THE LIGHT-WEIGHT ENGINE. A Technical Analysis by John Allen

Introduction

This note gives general details on the post-war AMC lightweight engines which were used in AJS 14 and 8 models and Matchless G2 and G5 models. It covers all models.

The 250cc AJS 14 and Matchless G2 were introduced in the early summer of 1958 to complement AMC's existing range of bikes. They were better than most of the 250cc machines available but suffered from a weak engine bottom end and poor telescopic front forks. Although not particularly light, they were called 'Light-weights.' During 1960, 1961 and 1962, 350cc models (the 8 and G5) were sold with a stronger crankpin, duplex primary chain and 1 1/8inch diameter 'Teledraulic' forks. Similarly, sports and scrambler versions of the 250cc models, the 14S and G2S and 14CS and G2CS, were sold. 250cc CSR models were built with Teledraulic forks, a more substantial crankpin and duplex primary chain, and became available in the summer of 1962, remaining in production until the demise of AMC in the late summer of 1966. The 250cc engine has ten fins on the barrel while the 350cc has twelve.

The Light-weight models have suffered from a poor relation attitude, being used by either those who could not get a heavy-weight single or a twin or those who were simply masochistic. This isn't fair. They remain an affordable introduction to the marques and can be made to go reliably and quickly. For the smaller models, the later ones are better (try to avoid the ghastly Francis-Barnett forks).

Manuals and parts lists

Bruce Main-Smith Ltd, 1 Featherby Drive, Glen Parva, Leicester LE2 9NZ, can supply photocopies of instruction manuals and parts lists for most models. However, they were not published yearly and it appears that there are no parts lists for 250cc models after 1962. The instruction manuals were quite comprehensive but did not give details about work on the bottom end of the engine.

Lodgemark Press publishes a manual, written by an ex-service manager at AMC – Fred Neill, with details of the post-1963 engines. This covers all post-1956 singles (both heavy-weight and light-weight but it does contain some mistakes, although usually these are obvious. The main problem with it is that its layout is extremely poor and there is no index. I believe that it can be obtained from the Spares Scheme.

At autojumbles, you may find a true AMC service manual, about A4 size with a red cover. This is essentially the same as the Lodgemark book, although some

do not have details of later 250cc CSR models.

Roy Bacon has written a couple of books about AMC models. These have some very good pictures, are better written than Neill's works and have some, at least, of the errors corrected. However, I feel that they do not go to such a depth as Neill's books (I would not rely on them when building an engine, for example).

Haycraft's book, in the Pitman series, has no information on lightweights whatsoever, although there is a picture of one on the cover.

Historical summary

When introduced in May 1958 the main features of the 250cc light-weight engine were:

Unit-construction appearance with the gearbox apparently integral with the engine castings (it was not, the gearbox, clutch and primary drive were hidden by bulbous side casings).

Offset (or désaxé) cast iron cylinder (to reduce wear) with a bore and stroke of 69.85mm and 64.84mm.

Oil tank bolted on to the timing side crankcase with a felt oil filter in the drive side crankcase (dry sump). No external oil pipes.

Crankshaft supported by two ball bearings, with a timed crankcase breather between them, in the drive side crankcase, and a bronze bush for the timing side bearing.

The 250 CSRs. This is a 1963 AJS 14CSR, with distinctive tank, Teledraulic

Reciprocating plunger oil pump driven by a worm on the timing side axle (similar to the heavy-weight single engine).

Single camshaft, carrying two cams, driven from timing pinion on timing side axle. The nose of the camshaft drove the ignition contact breaker through a centrifugal advance and retard mechanism.

Pushrods, enclosed in the barrel casting, activated by pivoted cam followers.

Wire wound piston.

Cylinder head and rocker box similar to the heavy-weight single with hair pin valve springs.

However the head was rotated 21° compared with the crankshaft. The head had secondary finning to encourage air over the spark plug.

Ignition was from a coil with an alternator providing the electricity.

