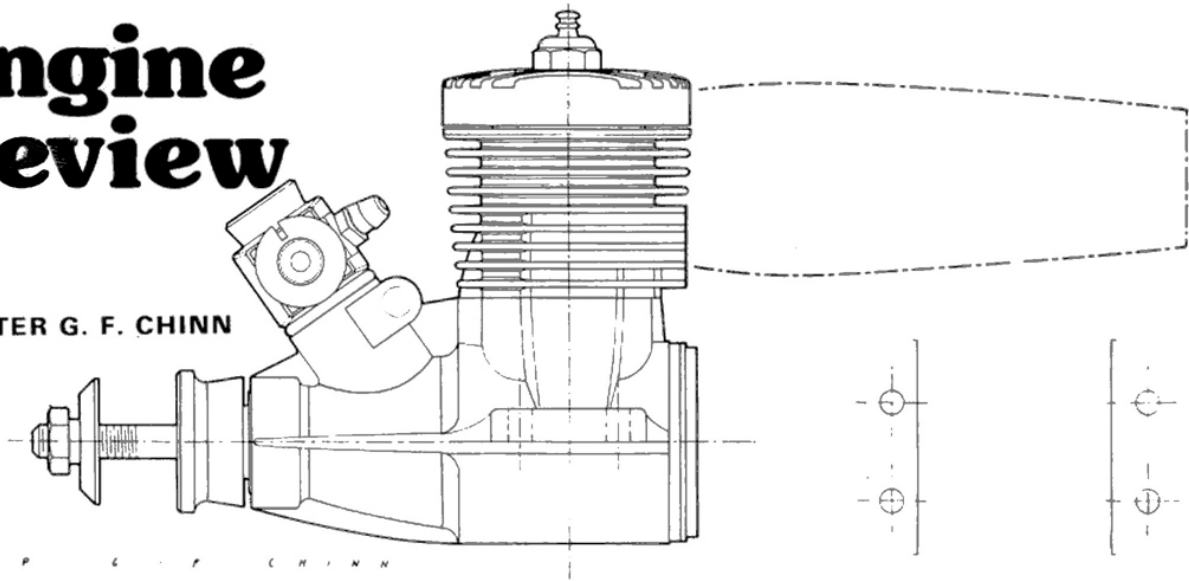


Cox Conquest .15 R/C

Engine Review

BY PETER G. F. CHINN



This interesting new power unit marks re-entry of Cox Co. into high performance .15 class after more than a decade. Throttle version in this report.

- The Cox Conquest 15 engine, which is available in standard free flight control line and throttle equipped radio control versions, marks the return of the L.M. Cox Manufacturing Company to the 2.5 cc international contest engine field after an absence of more than a decade.

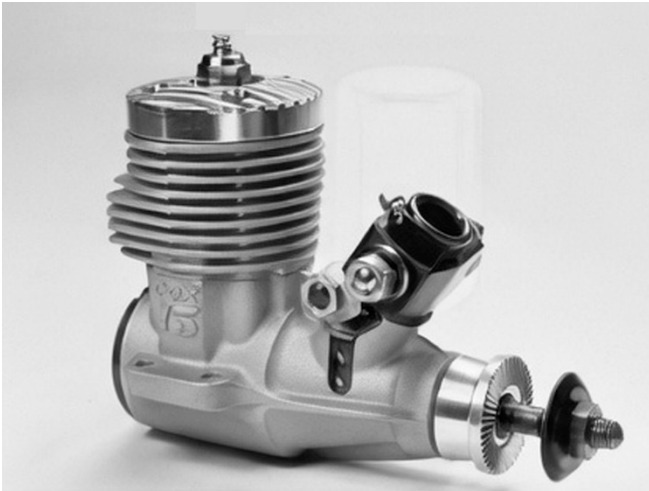
Pre-eminent in the Half A class, where the performance of the Cox "Tee Dee" .049 is still, after sixteen years, unsurpassed. Cox first entered the 2.5 cc (.15 cu.in.) market in 1959 with the Cox Olympic (contest) and Sportsman (sport) reed valve engines. In 1961-2, these were replaced by the Tee Dee 15 (contest) and Medallion 15 (sport) front rotary valve engines. The Tee Dee 15, subsequently developed into the "15 Special" and "Special Mk II" models, enjoyed considerable success in the FAI free flight power class until outpaced by the Super Tigre G 15 which, in turn, was ousted by the all-conquering Rossi 15.

