ENGINE ANALYSIS No. 105

COX Special 15

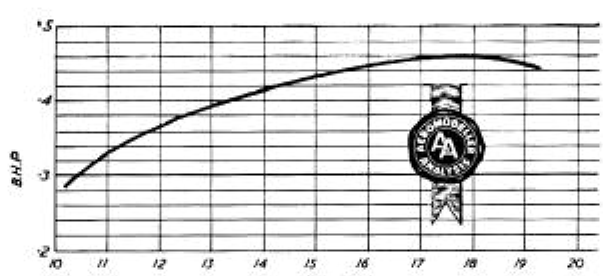
by R. H. Warring

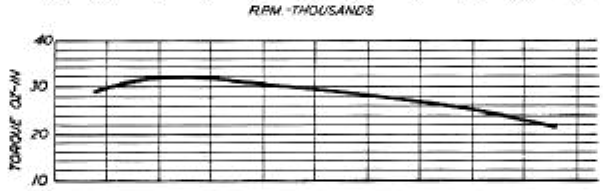
THE Cox is a remarkable species of engine. Having arrived at a design layout which lends itself to exact scaling up or down to produce a whole family of sizes, each specific size then seems to lend itself to further minor variations, reflected in an appreciable difference in performance. Virtually, in fact, you get what you pay for. The more expensive the model in any particular size, the more powerful it is. Just where the extra comes from is difficult to detect, for workmanship throughout the range is outstanding.

The Cox Special 15 replaces the Tee Dee 15 (see AEROMODELLER, January 1962), which itself was an engine of outstanding performance for its size and weight, but suffered on the initial production run, at least, in having a cylinder with too thin a wall. As a result the cylinder was prone to crack between the exhaust ports, in line with the bottom of the ports. This was rectified by increasing the cylinder wall thickness quite substantially.

Despite its high speed performance, and a peak B.H.P. figure well in excess of 0.4 on heavily nitrated fuels, the Tee Dee 15 did not receive the contest honours one could have anticipated (particularly in the free flight field), which position the Special 15 looks like rectifying. It has already proved itself an outstanding unit at the U.S.A. 1963 F.A.I. power team eliminations. Although basically the same as the original Tee Dee it does give the impression of being a more rugged and contestworthy engine, to say nothing of having found some additional power. The only major change, in fact, is the abandonment of a ball-and-socket con rod/piston assembly in favour of a more conventional gudgeon pin fitting. In other details, the comments of our January 1962 report generally apply.

The Cox Special is an out-and-out high speed engine. It is not happy on the larger propeller sizes, and even at





12,000 r.p.m. load-speed displays a certain reluctance to settle down. Starting characteristics, too, deteriorate at these lower speeds. But let it wind up to 17-20,000 r.p.m. with an 8- or 7-inch low pitch propeller and it becomes one of the sweetest running engines you could wish for, not particularly critical on settings and almost instant flick-starting, following a prime. About the only critical feature as regards handling is the fuel tank level for starting. Suction lift is relatively low when flicking over and the best tank position is just below the level of the spraybar. Gravity feed is not to be recommended as it makes it all too easy to flood the engine, especially if the battery is not right up to scratch.

Performance is noticeably improved running on highnitro fuels and 30 per cent. nitro seems about the best selection for normal free flight contest work. Although shortage of nitromethane in this country has led to the virtual disappearance of commercial high-nitro fuels, Cox racing glow fuel (30 per cent. nitro) is now available in Britain-and at quite a reasonable price for this type of fuel, too-and is an ideal match. Performance is still good on standard Cox fuel (15 per cent. nitro), but definitely down (and high speed running less consistent) on straight fuels. Starting characteristics also deteriorate on straight fuels, although the compression ratio is high enough for running on non-nitrated fuels.

A 30 per cent. nitro fuel also gives a reasonable element life with the standard glow head. A new "long life" head has recently been introduced to fit the "15" (and also in other sizes for the 09 and 049), the only differences being that the element wire appears to be slightly thicker, and the actual machined surface of the combustion chamber slightly rougher (i.e. not polished as in the standard Special head). We noticed no difference in performance at all at low to moderate load-speeds (which in the case of the Special ranges up to some 15,000 r.p.m.!) but at higher speeds the normal head was worth several hundred extra r.p.m. Whether this was a characteristic of just the samples tried or not we cannot judge. Certainly, however, the "long life" element is much more robust and will stand up to a 2 volt accumulator for starting-provided the leads are not left on too long and the ac. is of reasonably small size so that the terminal voltage is pulled down a bit under load.

