

## PUTTING POWER INTO

# FORD'S FANTASTIC FOURS

**Making Ford's incredible four cylinder engines change their personality is a relatively simple and highly rewarding task.**

WHEN the Ford Motor Company introduced the 997 cc overhead valve engine for its new Anglia late in '59, there were many grey-haired saggs who predicted inflexibility and short life for the unit. The ridiculously short stroke and those high engine revs they forecast, spelt disappointment for motorists used to the reasonably good lugging ability of the long-stroke, side valve 100E engine.

These early critics and doubters have, of course, been silenced by the remarkable performances of the radically designed Ford fours. Although it is 15 percent smaller in capacity than the 100E, the 103E develops eight percent more power — partially due to its piston area being some 62.6 percent greater than that of the preceding side valve engine. Despite the decrease in stroke, torque remains virtually the same at 52 ft/lbs.

In the past two years several other engines have evolved from the 103E, and each has met with similar success. They are the 107E which had 997 cc capacity but was fitted to the old-style Prefect, the 109E of 1340 cc from the Consul Classic 315, the 113E

with 1198 cc in the Cortina, and the latest five-main-bearing 1500 cc 116E.

All these engines have proven their suitability for extensive hotting-up. In 997 and 1100 cc forms they are virtually invincible in the highly competitive realms of Formula Junior racing cars, and they show every sign of remaining dominant for quite some time to come.

In addition to readily yielding more-than-average power for engines of their type and size, the small Fords have established an outstanding reputation for reliability and durability — considering the extreme stages of hotting-up to which they are subjected by racing enthusiasts.

No small part of this is played by the generously proportioned crankshaft bearing areas. The two and an eighth inch diameter main bearing journals, for example, have greater dimensions than the stroke of

## PROJECT PERFORMANCE

the 997 cc engine! When combined with crankpins of about two inch diameter, there is approximately an inch overlap between adjoining journals, consequently giving extremely robust construction. The same journal sizes are used throughout the three crankshafts in the 997 cc, 1198 cc and 1340 cc engines.

Modified for Formula Junior racing, the 997 cc engine develops about 85 bhp, while the same unit bored out to 85 mm (1100 cc capacity) gives about 95 bhp.

For everyday use, however, the maximum comfortable output is in the vicinity of 55 to 60 bhp for 997 cc engines, and about 60 to 65 bhp for the 1100s. The recently introduced 1198 cc Cortina is capable of churning out a consistent 60 to 70 bhp when modified for street work, while the 1340 cc version is happy enough in the 80 to 85 bhp bracket, as in the Lotus Super Seven.

There is nothing unorthodox about hotting these engines. The same basic procedures applied to most modern engines (multiple carburetion, non-restrictive exhaust system, porting and polishing, warm camshaft, etc) are employed on the Fords. It's a matter mainly governed by what degree of hotting-up is desired and how much money can be spent.

There is one way, though, of improving the performance of an Anglia or Cortina without resorting to any hotting-up whatsoever! How come? Easy: just add some inches as the hot rodders say — increase the cubic capacity.

Due to the standardisation of engine blocks and vital dimensions throughout the range, the three different stroke crankshafts are interchangeable. They are, in fact, almost the sole means by which Ford

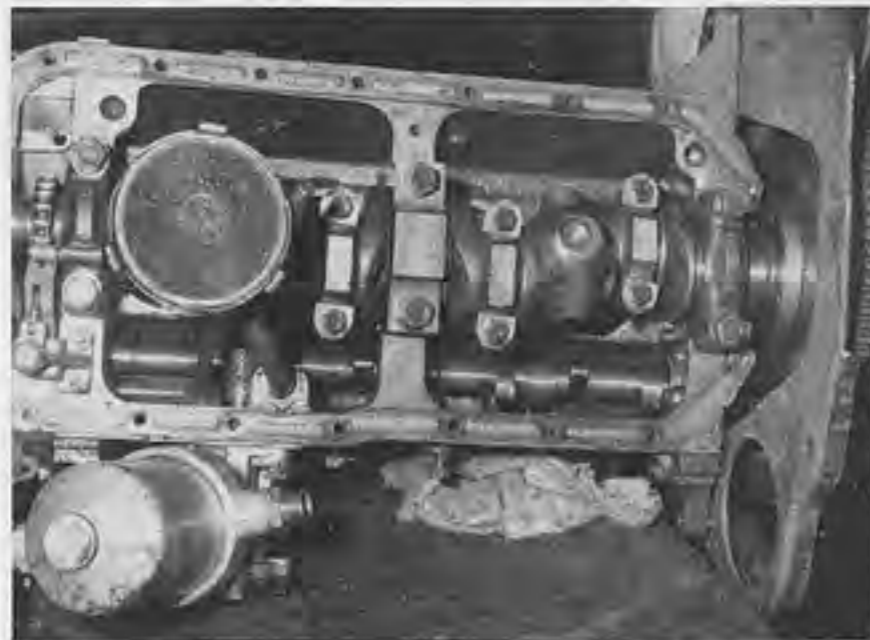
*Lightening the flywheel is a simple task if you know exactly where to mill off the metal. This one has had four pounds removed. Alloy rocker cover by Eddie Thomas (17).*