The new Cox Conquest 15 was first announced a year ago but did not immediately become widely available, partly because of a decision to incorporate some modifications subsequently found desirable in this totally new design. The Conquest, in fact, marks an almost complete departure from previous Cox practice and certainly breaks with traditional Cox design that has been part of the model engine scene for a quarter century.

For example, its crankcase is of pressure cast aluminum alloy instead of being machined from extruded bar stock and its crankshaft runs in ball bearings (the only other Cox production engine to use ball bearings was the comparatively short lived Olympic) instead of directly in the crankcase material. It has a pressure-cast finned aluminum cylinder jacket with a hardened liner instead of a machined one piece unhardened steel cylinder with integral fins and it uses Schnuerle porting with a rear exhaust.

With so many traditional Cox features discarded in this new design, it is no surprise to find that the Conquest, while still managing to be different, is somewhat closer in layout and construction to one or two foreign rivals than was its predecessors. Clearly, in the FF/CL version, there is at least a superficial resemblance to the Rossi R.15 and a quick look at the engine's construction suggests that Cox might also have cast an interested glance in the direction of the rear exhaust Taipan 15-TBR. In particular, the design of the crankcase and cylinder jacket is very similar to that of the Australian engine.

Cox Conquest .15 R/C



On test the new Conquest 15 proved to be the most powerful .15 R/C engine featured to date in our long history of Engine Reviews.

As on the Taipan, the jacket separates from the main casting just above the crankcase, thereby simplifying the coring of the three bypass channels for the Schnuerle scavenging system, the 18 mm o.d. of the cylinder sleeve being used to align the two castings. Four long screws pass through the jacket from the cylinder head and tie the complete cylinder assembly to the crankcase.

Where the Cox shows more originality is in its moving parts. It has, for example, a unique crankshaft counterbalancing system. The crank web has a full disc rear face but with asymmetric milled cutaways each side of the crankpin plus extra counterbalancing by means of three carbide counterweights inserted into the web opposite the crankpin and held captive by a machined aluminum cover. The shaft also has a slightly larger main journal (11 mm o.d.) than the Rossi or Taipan (10.5 mm and 10 mm respectively) and, instead of having a parallel bore, the gas passage through the shaft is divergent, opening up from 6 mm i.d. at the forward end of the long rectangular valve port, to 8 mm i.d. at the rear face of the crank web.

Reciprocating weight is also somewhat below average for a lapped piston .15. Complete with wristpin, the current Conquest 15 R/C piston checked out at 5.6 grams (an earlier standard model piston and pin was half a gram lighter)



Unique Cox shaft has large o.d. main journal with tapered bore and inserted carbide counterweights in crank disc, uses Perry carburetor.

whereas the Rossi and Taipan scaled 6.0 and 6.6 grams respectively.

As already mentioned, the Conquest is available in standard and R/C types. We were asked to deal with the R/C model. Outwardly, this is distinguishable from the Free Flight Control Line engine by its finned one piece cylinder head with conventional glow plug and by its throttle type carburetor. Further details are contained in the following break-down of parts.

CRANKCASE AND BEARINGS. The crankcase is a well-executed aluminum pressure die casting with an integral front housing and short, strong beam mounting lugs. The front end is of sturdy proportions braced by longitudinal webs at the sides, top and bottom. The large bore intake boss is raked forward 35° from the vertical and its 12 mm i.d. molds gently into a long narrow intake port that is offset in the direction of shaft rotation to promote a tangential gas flow. The case is fitted with steel caged ball journal bearings, a standard 9 ball 7x14x3.5 mm bearing at the front and a specially made ball 11x22x5 mm bearing at the rear.