Performance we found to be quite markedly affected by weather. Initial runs in very cold conditions were somewhat disappointing, but subsequent runs in a higher ambient temperature produced outstanding results. By this time, too, the engine had received some 11/2 hours running and although Cox engines are noted for their accuracy and are never "tight" even when I new, performance does improve with about an hour's running time. The manufacturer's also make a special mention of "shellacing" or the formation of varnish-like deposits which can build up on the walls of the cylinder and contribute high frictional drag, although there was no evidence of this in our handling time, using Cox fuel throughout. The only time we experienced marked loss of power was in very cold weather, or when the cylinder has become accidentally unscrewed. It is relatively easy to loosen the cylinder

Specification

Displacement 2.449 c.c. (.1494 cu. in.)
Bore: .591 in.
Stroke: .556 in.
Weight: 41/2 ounces
Max. power: .46 B.H.P. at 18,000 r.p.m.
Max. torque: 32 ounce-inches at 12,000 r.p.m.
Power rating: .185 B.H.P. per c.c.
Power/weight ratio: .102 B.H.P. per ounce

Material specification

Crankcase: machine from light alloy bar stock
Intake housing: injection moulded plastic
Cylinder: mild steel (integral fins)
Cylinder head: turned fromlight alloy (integral glow element)
Back cover: machined from solid
Crankshaft: hardened steel 1/16 in. diameter
Connecting rod: machined from light alloy (plain big- and little-ends)
Piston: cast iron special alloy
Propeller shaft: .161in. N.S.F. steel screw and spinner (turned from light alloy)
Venturi intake: machined from light alloy
Carburettor collar: light alloy (anodised gold)
Needle: steel (spring ratchet)
Propeller driver: machined from light alloy (anodised gold)
Manufacturers: L. M. Cox Manufacturing Co., Box 476, Santa Ana, California, U.S.A.
U.S. Retail Price: $14.98. Price in G.B. 146s. 0d.
British importers: A. A. Hales Ltd., Potters Bar, Middlesex.

Propeller—R.P.M. Figures

Propeller	*R.P.M.*
8 x 4 Trucut	17,500
9 x 4 Trucut	13,800
9 x 6 K-K nylon	11,800
9 x 4 K-K nylon	14,200
8 x 4 K-K nylon	16,300
7 x 4 K-K nylon	19,200
9 x 4 Top Flite nylon	13,600
9 x 3 Top Flite nylon	15,800
8 x 4 Top Flite nylon	16,700
7 x 6 Top Flite nylon	16,600
7 x 4 Top Flite nylon	20,000

Fuel used: Cox Racing glow fuel (30 per cent. nitromethane).

when removing the head soon after a run for instance, as the head-cylinder fit is very tight, due to the greater expansion of the aluminium head when hot.

Test figures showed the remarkably high r.p.m. of 16,700 to 17,500 on 8 x 4 propellers, which appears a logical free flight size. A typical 9 x 4 pulls the revs. down quite a bit, but a 9 x 3 would also seem a good choice. Peak power, as determined from the dynamometer test, was developed at 18,000 r.p.m. although with smaller loads speeds well over 20,000 r.p.m. could be attained and held with remarkable steadiness. For a plain bearing engine this is a most remarkable performance. The only "fussy" characteristics we found, apart from fuel tank level for easy starting, was that the Special, like all Cox engines, readily suffers a blocked jet if the fuel is at all dirty. Clean fuel-and preferably filtered fuel-seems a "must" to be sure of avoiding this trouble.

Constructionally the Special features the now familiar Cox layout, with virtually all metal parts turned from bar stock on automatic machines and produced to very close tolerances. The same 7/16 in. o/d crankshaft as on the Tee Dee 15 is retained with the large 7/16 in. by .290 in. port opening, although the edges are flat. The plastic housing surrounding the crankcase unit forms, in effect, an induction chamber above the port, as well as taking the screwed-in intake venturi and carburettor assembly. The plastic moulding also incorporates a stub tube for pressure feed, if desired.

To make use of this facility the underlying metal must be drilled through to open up a hole which is then "timed" by the crankshaft port. We have heard of people doing this with the shaft *in situ* (rotating the shaft into a position where the drill enters the port), but this is hardly to be recommended in view of the burr which could be produced on the inside, leaving this to be "smoothed" by the shaft! To drill for pressurisation demands a complete disassembly job.

This also raises another important point. Modellers used to rugged diesels and apt to use more than a reasonable amount of brute force on disassembling motors. Although the Cox is not a weak engine by any counts, it must be handled with extreme care when taking apart and putting together, and *only* using the co mbination tool provided in the proper manner. The cylinder is quite soft and readily damaged *if* mishandled. The piston on the Special, incidentally, is also unhardened and incorporates a floating gudgeon pin on which are located two tightly fitting spacers to position the con. rod centrally. Another detail feature is that the top edge of the piston is quite generously radiused off. The Tee Dee 15 had a hardened piston and ball and socket little end.

Summarising, we can only again rate the Cox Special as an outstanding example *of* precision production engineering with an exceptional performance, rendered even more remarkable in terms *of* power/wcight ratio. It is not everybody's engine in that it is essentially intended as a high speed unit and it will give a disappointing performance *if* used with large props. It is also not as easy to start as a sports type glow motor, and is vicious on mistakes or carelessness flicking over with a 7-inch prop. Compared with a diesel, too, it will undoubtedly have a more limited life-but prop. for prop. it will out-rev any other engine of its size we know over its optimum speed range. It would appear to have outstanding potential as a contest engine.