Changes:

- ***1960 [350cc Light-weight introduced with a bore and stroke of 72mm and 85.5mm, duplex primary chain].***
- ***1962 – New clutch and chaincase introduced in December 1961 (after engine number c11500).***
- - Hard chromed cam followers used on engines after engine number 12128 (including CSRs).

This is a final year's Matchless G2CSR (toting a supply of 'Watson's Matchless Cleaner!). Note the alloy guards – the silencer and badging are not standard, but the rest is. And very nice it is too

- - CSRs introduced in May (engine numbers 12128 to 12673). these had steel flywheels, large diameter crankpin, larger inlet valve new timing side covers and chaincases, a repositioned oil hole in the timing chest and a duplex primary chain.
- ***1963 [Only the CSRs remained in production] (engine numbers from 12828)***
- - Long stroke oil pump fitted with direct feed to cam followers.
- - Change in crankcase oil ways.
- - Oil metering plugs deleted from rocker box.
- ***1965 (engine numbers from 13965)***
- - High compression pistons fitted, ignition timing 24 degrees BTDC (advanced).
- - Coil valve springs with collars to suit.
- - Oil control screw in cylinder head deleted.
- ***1966 (engine numbers from 14757 to 15506)***
- - Ignition timing 27 degrees BTDC (advanced!).
- - Low compression piston offered using a timing of 34 degrees BTDC (advanced).
- - Direct oil feed to cam followers deleted.

Potential problems

Crankpin – The early engines suffered from crankpin breakages. AMC redesigned the crankpin and conrod a number of times and the final large diameter pin is available as a pattern part from Alpha Bearings to order. If you can get a late conrod.

Crankcases are interchangeable between early and late models. However, the chaincase was wider on duplex primary chain models. The alternator was also set further into this chaincase.

The main bearing arrangement which used two ball bearings had a short life. The inboard bearing, next to the drive side flywheel, should be replaced by a roller bearing. This will also ease assembly.

Valve gear wear – The contact between the hairpin valve spring and collar wears, and to a much lesser extent the spring tangs and valve spring tray.

Inlet valve sticking – Carbon from the valve stem oiling can stop the valve from closing. This sticking is often a problem if the bike has not be used for some time.

Piston cracking – Pistons can crack either across the dome or around the top ring groove. This is usually associated with pattern pistons and a large right hand. Less serious, in the short term, is skirt cracking from expansion slots on some pattern pistons.

Automatic advance and retard unit – This was a Wipac part and appears to be more robust than its Lucas equivalent. However, there is no way of lubricating it. They can break up. A special tool is needed to remove it.

Rocker box gasket – Some pattern gaskets destroy themselves due to the movement between head and rocker box.