CYLINDER LINER AND JACKET. The hardened steel cylinder sleeve has an unbridged rectangular exhaust port of fairly large area which is timed to remain open for 150° crank angle. It is flanked by a pair of bypass ports that are angled,

Cox Conquest .15 R/C



Unusual Cox muffler, fitted to engine in three parts, has closed expansion chamber surrounding slotted outlet tube, lightweight.

in the usual Schnuerle manner, to direct gas flow away from the exhaust port towards the opposite side of the cylinder but are also sloped approximately 10° upward. These ports, which, according to our measurement of the test engine, are open for 130° of crank angle, converge toward a curved-sided steeply inclined third port which opens about 3° later for a 124° period.

The cylinder liner has a nominal wall thickness of 1.5 mm and has a slightly tapered bore; the cylinder i.d. increasing approximately .002" at the bottom to reduce drag over the lower part of the piston stroke. The liner is located by the usual top flange where it is also keyed in position by a notch that engages a pin in the cylinder jacket. The jacket itself is of pressure die cast aluminum and is closely fitted to the liner. A paper gasket is fitted between the machined joint faces of the jacket and crankcase.

PISTON AND CONROD ASSEMBLY. The lapped, reflectorless piston is machined from a lightweight sintered iron molding and has a plain skirt without cutaways or windows. It is fitted with a 4 mm wristpin retained by wire snap rings. The forged aluminum conrod has plain unbushed eyes and is 1.0" long between centers. There is a .050" wide brass spacer on the wristpin between the conrod and piston boss. Bare piston weight on the test engine was 4.7 grams, to which the wristpin adds 0.9 gr. and the conrod 1.6 gr. The wristpin is hollow' but blind at the rear so as to prevent gas loss through it from the third port to the exhaust.



Cylinder sleeve is closely fitted to pressure cast finned jacket. Four long screws tie complete assembly with gasket to crank case.

CYLINDER HEAD. The R/C engine head is an orthodox one-piece unit with machined fins. It has a 9.4 mm. dia. bowl-shaped combustion chamber surrounding a long-reach bar type glow plug and bounded by a 2.8 mm wide squish band. Four long Allen head cap screws tie the complete head, jacket and liner assembly to the crankcase with a .003" copper gasket between the head and cylinder sleeve. The nominal geometric compression ratio, according to measurement of our test sample, is approximately 11.0:1.

CRANKSHAFT. As already noted in our introductory remarks, this features a novel counter balancing system that uses captive counterweight in addition to internal cutaways each side of the crankpin. Each of the three sintered carbide counterweights is 3/16" dia. x 3 16" long and weighs 1.2 grams. They are inserted into holes in the crank-disc opposite the crankpin and held captive by the cup type aluminum sealing rim that encases the periphery and front face of the crank disc. The hollow crankpin is 3/16" nominal o.d. and is finely finished to minimize conrod wear. At the front end the shaft steps down to a 7 mm dia. front journal via a 45° shoulder and is axially located by a steel spacer between the shoulder and the inner ring of the front ball bearing which, of course, takes all thrust loading.

The 11 mm o.d. main journal has a 13.4 mm long valve port. This port is very much wider than the port in the front housing, as a result of which rotary valve dwell is longer than would otherwise be obtained. The rotary valve is limed to remain

Cox Conquest .15 R/C

open for approximately 205° of crank angle, timed from 35° after bottom dead center to 60° after top dead center.

CRANKCASE BACKPLATE. As on other Cox shaft valve engines, a screw in back plate is used. This is machined from aluminum bar stock and has a black anodized finish. It does not have a conventional gasket but is equipped with a synthetic rubber O ring in a deep groove immediately ahead of the back plate flange. This makes a perfect seal when the back plate is screwed into the crankcase opening, which has a machined and tapered seating for this purpose.