*Big double choke racing Weber carburetors dwarf Anglia engine. Costly, they are better for racing cars rather than road models.*



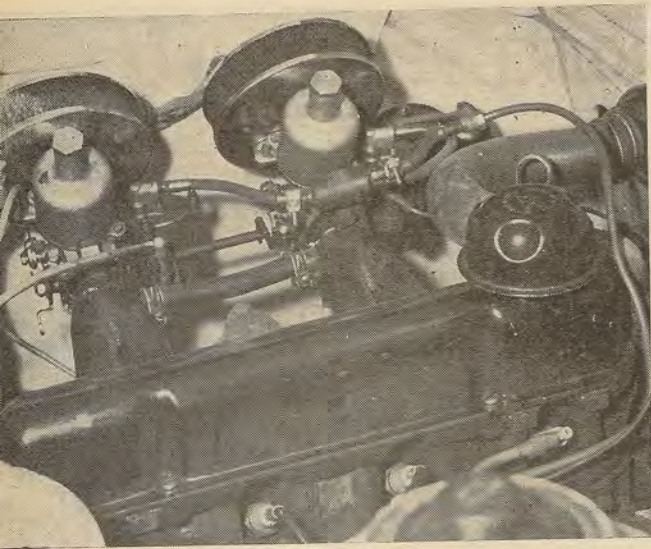
*Combustion chamber shape should remain basically the same as original, only the rough edges being smoothed down. Specialist firms can produce the spectacular results with more complex head work.*

By  
**MIKE  
McCARTHY**



*A steel centre main bearing cap is fine insurance against costly bottom end blow-up. It should be fitted to all modified Anglia/Cortina engines.*





*A large number of carburetion modifications available for the Anglia ranging from this simple twin SU setup to more complex Weber adaptations.*

has obtained what amounts to three engines from one. All three (997, 1198 and 1340 cc) have the same 80.96 mm (or 3.187 in) cylinder bores, the stroke in each case being 1.906 in, 2.290 in and 2.561 in respectively.

It is possible, therefore to simply substitute the crankshaft and connecting rods of say a 997 cc engine with that of the 1340 cc unit, and add some bhp without further ado. It seems that the pistons for all three engines are identical, the difference in stroke being compensated for by appropriate length connecting rods.

The only problem lies in the strength of the cylinder block casting. Early model Anglias were fitted with blocks designated 105E, but this was changed after the 109E was released. The later block, although dimensionally identical to the 105E, is reinforced and stronger. If the engine concerned has a 109E block have no fears about installing a longer stroke crank, but think twice about it before using a 105E.

The only drawback to giving your 109E Anglia another third of a litre displacement is that the 2.561 in crank and rods must be imported from England as the 1340 cc engine is not available in Australia.

The 2.290 in stroke Cortina crankshaft and rods, on the other hand, are easily obtainable and would be a straightforward installation — lifting the Anglia's bhp from 39 at 5000 rpm, to 48.5 at 4800 rpm.

Another method of adding more cc is to bore the cylinders out to their practical maximum of 85 mm or 3.346 in — giving close on 1100 cc with the Anglia crank, and slightly over 1300 cc with the Cortina's.

Judging by performances obtained overseas and locally, sleeving the 1198 cc and 1340 cc engines down to 1100 cc (so as to be eligible for that class) does not produce the same heartening results as boring out the smaller engine.

John Malcom Motors can supply a set of 85 mm pistons and gudgeon pins for approximately £25.15.0 a set, including tax. For road engines John Malcom fits Standard Vanguard piston rings, but Formula Junior engines require special rings. If the cylinder head is left standard, the overhead engine has a compression ratio of about 9.5 to 1. Porting and polishing the combustion chambers reduces the ratio almost to original.

At this stage it may be best to back-track momentarily and point out that when anything other than mild hotting-up is envisaged it is wise to fit a steel centre main bearing cap. These are machined from solid steel, and are an inexpensive form of insurance against costly bottom-end failures. They are available

from many specialist firms, such as Waggott Engineering, Lynx Engineering, and John Malcom Motors for between £5 and £6. A steel centre main bearing cap and thorough dynamic balancing job on the crankshaft, flywheel/clutch assembly will assure maximum reliability and smoothness.