Cast iron exhaust valve seats can become loose; later engines used bronze

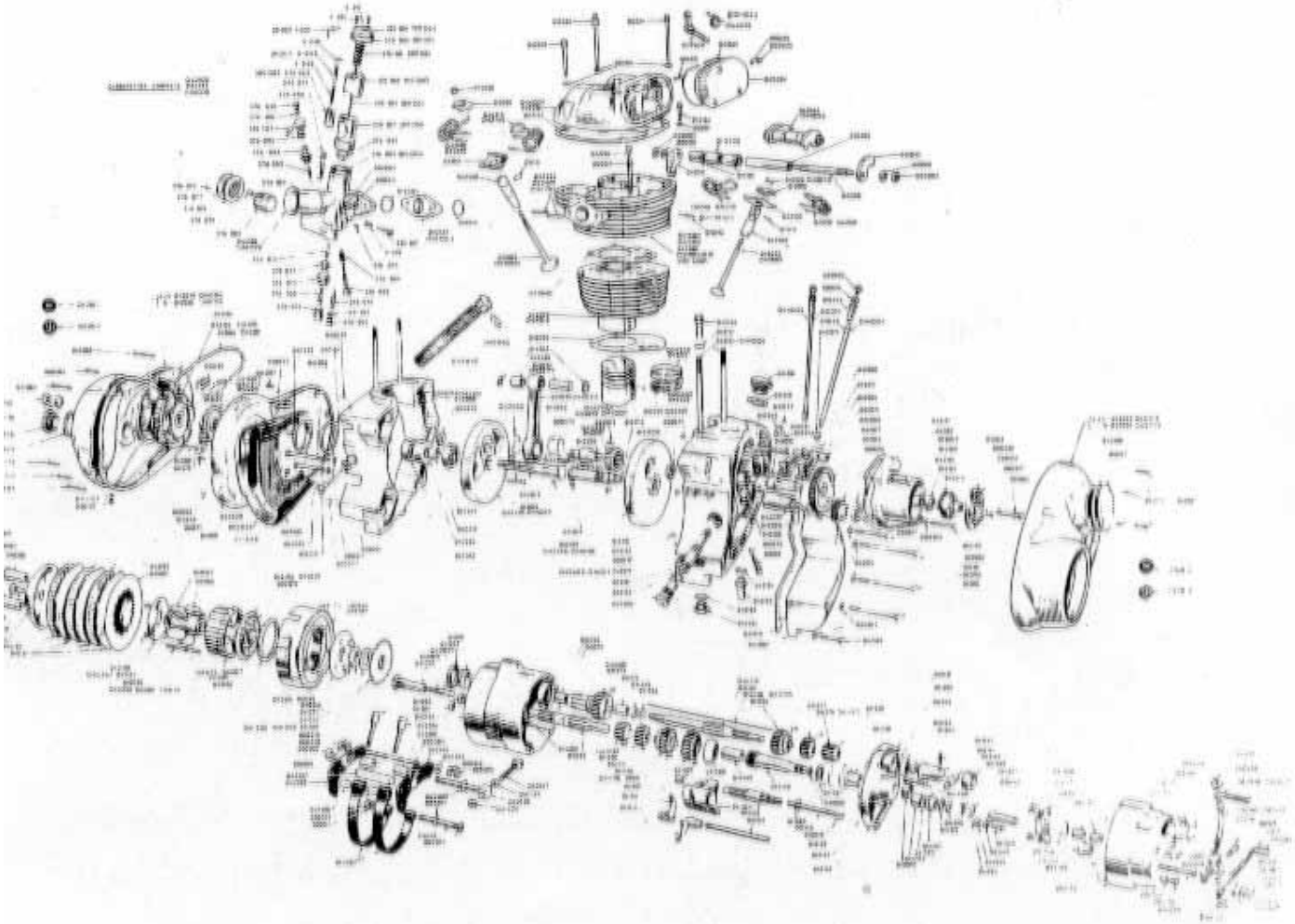
seats. Likewise the exhaust valve guide can work loose since it is too short for the job.

Pattern cylinder head gaskets can give problems; use copper ones instead.

Oil pump – The oil pump is almost foolproof. However, the long stroke oil pump cannot be fitted to early engines.