CARBURETOR. The Conquest R/C is fitted with a "Micro" size Perry carburetor with the choke bore enlarged to 5.3 mm. increasing the effective choke area to approximately 17 sq.mm which, of course, is very large for a .15 cu.in. R/C engine. The carb is retained in the intake boss by a cotter pin and nut.

MUFFLER. A special Cox muffler (Catalog No. 2861) is available for use with the Conquest. This consists of two pressure cast shells, forming the inlet duct and expansion chamber, and a slotted outlet tube. The muffler is fitted by first attaching the front section to the engine with the shorter of the two screws supplied. The rear section is then added, held in place by the second, longer, screw. Finally, the machined black anodized outlet tube is inserted into the rear of the muffler body and screwed home. The tube is threaded at the forward end and flanged at the rear and thereby locks the two body sections together. The tube has six gas entry slots totalling just over 80 sq.mm, in area. The outlet tube is 9.6 mm i.d. giving a very generous outlet area of 72 sq.mm.

PERFORMANCE. Our test motor comes direct from the Cox factory' where it had already been run for 30 minutes and checked out as up to standard performance levels. It was put through our basic break in procedure but was quickly found to be quite free and we did not therefore prolong the break-in any further.

Starting qualities were excellent, right from the beginning. The Conquest hand started practically

first flip from cold. Restarts were almost as good, the response being noticeably slower only immediately after a run when the engine was still hot.

The manufacturer's recommended fuel for the Conquest 15 R/C is a low nitromethane content blend such as standard Cox Glow Fuel or any good quality mixture containing between 5% and 15% nitromethane. Recommended prop sizes for general R/C use are 8x4 or 8x3 ½, Checked on our standard 5% nitro test fuel and with the muffler fitted, our motor recorded 15.500 rpm on an 8x4 Taipan glass fiber nylon and 16.900 rpm on an 8x4 Cox gray prop. (Actually, the latter is not recommended by Cox for the Conquest as, like other nylon props, it may be unable under certain conditions to withstand the increased centrifugal loading imposed by the high rpm of which this engine is capable.) By removing the muffler but still with 5% nitro fuel, these figures were increased to 16.200 and 17.800 rpm respectively.

Turning to wood and glass fiber epoxy props, still without muffler, we obtained 16.400 on an 8x4 Power-Prop wood, 19.800 on a 7x4 Power Prop wood 20.300 on a 7 ½ x 3 ¾, Bartels glass fiber epoxy and 22.800 on a 7x3 ½, Bartels glass fiber epoxy. These prop rpm levels clearly suggested that the Conquest would probably peak at uncommonly high revolutions and with a power output in excess of anything previously- recorded with a .15 cu.in. R/C engine.

This was, in fact, confirmed by our subsequent torque tests. Running on 5% nitro fuel and with the muffler fitted, a maximum torque of just under 26 oz.in. was recorded at 13.000-14.000. When loaded for speeds below 12.000 rpm, torque dropped off abruptly but was well maintained under lighter loads, as a result of which the power curve continued to climb, finally levelling out at 23.000 where output just topped 0.50 bhp.

A second series of readings were then taken on the same 5% nitro fuel but with the muffler removed, followed by a third series, also without muffler, but using the maximum recommended nitro content of 15%. The results of this third test

Cox Conquest .15 R/C

are shown in the curves marked "B" on the performance graph and indicate a maximum torque of 28 oz.in. and a peak power output just short of 0.60 bhp at over 24.000 rpm. Actually very little of the extra performance shown was due to the higher nitromethane content of the fuel: most of it came from the removal of the muffler.

Comparing the Conquest 15 R/C with other high-performance 2.5 cc throttle equipped motors tested for the Engine Review series (K&B15 R/B Series 72, Super Tigre G. 15 R/C and Taipan 15 TBR R/C) the Cox proved to have the highest peak output of any, as well as the highest peaking speed, which suggests that it should be a good choice for Quarter Midget pylon racing.