And there are few four cylinder engines which operate as smoothly as a well tuned 997 Ford!

If your ambitions aren't limited by your bank balance you can really let your hair down when operating on these engines. Take carburetion as being representative of the various means hotting-up. You name the layout you prefer, and someone has it for the Fords.

For those who like a well-filled engine compartment, Frank Match Motors offer a kit comprising two dual-throat side draft Weber carburetors, manifold and linkages at about £122. Similar arrangements, from the same source or Automotive Carburetors, or Lynx Engineering, but utilising one dual-throat side draft Weber cost about £69.10. Automotive carburetors also has a promising alternative (based on the versatile twin-throat downdraft 28/36 DCD Weber). The carb is priced at £34.3 and linkages and a fabricated manifold can be supplied for £15 to £20. Incidentally, the 28/36 DCD is the same type and model carb fitted to the 1500 and 2300 Fiats and some hot English Minis. A wide range of engine sizes are accommodated by swapping jets and choke tubes.

Coming down in price, there are numerous twin SU kits — some for 1½ in, others for 1¼ in and a few the big 1½ in. Complete kits, such as the Monaco, sell for about £40.

For the economically-minded, there are twin manifolds that accept the original Solex carburettor and another of the same.

While considering induction variations, mention should be made of a cast manifold which facilitates supercharging the Anglia and Cortina. It is manufactured by Lynx Engineering and costs about £21. Or, in a package deal, Lynx can supply a supercharger, manifold, drive, etc, for approximately £150. This should appeal to those owners who want maximum performance with minimum modifying, for it's essentially a bolt-on item. Yet even the engine is otherwise standard, the increased power and torque make for traffic light grand prix walk-overs! Unless you're up against another supercharged Anglia or Cortina, that is!

While outside the cylinder head, the existing exhaust system should be improved, or discarded and replaced by something more efficient. In the former category there are sports mufflers, such as the Lukey. Fabricated extractor-type exhaust headers, like those built by Sonic in Sydney, cost about £17.10.

Although the standard Anglia and Cortina breathe relatively well for mass produced engines, this aspect can be further improved with judicious porting and polishing treatment. Most of the firms who specialise in reworking Ford cylinder heads have their own ideas as to what modifications give best results, making it difficult to outline any average procedure. And, naturally, the more power required, the more involved and painstaking the process becomes — and secretive too!

The inexperienced modifier can be well advised to limit his efforts to a thorough port and polish job, without materially altering the shape and size of the ports and chambers.

Having the work done professionally is the surest method of obtaining satisfactory performance. Oxenford Conversions, for instance, claim a nine bhp increase for a reworked Anglia head at a cost of £39.10. Other firms supply various and progressively hotter stages. At John Malcom Motors, for example, Anglia and Cortina heads are modified in three distinct stages before reaching Formula Junior specifications. The first stage sees the head ported and polished, shaved .045 in to bring compression back to standard, and a set of inner valve springs fitted — all for about £24. Subsequent stages have detailed

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improvements (such as reshaped combustion chambers and larger inlet valves) and are more expensive.

Having heard reports from overseas that the Anglia/Cortina engines are not above suffering rocker shaft and rocker post troubles, we made a check locally to ascertain whether or not the same ailment is evident here. Apparently it's not, for most of the replies (mainly from Formula Junior exponents) were negative. In only one instance, out of more than half a dozen, had there been any trouble with the overhead valve train. This was cured for £5 by fitting a stronger rocker shaft manufactured by Lynx Engineering.

About all that remains to do is the fitting of a camshaft which is compatible to the other modifications. The importance of selecting the correct cam cannot be over-emphasised as this is one aspect where the Ford engines are a bit finicky. They perform indifferently when equipped with an ill-suited cam—perhaps more so than other contemporary engines. Only the correct cam, for any given stage of hotting-up, will endow the little Fords with the smoothness for which they are renowned.

A cam that is too mild or one that is too lumpy, means other expensive equipment and modifications are not operating at their peak.

There are a few other items applicable to the Anglia-Cortina — such as lightened flywheel (or a Lynx alloy flywheel) and heavy-duty bearings — but these are not strictly necessary for road engines.

Finally, after having built up an engine that revels in hard motoring, a couple of points to add security. Hardibestos competition brake linings — at approximately £3.8 a set — give sure results at those occasional moments when your right foot is not pushing its way into the carbies. And for much improved handling and traction there are stabiliser bars (for the front suspension — saves buying a Ford stabiliser bar and having to cut its ends off) and torque rods to prevent rear spring wind-up, from John Malcom Motors. These are priced at £7.10 and £5.68 respectively

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