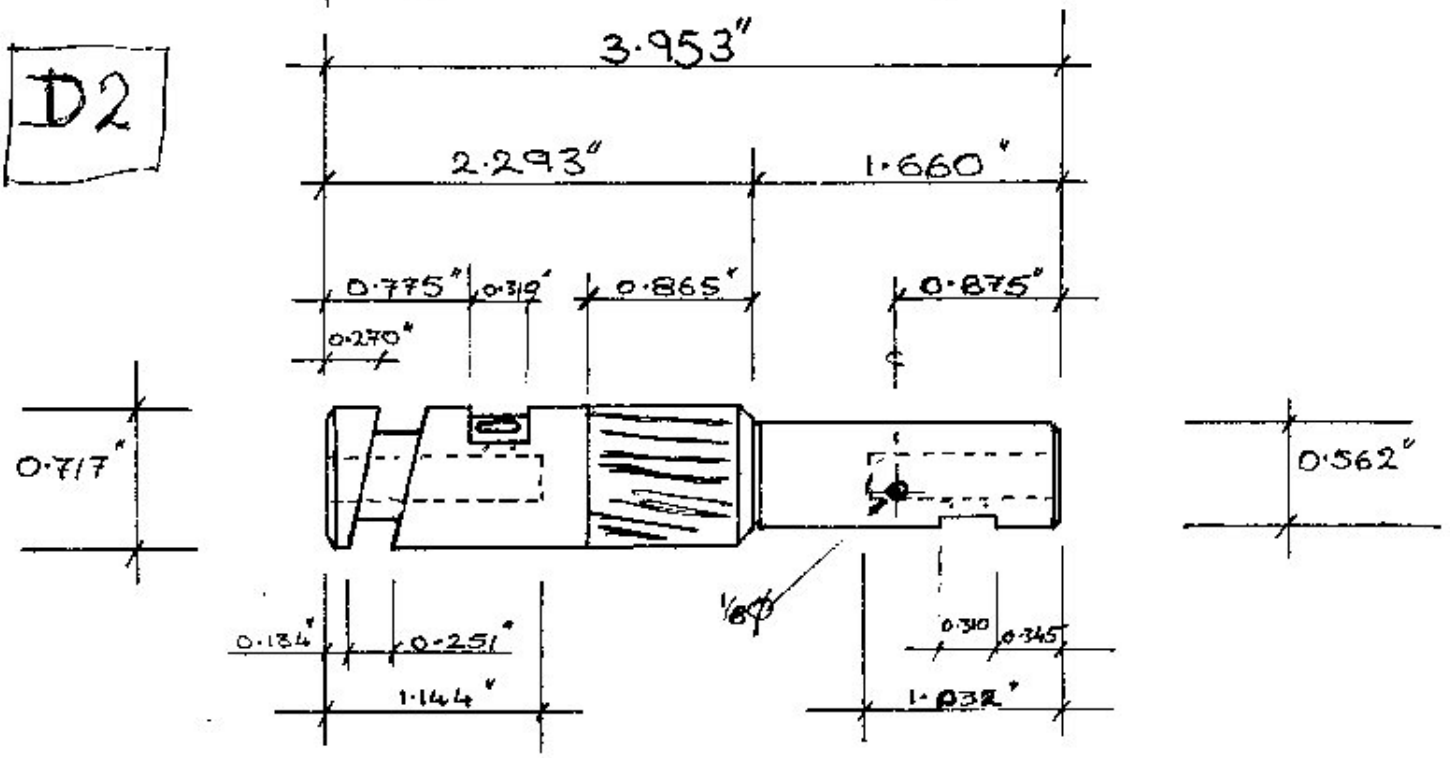
The engine can suffer from bad oil leaks. Porous castings have been blamed, particularly for barrel oil leaks. However, before going to the bother of sleeving the oil passage to the cylinder head check that the small breather hole between the oil tank to the crankcase cavity is not blocked.

