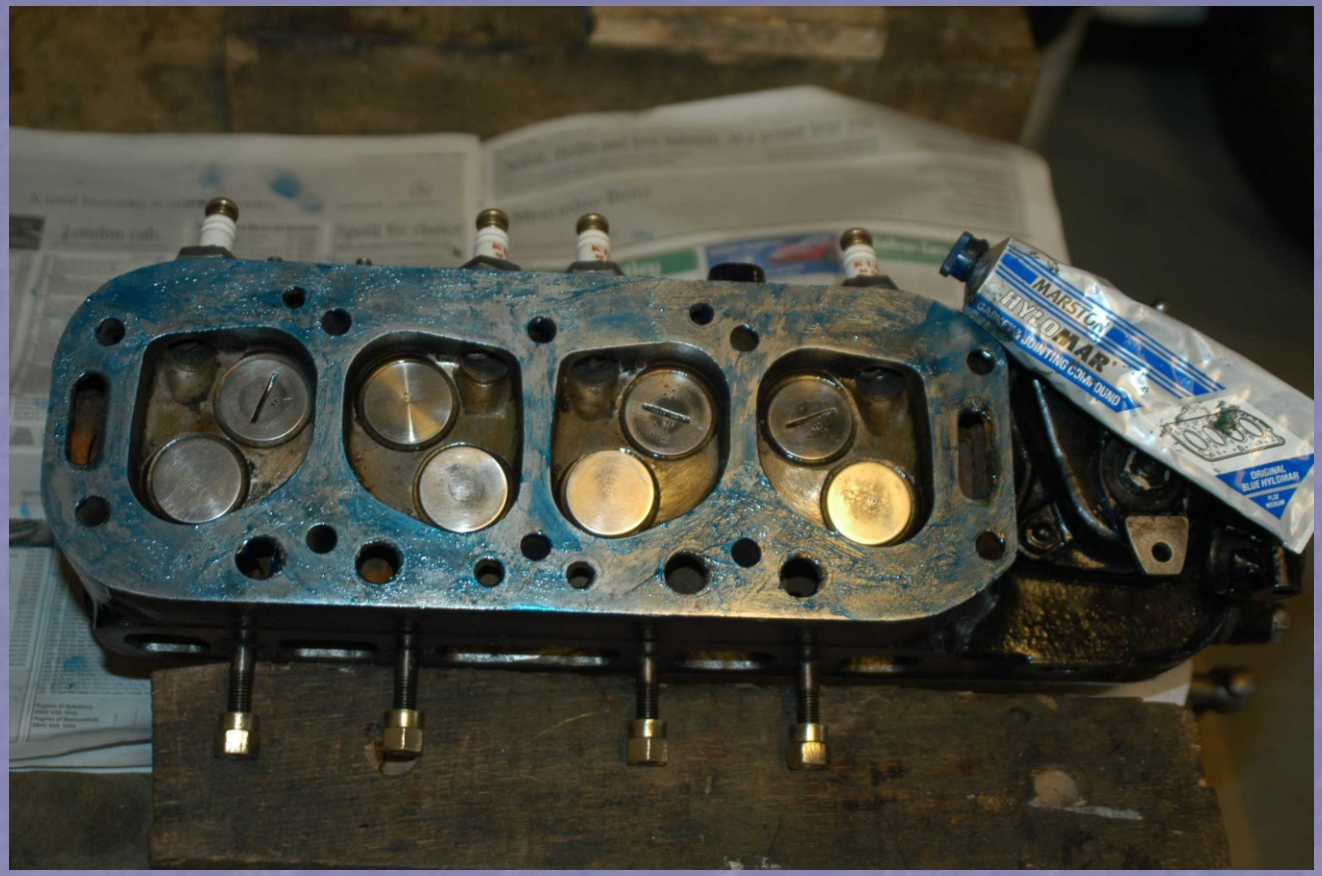
Engine Block Ready for OHC Head

Over hauled Dynamo fitted when #1 Cylinder is at TDC

Fitting Cylinder Head

Head covered lightly with Hylomar Seal and Gasket fitted; use Cu pipe to ease gasket down the studs

OHC Cylinder Head Prepared



The Gasket sealer was lightly applied all over the head's machined surface. After allowing the solvent to evaporate the cylinder head was fitted and torqued down

OHC Head Torqued Down

Crows Foot Spanner 5/16" BSF

- The 'Crows Foot' spanner was procured and ground to fit all the Cylinder Head Nuts even when the exhaust manifold is in place. This is an essential tool for OHC Minor
- The order of nut tightening was done according to the Manual.
- After running the engine to get it warm the head was re tightened.
- The cam clearances were checked and adjusted where appropriate, when 'hot'

Engine Tune Up

- After the engine had warmed up:
- The Engine Timing was achieved with a strobe lamp
- The Carburettor was set to ‘Lean’
- The Distributor was set to optimise the Advance & Retard Control

Compression Tests Before & After

Test Conditions	9/11/03	7/9/04 *	26/9/04 +	27/9/04 +
Mileage	3600	4300	4300	4300
Cylinders	Hot	Hot	Cold	Hot
1	63	25	58	61
2	59	25	54	60
3	60	65	65	60
4	59	60	60	57

- *** When loss of engine power was first observed.**
- **+ Valves then ground and new head gasket fitted.**