The maker's suggested prop for Quarter Midget is a 7x5 which should be about right although some minor reworking might be required to match it to the engine's peak in the air.

In only one respect did the Conquest just fail to beat every other 15 R/C tested to date. This was in its ability to pull the larger prop sizes. Here our much-prized example of the late lamented K&B 15 R C Series 72 still manages to outpace all the opposition with a torque of over 30 oz.in. at 11.000 - 12.000 rpm. a willingness to turn a 10x3 1/2 at a steady 11.500 rpm and a 9x4 Top Flite at 13.000 on 25% nitro the sort of performance that still makes us think of it as the ideal power plant for a 4 engined R/C scale model under FAI rules where total engine displacement is still limited to 10 cc. However, the Cox comes close, as is indicated by its ability to turn a 9x4 Taipan at 12.800 and an 8x5 Power Prop at 14.600.

The Conquest's best throttle response came when we set the Perry idle disc on the rich side of the reference mark. We were then able (with the help of the muffler) to get the motor to idle down to around 3.200 rpm which, from a full throttle 17.000 is pretty good.

Stripped down and examined at the conclusion of the tests (which had included running at speeds of up to 26.000 rpm) the Conquest was found to be in good shape. One glow plug burned out during the tests. We only encountered one slight

problem: the muffler tube came loose a couple of times when the engine was running at between 18.000 and 22.000 rpm which suggests that one must make sure that it is adequately tightened when the muffler is assembled on the engine. We found it helpful here to fit a 1/2 x 5/8 fiber washer between the flange at the rear of the tube and the seating inside the body casting.

All in all, an interesting design and an impressive performer.

SUMMARY OF DATA

Type: Single cylinder Schnuerle loop scavenged two-stroke cycle with crankshaft type rotary valve and twin ball-bearings. Throttle type carburetor with adjustable automatic mixture control.

Checked Weights: 6.4 oz (less muffler) 8.2 oz (with Cox muffler)

Displacement: 0.1509 cu.in. - 2.472 cc.

Bore: 0.591"

Stroke: 0.550"

Stroke/ Bore Ratio: 0.931 : 1

Measured Nominal Compression Ratio: 11.0:1

Specific Output (as tested):

3.31 bhp/cu.in. on 5% nitromethane, with muffler.

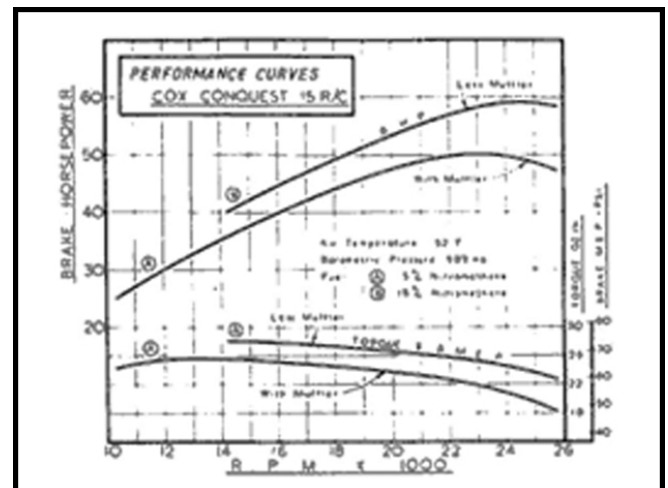
3.91 bhp/cu.in. on 15% nitromethane, less muffler.

Power/Weight Ratio (as tested):

0.98 bhp lb. on 5% nitromethane, with muffler.

1.48 bhp lb. on 15% nitromethane, less muffler.

Manufacturer: I.M. Cox Manufacturing Co. Inc., 1525 East Warner Avenue, Santa Ana, California 92702. ■



Cox Conquest .15 R/C



More: https://flyinghlsat.com/search.php?search_key=words=Cox-Engines