EXPLODED VIEW OF MATCHLESS & A.J.S. 250c.c. & 350c.c.
OVERHEAD VALVE ENGINE

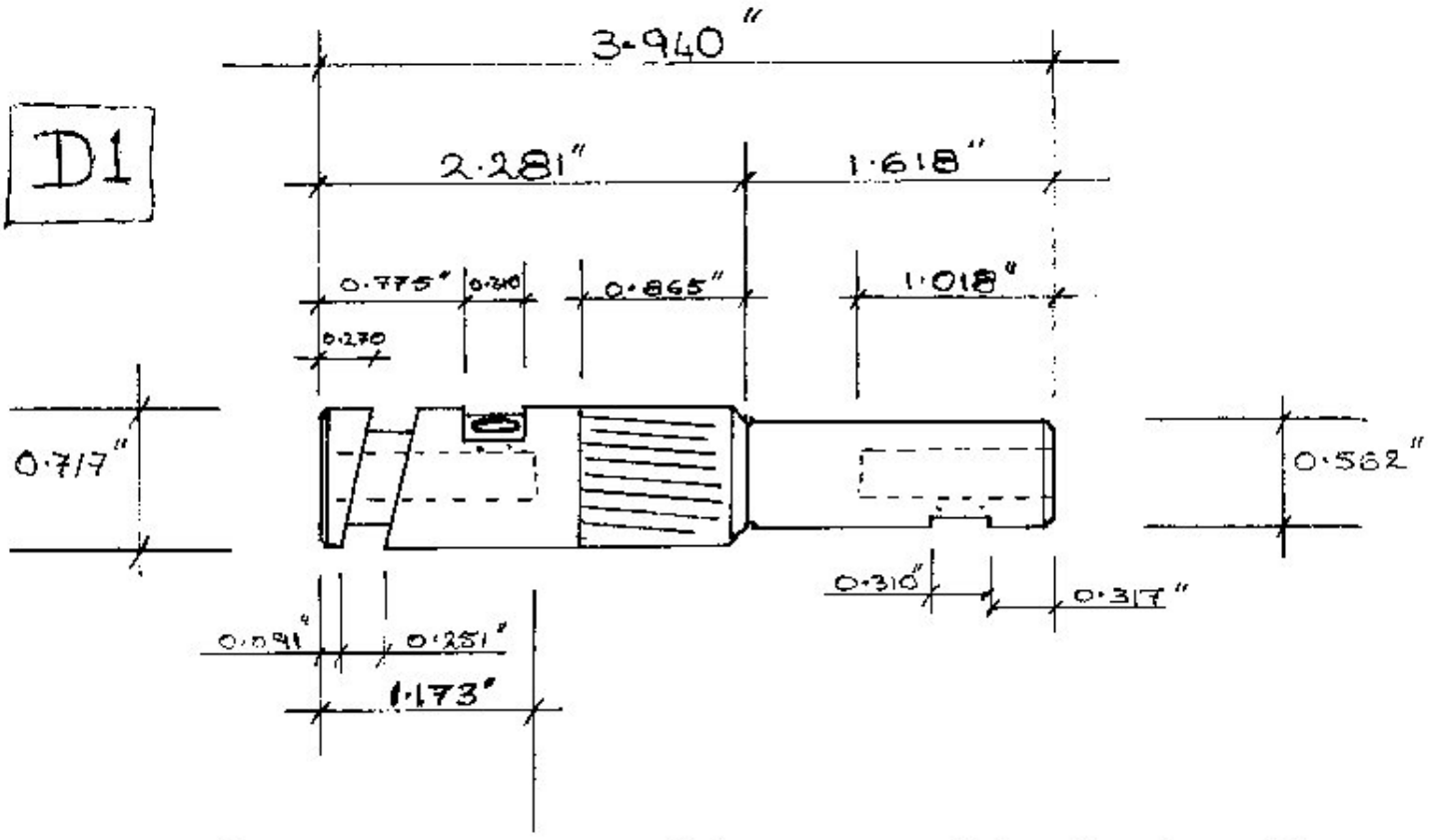


IDENTICAL (PLUNGER NO MARKING) G2 PLUS 1/8" FEED HOLE

D2



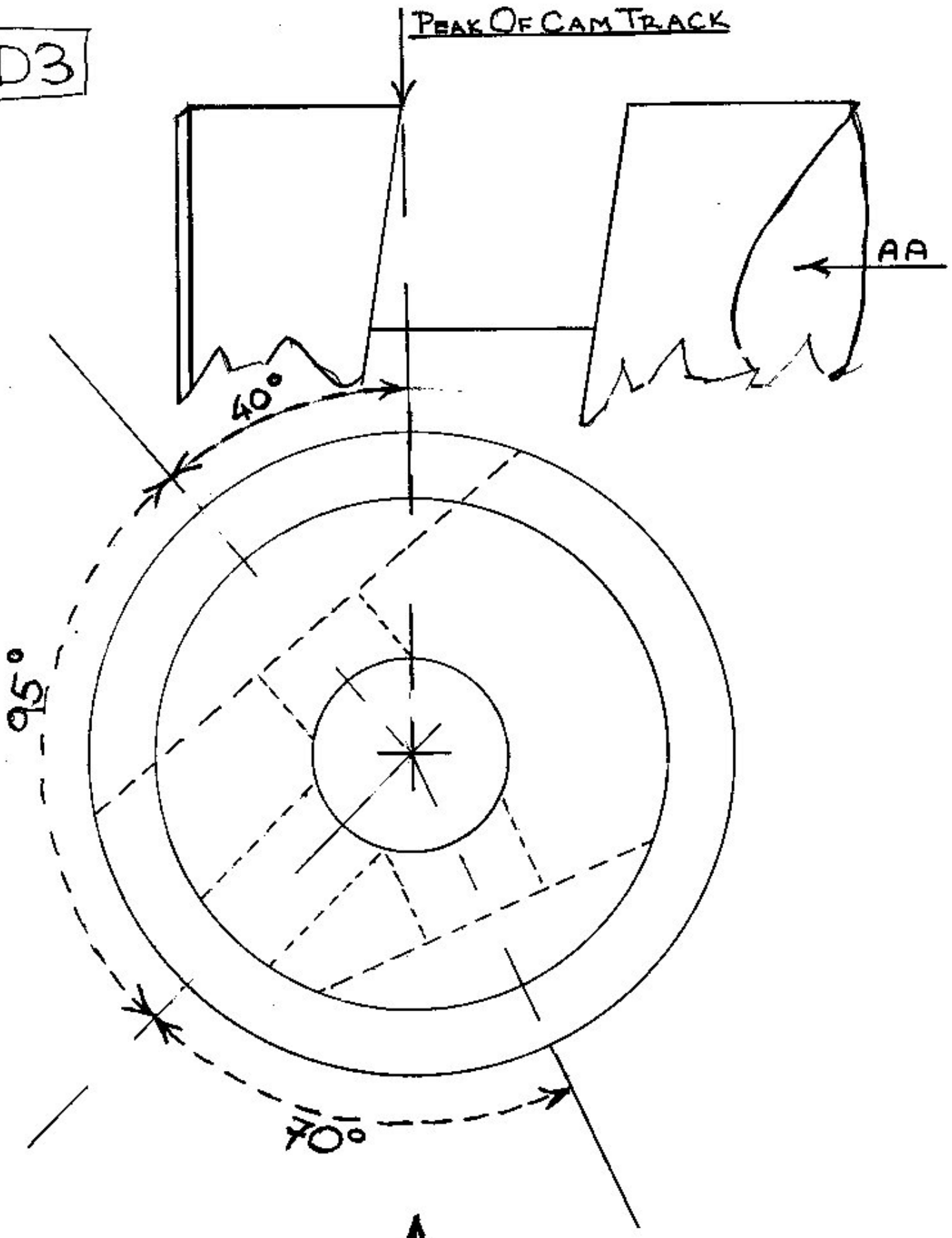
D1



G2 PLUNGER MARKED G2 ON END RETURN

2/4/02
V D

D3



1. TIMING CHART FOR G2 MARKED OIL PUMP PLUNGER ALSO PLUNGER WITH IDENTICAL TIMING PLUS 1/8" DIA OIL FEED HOLE

DB 2/4/02


2S
G2
?

MODEL	DATE	REMARKS.
G2. [illegible] R.	31 AUG 1962	
	31 AUG 1962	
	31 AUG 1962	
	31 AUG 1962	
	31 AUG 1962	
	31 AUG 1962	
	31 AUG 1962	
	31 AUG 1962	NUMBER A IS INTRODUCED TO DENOTE AN ENGINE WITH LATEST PATTERN OIL PUMP, (DIRECT FEED TO CAMFOLLOWERS) NEW CRANKCASE OILWAY, METERING PLUGS DELETED FROM R/BOX. 31. 8. 62.
	31 AUG 1962	
	31 AUG 1962	
	31 AUG 1962	
	31 AUG 1962	
	31 AUG 1962	
	31 AUG 1962	
	31 AUG 1962	
	31 AUG 1962	
	31 AUG 1962	
	3- SEP 1962	
	3- SEP 1962	
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	4- SEP 1962	